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Draft Environmental Impact Statement

Proposed Revised Land Management Plans for the Malheur, Umatilla, and Wallowa-Whitman National Forests

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Introduction

National Forest System lands in the Blue Mountains play an important role in supporting a variety of fish and other aquatic species critical to meeting the needs and values of people residing in the area. More than 30 native and 24 nonnative fish species occur in subbasins wholly or partly within the Blue Mountains national forests (Blue Mountain aquatic species list, project record). Some of these native species spend only a portion of their life cycles in National Forest System lands, others do not naturally occur within National Forest System lands due to absence of suitable habitat. To assess effects to viability of aquatic species within each of the national forests, a suite of aquatic focal species was selected to represent other aquatic species in National Forest System lands with similar distributions or habitat requirements. The set of focal species chosen reflects the diversity of aquatic habitats and species present within each national forest in the planning area.

One factor in selection of a focal species is that the species is recognized as potentially sensitive to management actions (Andelman 2001, Lambeck 1997, Wisdom et al. 2001). Under FSH 1909.14 chapter 43.22d, focal species are to be selected only from among those at-risk species whose habitat could be substantially affected by management of National Forest System lands, and from among species for which we have enough information to evaluate effects of management. The selected focal species in aggregate occupy the full extent of fish-bearing habitat in National Forest System lands in the planning area. Projected effects of alternatives on viability of each focal species will represent projected effects to viability for the group of species represented by that particular focal species. By law and agency policy, however, viability for focal species and any other species of viability concern must be analyzed individually.

Viability analyses consider population conditions for each species and an assessment of the habitat necessary to sustain those populations. Spawning and rearing habitat and access to such habitat are considered the most crucial habitat elements provided by National Forest System lands and the most likely aspects of habitat to be affected by land management activities; therefore, analyses are based on effects to quality, quantity, distribution and access to spawning and rearing habitats. Conclusions regarding effects to viability are drawn at subbasin (population) scale and by forest for each focal species individually. For those few species of conservation concern that are not well represented by one or more of the selected focal species, effects conclusions are based on factors relevant to the species.

Viability assessments for other individual species of conservation concern will follow the analyses for focal species, and will include subsets of focal species, as well as species not selected as focal species. Some species of conservation concern are limited in their distribution to certain subbasins, even though the representative focal species occupies a broader area. The subbasin-scale analysis for each focal species facilitates subsequent assessments of more geographically limited species of conservation concern.

Species subject to a required viability analysis fall into a variety of categories of conservation concern, and some fall into multiple categories. Viability for each species analyzed will be discussed individually by applicable category as required by law and Forest Service policy. Viability analyses based on category will be presented in the following order:

- focal species
- threatened and endangered species
- Forest Service sensitive species
- management indicator species

Each focal species consists of one or more regional subgroups of the species, termed variously as evolutionarily significant units (ESU), distinct population segments (DPS) or geographic management units (GMU).

"ESU" is used by the National Marine Fisheries Service (NMFS) and refers to regional subgroups of the various Pacific salmon species.

"DPS" is used by the NMFS to refer to regional subgroups of summer steelhead, as well as by the Forest Service Sensitive species list to refer to certain regional subgroups of redband trout. The term "DPS" is also used by the U.S. Fish and Wildlife Service (USFWS) to refer to regional subgroups of bull trout and redband trout, and is the term used in the Endangered Species Act to describe subunits of species that are eligible for listing, or to describe subgroups of species that could be delisted separately by meeting specific recovery objectives identified in a Species Recovery Plan.

"GMU" is used by a regional State, Federal, and private sector working group to refer to regional subgroups of redband trout to facilitate development of a species-wide, multi-state conservation strategy for redband trout.

Each of these terms will be used as relevant for purposes of category discussions and as required by law and regulation in the analyses for individual aquatic species that follow.

For each individual species ESU, DPS, or GMU, the goal for viability is to provide habitat sufficient to support self-sustaining populations in National Forest System lands within inherent capabilities of the landscape. "A self-sustaining population is one that is sufficiently abundant and has appropriate population characteristics to provide for its persistence over many generations" and "focal species populations are sustainable when their habitat is in good ecological condition and when they have access to habitat and other populations" (Reiss et al. 2008, p. 8). For those species not currently listed under the Endangered Species Act, the intent is to provide ecological conditions that would help keep the species from being listed.

The selected focal species or spatially discrete subgroups thereof, are either currently listed as threatened under the Endangered Species Act or are on the Regional Forester's Sensitive Species list, and/or function as management indicator species for the current (1990) forest plans. Individual threatened and endangered species subgroups are non-uniformly distributed across the plan area, and analysis for each species subgroup is limited to the subbasins where spawning and rearing habitat for the individual species is present. The Magnuson-Stevens Act (MSA) requires analysis of effects on all Pacific salmon species, including those not listed under other laws or policies. Table 206 through table 208 list species of conservation concern by national forest and display the relationship to the various species analysis categories described here.

Table 206. Focal species and species of conservation concern documented (D) or suspected (S) within the Malheur National Forest (includes portion of Ochoco National Forest administered by the Malheur National Forest)

Species, ESU/DPS[1]	Scientific Name	Focal Species	Species of Conservation Concern: Federally threatened or Endangered	Forest Service Sensitive	Management Indicator[2]	Magnuson-Stevens Act
Steelhead, Middle Columbia River	*Oncorhynchus mykiss*	D	D			
Bull trout, Columbia River Basin	*Salvelinus confluentus*	D	D		D	
Spring Chinook salmon, Middle Columbia River	*Oncorhynchus tshawytscha*	D				D
Redband trout, Interior Columbia River	*Oncorhynchus mykiss*	D			D	
Redband trout, Great Basin (Malheur Lakes)	*Oncorhynchus mykiss*	D		D	D	
Westslope cutthroat trout	*Oncorhynchus clarki lewisi*			D	D	
Harney Basin duskysnail	*Colligyrus depressa*			S		
Western ridged mussel	*Gonidea angulata*			D		
Shortfaced lanx	*Fisherola nuttalli*			S		
Columbia clubtail	*Gomphus lynnae*			S		

1. Evolutionarily significant unit/distinct population segment as defined by NMFS or USFWS
2. Management indicator species selected for the 1990 forest plans. These species are not proposed as management indicator species for any of the action alternatives.

Table 207. Focal species and species of conservation concern documented (D) or suspected (S) within the Umatilla National Forest

Species, ESU/DPS[1]	Scientific Name	Focal Species	Species of Conservation Concern: Federally threatened or Endangered	Forest Service Sensitive	Management Indicator[4]	Magnuson-Stevens Act
Steelhead, Snake River Basin	*Oncorhynchus mykiss*	D	D			
Bull trout, Columbia River Basin	*Salvelinus confluentus*	D	D			
Spring Chinook salmon, Middle Columbia River	*Oncorhynchus tshawytscha*	D				D
Spring Chinook salmon, Snake River Basin	*Oncorhynchus tshawytscha*	D	D			D
Fall Chinook salmon, Snake River Basin	*Oncorhynchus tshawytscha*	D	D			D
Redband trout, Columbia River Basin	*Oncorhynchus mykiss*	D			D	
Westslope cutthroat trout	*Oncorhynchus clarki lewisi*			D	D	
Margined sculpin	*Cottus marginatus*			D		
Western Ridged Mussel	*Gonidea angulata*	D		D		
Shortfaced lanx	*Fisherola nuttalli*			S		
Pristine springsnail	*Pristinicola hemphilli*			D[2]		
Columbia clubtail	*Gomphus lynnae*			S[3]		
Steelhead, Snake River Basin	*Oncorhynchus mykiss*	D	D			

1. Evolutionarily significant unit/distinct population segment as defined by NMFS or USFWS
2. Washington sensitive only
3. Oregon sensitive only
4. Management indicator species selected for the 1990 forest plans. These species are not proposed as management indicator species for any of the action alternatives.

Table 208. Focal species and species of conservation concern documented (D) or suspected (S) within the Wallowa-Whitman National Forest

Species, ESU/DPS[1]	Scientific Name	Focal Species	Species of Conservation Concern: Federally threatened or Endangered	Forest Service Sensitive	Management Indicator[3]	Magnuson -Stevens Act
Steelhead, Snake River Basin	*Oncorhynchus mykiss*	D	D		D	
Steelhead, Middle Columbia River	*Oncorhynchus mykiss*	D	D		D	
Bull trout, Columbia River Basin	*Salvelinus confluentus*	D	D		D	
Spring Chinook salmon, Middle Columbia River	*Oncorhynchus tshawytscha*	D				D
Spring Chinook salmon, Snake River Basin	*Oncorhynchus tshawytscha*	D	D			D
Fall Chinook salmon, Snake River Basin	*Oncorhynchus tshawytscha*		D			D
Sockeye salmon, Snake River Basin	*Oncorhynchus nerka*		D[2]			
Redband trout, Interior Columbia River	*Oncorhynchus mykiss*	D			D	
Westslope cutthroat trout	*Oncorhynchus clarki lewisi*			D	D	
Resident trout	*Salvelinus* sp. *and Oncorhynchus* sp.			D	D	
Western Ridged Mussel	*Gonidea angulata*			S		
Shortfaced lanx	*Fisherola nuttalli*			D		
Columbia pebblesnail	*Fluminicola fuscus*			D		

1. Evolutionarily significant unit/distinct population segment as defined by NMFS or USFWS
2. Snake River Hells Canyon migratory corridor only
3. Management indicator species selected for the 1990 forest plans. These species are not proposed as management indicator species for any of the action alternatives.

Affected Environment – Aquatic Species Diversity

The affected environment for species diversity consists of all fish habitat and all populations of the selected focal species within the 25 subbasins associated with the planning area. Lands of other ownership within each subbasin were assessed for purposes of cumulative effects analysis for these populations since the populations occupy many land ownerships in these subbasins. The affected environment includes all fish-bearing habitats in National Forest System lands, irrespective of species. Unless otherwise noted, the description of effects is only for fish populations and fish habitat within National Forest System lands in the Blue Mountains national forests planning area (excluding Hells Canyon Natural Recreation Area). Therefore references to the planning area, analysis area, or national forest are to public lands administered by the Forest Service, unless specifically noted otherwise.

The area managed under the Hells Canyon National Recreation Area (HCNRA) Comprehensive Management Plan (CMP) contributes to species diversity. Management direction under the HCNRA CMP will remain unchanged by this plan revision. Species that may be affected by ongoing HCNRA management, but which would not be affected by revisions to the forest plans, will not be analyzed here.

Management direction specific to key and priority watersheds contributes to the maintenance or restoration of viable populations and aquatic species diversity. For PACFISH and INFISH, the immediate purposes for establishing key and priority watersheds were to protect fish habitat and to initiate restoration through natural processes (USDA and USDI 1995 and USDA1995). Under these two strategies, PACFISH and INFISH selection criteria for both key and priority watersheds included watersheds that currently provide high-quality fish habitat and water quality, as well as watersheds with the potential for easy habitat restoration with relatively low capital investment, and the presence of one or more Endangered Species Act-listed species. Table 209 displays the current distribution of PACFISH key watersheds and INFISH priority watersheds among subbasins associated with the Blue Mountains national forests.

As new understanding of landscape-scale disturbance processes has developed during the past 15 years and as budgets for active restoration have become smaller, the need to target restoration more strategically and effectively became widely evident and accepted in the Pacific Northwest region. For example, within the Umatilla National Forest, virtually every subwatershed became a key watershed as defined by PACFISH due to presence of listed anadromous species and/or designated critical habitats. This created challenges in terms of prioritizing watersheds for active restoration, but also ensured that protective management for the benefit of aquatic species was instituted across the majority of watersheds in each forest.

For more than 15 years, key and priority subwatersheds have accordingly all received heightened levels of protection under PACFISH and INFISH. The benefits of protective management are becoming evident, based on landscape scale monitoring of improvements n riparian and aquatic habitats. Riparian and aquatic habitats across the Blue Mountains plan area have begun to exhibit positive responses to passive restoration processes (Archer et al. 2009).

However, as research has increasingly shown since 1995, landscape scale natural processes create shifting subwatershed mosaics through time and space, and watersheds with varying riparian and aquatic habitat conditions. The rich variety of life histories and mobility among members of the salmon and trout family demonstrate that as a group they are adapted to these landscape scale disturbance processes.

Table 209. Current distribution of key (PACFISH) and priority (INFISH) subwatersheds by subbasin for each national forest

National Forest	Subbasin	Subwatersheds Occupied by One or More ESA-listed Focal Species	PACFISH Key Subwatersheds	INFISH Priority Subwatersheds
Malheur	Middle Fork John Day	29	29	0
	Upper John Day	47	47	0
	Upper Malheur	19	0	19
	Silvies	0	0	20
	Silver	0	0	14
	North Fork John Day	4	4	0
	Harney-Malheur	0	0	4
	South Fork Crooked River-Beaver Creek	0	0	7
	Totals	**137**	**80**	**64**
Umatilla	Middle Fork John Day	1	1	0
	North Fork John Day	84	84	0
	Lower John Day	4	4	0
	Willow-Columbia	2	2	0
	Umatilla	15	15	0
	Walla Walla	10	10	0
	Tucannon	7	7	0
	Asotin	6	6	0
	Lower Grande Ronde	25	25	0
	Upper Grande Ronde	9	9	0
	Totals	**163**	**163**	**0**
Wallowa-Whitman	Imnaha	29	29	0
	Lower Grande Ronde	29	29	0
	Upper Grande Ronde	50	50	0
	Lower Snake-Asotin	1	1	0
	North Fork John Day	7	7	0
	Hells Canyon, Brownlee, Salmon	32	20	12
	Powder	30	0	30
	Burnt	0	0	22
	Wallowa	22	22	0
	Totals	**172**	**132**	**64**

Based on the need to incorporate information gained over the past 15 years, the existing regional aquatic conservation strategies were combined and updated to create a new regional Aquatic Restoration and Conservation Strategy, commonly referred to as the ARCS (USDA, 2008). The identification of a new set of key subwatersheds for the Blue Mountain forest plan revision was accomplished under the guidance of the ARCS and the Regional Aquatic Sustainability Model. The selection was based on the assumption that an appropriate distribution of habitat conditions can be provided on National Forest System lands within this set to support viability for the selected focal species and the other species that share their habitats.

Both Endangered Species Act-listed and non-listed species have been selected as aquatic focal species for analysis of environmental effects for the Blue Mountains forest plan revision habitat. Population conditions for each of the selected focal species were used as the basis for selection of a revised set of key watersheds for the action alternatives (Gecy 2013a). The conditions and trends for focal species in National Forest System lands are particularly influenced by management actions and natural processes within the watersheds they inhabit, as discussed in the regional Aquatic and Riparian Conservation Strategy (ARCS) (USDA Forest Service 2008).

Consistent with guidance provided by the ARCS, key watersheds selected for this Plan Revision are a network of watersheds identified to serve, or which have the potential to serve, as strongholds for important aquatic resources (focal species). They are areas crucial to threatened, endangered, or sensitive fish and aquatic species, and/or areas that provide high quality water important for maintenance of downstream populations. The value of the selected key watersheds to aquatic species was identified through application of the Blue Mountains Plan Revision Sustainability Model for Aquatic Species, and validated through review by fisheries biologists located on the affected forests (Gecy 2013a).

Regional guidance provided by the ARCS indicates that management of these areas is intended to emphasize minimizing risk and maximizing restoration or retention of ecological health (USDA Forest Service 2008). Plan Revision goals, objectives, standards and guidelines for key watersheds were designed with that guidance in mind. The identification of a revised set of key subwatersheds (to include priority subwatersheds for restoration) was based on the assumption that an appropriate distribution of habitat conditions can be provided in National Forest System lands within this set that in the long term, will contribute to sustaining viability for the various populations of the selected focal species and the species of conservation concern they represent.

Affected Environment – Aquatic Species Viability

Focal Species

The four aquatic focal species selected for this analysis are spring Chinook salmon, bull trout, summer steelhead, and redband trout (see table 206 through table 208). These focal species are all native salmonid species and represent broader biotic communities within various subsectors of aquatic habitats: headwaters, small tributaries, large tributaries, and rivers within the plan area. The selected focal species fall into two primary behavioral groups. Anadromous species, salmon and steelhead, breed and spend part of their life in fresh water, then travel to the ocean to feed until maturity, returning to fresh water 1 or more years later, to breed. Resident species, bull trout and redband trout, may migrate long distances seasonally within fresh water habitats but they spend all their lives in fresh water and never migrate to and from ocean habitats.

Each selected focal species reflects adaptation to long term, local ecological characteristics and processes within each subbasin. Although habitats for the selected focal species overlap in places, each species uses a different portion of the wide range of aquatic habitats in National Forest System lands, depending on their life stage and season of the year, their habitat requirements, and current habitat conditions both on and off-forest. Current conditions for aquatic focal species and their habitats on National Forest System lands reflect natural processes and watershed characteristics, along with the effects of past and present land management activities and on the species within the larger river basin landscapes in which those National Forest System lands are embedded. The ongoing and future influences of long-term climate change in the Pacific Northwest on aquatic focal species are discussed later in this chapter.

Fine-grained differences in habitat patterns of use by each species are described later in this section. Spawning and rearing habitat for one or more of the selected focal species is present in each subbasin in which planning area lands are located. As a group, focal species are well distributed throughout the subbasins within each national forest, but the distribution for individual species or subgroups varies across each forest.

For purposes of this discussion, subbasin-scale populations are connected networks of smaller local populations of each species and are analyzed subbasin by subbasin. Effects to each subbasin population are based on a subwatershed-scale habitat and population condition model for each focal species and are aggregated for each species using a subbasin-scale application of the Blue Mountain aquatic species sustainability model developed by Gecy (2013a). Both models are derivations of a Regional Sustainability Model developed by Reiss et al. (2008). Any strong local populations of any of the focal species that remain within the Blue Mountains national forests are located within subwatersheds currently characterized by very limited management activity and low road density.

Long term viability of each focal species is partially dependent upon availability of sufficient high quality spawning and rearing habitats within subbasins through time, as well as reliant on population and habitat connectivity within and between subbasins. Within National Forest System lands, an assortment of seasonal or year-round barriers currently impacts population connectivity. These barriers include physical barriers, such as culverts in National Forest System roads, barriers created by high water temperatures or low seasonal flow, and/or water diversions within National Forest System lands for beneficial uses outside the stream channel. The extent to which particular types of barriers impact a particular focal species is subwatershed and subbasin specific. Similar barriers in lands downstream of the national forests further impair population connectivity within and between subbasins for each focal species.

All four focal species within the plan area occur as multiple Distinct Population Segments (DPSs) or as multiple Environmentally Significant Units (ESUs) of the species. One or more DPS or ESU of each focal species is present within each national forest. DPSs and ESUs are important spatially- defined regional subgroups within each species. Because component populations of each species are generally described by both U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) at the subbasin scale, except where otherwise noted, current viability status for each DPS and ESU is described in this order: first for each population based on subbasin boundaries, then summarized for each DPS or ESU as they occur within each national forest, followed by a summary for each species where more than one DPS or ESU of the species is present within a national forest.

Focal Species Descriptions

Spring Chinook Salmon

Spring Chinook salmon are able to access intermediate sized tributaries and spawn farther upstream than fall run Chinook salmon and can be found in medium sized river reaches and tributaries within and downstream of national forest boundaries. Their habitat somewhat overlaps with steelhead habitat at the upper end of their distribution and overlaps with fall Chinook salmon habitat in the lower reaches of large rivers at the lower end of their distribution.

Non-native spring Chinook salmon stocks are present in the Umatilla and Walla Walla subbasins, where the original stocks are extinct. Hatchery stocks and wild stocks comingle in the Snake River Basin in subbasins below Hells Canyon Dam that are still accessible to anadromous species. Selection of spring Chinook salmon as a focal species represents the habitat needs of other aquatic species inhabiting lower elevation medium and large sized rivers and larger tributaries within the plan area, in particular, large bodied anadromous species and fall spawners.

Native spring Chinook salmon within the plan area belong to two different Environmentally Significant Units (ESUs) that occur in non-overlapping portions of the plan area: the Middle Columbia River (MCR) spring Chinook salmon ESU and the Snake River Basin (SRB) spring Chinook salmon ESU. SRB spring Chinook salmon are listed as Threatened under the Endangered Species Act; MCR spring Chinook salmon are not listed at this time. The Malheur National Forest provides habitat for populations within the MCR spring Chinook salmon ESU only; whereas the Umatilla and Wallowa-Whitman National Forests provide habitat for populations of both ESUs.

Viability analyses for MCR spring Chinook salmon in the John Day River Basin and reintroduced nonnative stocks in National Forest System lands in other Middle Columbia River subbasins associated with the planning area would serve as surrogates for current viability of other non-Endangered Species Act-listed fall- spawning anadromous species in National Forest System lands (see table 210). The SRB spring Chinook salmon ESU will be analyzed separately from the MCR spring Chinook salmon ESU where they both occur in the same forest to facilitate subsequent Endangered Species Act determinations for effects specific to SRB spring Chinook salmon. Conclusions for spring Chinook salmon as a focal species will be drawn based on review of effects to each individual ESU, for those forests where both ESUs are present, i.e. the Umatilla and Wallowa-Whitman National Forests.

Bull Trout

Bull trout exist as a variety of life history forms, freshwater migratory and headwater resident, within the plan revision area. Migratory bull trout move between their natal streams and larger bodies of freshwater, such as lakes, reservoirs and mainstem rivers where they can grow much larger than the residents that remain in small colder headwaters as adults. The migratory life history is still present in most of the populations associated with Blue Mountains national forests, but some headwater resident populations have been isolated and are very small due to historic land use impacts. Connectivity among such resident populations is no longer provided by migratory individuals and these populations are at heightened risk of long-term extirpation.

Bull trout, like spring Chinook salmon, are fall spawners with eggs that overwinter in the gravels and fry that emerge from redds in late winter and early spring. Bull trout tend to fare best where aquatic habitats provide not only cold water, but also high habitat complexity associated with instream large wood. Bull trout serve as a focal species based on their ability to represent aquatic species with similar habitat preferences and life history characteristics. They represent species present in medium-sized, high-elevation tributaries to headwaters, fall spawners, migratory freshwater species, those species requiring year round high quality cold water and habitat complexity, and those species closely associated with streambeds. Bull trout are noted for their affinity for cold headwaters and high habitat complexity and are an indicator of high quality habitat.

Steelhead

Steelhead spawn and rear in medium and small rivers, tributary streams, and upstream portions of mainstem rivers. In the plan area, steelhead belong to two DPSs that occur in non-overlapping areas: the Middle Columbia River (MCR) steelhead DPS and the Snake River Basin (SRB) steelhead DPS. The Malheur National Forest provides habitat only for MCR steelhead populations whereas the Umatilla and Wallowa-Whitman National Forests provide habitat for populations of both the MCR and SRB steelhead DPSs. Both DPSs are listed under the Endangered Species Act.

Steelhead represent a different range of needs both spatially and temporally than spring Chinook salmon, although both species need good quality spawning and rearing habitat, cool water, and sufficient flow in the migration corridors as well as in spawning and rearing reaches. Steelhead as a focal species represent large- bodied spring- spawning anadromous species using cool mid-elevation large tributaries to headwaters, within accessible portions of the Middle Columbia River and Snake River Basins.

Redband Trout

Redband trout are considered present wherever steelhead are present in the interior Columbia River Basin, including portions of the Snake River Basin downstream of Hells Canyon Dam. The juvenile life stages of the two forms can be very difficult to differentiate where they co-occur, as they are the same species (*Oncorhynchus mykiss*), but express two different life histories, steelhead expressing ocean-going anadromy and redband trout expressing year-round freshwater residency. Redband trout are found throughout the planning area, including subbasins where steelhead have no access.

Redband habitat requirements as a resident freshwater species are similar to those of steelhead juveniles in freshwater, as they are the same species. Redband trout occupy small and medium rivers and streams year round. They spawn and rear in medium and small rivers and tributaries and upstream portions of mainstem rivers from late winter into May. As small-bodied lifelong-resident spring spawners, redband trout represent a different range of needs both spatially and temporally than spring Chinook salmon or steelhead. They spawn at elevations lower than those used by bull trout and tolerate warmer temperatures in their spawning and rearing habitats than bull trout. They are representative of species that preferentially use the middle to upper portions of the water column, as opposed to the streambed affinities displayed by bull trout. Redband trout are analyzed as a focal species based on their ability to represent resident aquatic species with similar habitat preferences and life history characteristics, particularly spring spawners, those requiring year- round good quality water, species inhabiting large tributaries to very small headwaters at middle elevations, and species in watersheds where no other focal species are present.

Current Status of Focal Species

As a basis for determining forest-level effects to viability of each species of conservation concern, current habitat conditions and population status in National Forest System lands in each subbasin, and within the subbasin as a whole, are assessed for each focal species, and by subbasin for each DPS and ESU, using National Forest System stream inventory data, information from other sources including subbasin assessments, and applied through protocols described in the Blue Mountains Aquatic Sustainability Model (Gecy 2013a). Current trends for riparian and aquatic habitats for each aquatic species were assessed in this analysis, using data from regional-scale effectiveness monitoring using protocols developed in response to requirements of

Biological Opinions for the 1990 forest plans as amended by PACFISH and/or INFISH (Gecy 2013a, Archer et al. 2009).

This monitoring is done at a larger scale than the plan area, but includes all portions of the plan area. Implementation of PACFISH and INFISH in their respective areas was designed to forestall any further management- related habitat degradation and to allow for nearly natural rates of habitat recovery. Riparian and aquatic habitat Passive restoration of riparian and aquatic habitats through natural processes appears to be occurring within National Forest System lands based on recent monitoring-based habitat trend analyses (Archer et al. 2009). The Watershed section of chapter 3 discusses these effectiveness monitoring results in greater detail, which will not be repeated here. Instead it will simply be noted that riparian and aquatic habitat conditions are currently trending upward at the scale of the plan area, following 15-plus years of management under the 1990 forest plans as amended by PACFISH and/or INFISH, based on these monitoring results.

Spring Chinook Salmon

Spring Chinook salmon, as a whole, are currently a viable focal species in all three Blue Mountains national forests, based on the analyses and overall subbasin-scale habitat and population conditions in each national forest, which are summarized in table 210. The table identifies populations as either belonging to the MCR or SRB ESUs and/or as nonnative hatchery stock where neither the original MCR or SRB stocks exist any longer. Distinctions are made here to simplify and reduce redundancy of effects analysis and discussion specific to threatened SRB spring Chinook salmon ESU in the section on “Threatened and Endangered Species” that follows. Spawning and rearing habitat for both MCR and SRB spring Chinook salmon in National Forest System lands is in fair to good condition.

Malheur National Forest – Spawning and rearing habitat in National Forest System lands is in fair condition and supports two well- distributed, moderately viable populations in two subbasins.

Current habitat quality, quantity and connectivity of spawning and rearing habitats within the Malheur National Forest indicate that habitat connectivity, quantity and quality for spring Chinook salmon within National Forest System lands are being maintained and continue to contribute to viability of MCR spring Chinook salmon populations.

Umatilla National Forest – The Umatilla National Forest provides habitat for multiple, well-distributed populations within each of the MCR and SRB spring Chinook salmon ESUs. Spawning and rearing habitat for both ESUs throughout National Forest System lands is in fair condition. The few culvert or other barriers in National Forest System lands identified as affecting spring Chinook salmon of either ESU have been progressively replaced or removed over the past ten years. The majority of spawning and rearing habitat for spring Chinook salmon in the Walla Walla and Umatilla River subbasins is located downstream of the national forest, where water withdrawals for irrigation and municipal water supply combine with high summer temperatures to create poor seasonal habitat connectivity lower in the subbasin. National Marine Fisheries Service’s BRT determined that habitat risks were moderate in the Umatilla and Walla Walla subbasins across all lands, which is consistent with fair habitat conditions in National Forest System lands for these populations, which is displayed in table 210. The North Fork John Day population is the only native stock in the Middle Columbia portion of the Umatilla National Forest. NMFS considers this a viable population at the all-lands scale.

Table 210. Affected environment for spring Chinook salmon within the Blue Mountains national forests

Subbasin	Population Name	Population Status and Trend (all lands)[1]	ESU	Spawning and Rearing Habitat Miles and Condition (NFS lands)[2]
Malheur				
Middle Fork John Day	Middle Fork John Day	Viable/unknown	MCR[3]	15 miles/fair
Upper John Day	Upper John Day	Viable/unknown	MCR	1 miles/fair
Designated Critical Habitat	None	N/A	MCR	NA
Umatilla				
North Fork John Day	North Fork John Day	Viable	MCR	60 miles/
Umatilla	Umatilla	Reintroduced (nonnative stock)/ unknown	Hatchery/non native	8 miles/fair
Walla Walla	Walla Walla	Reintroduced (nonnative stock)/ unknown	Hatchery/non native	5 miles/fair
Tucannon	Tucannon	Not viable/increasing	SRB[4]	6 miles/fair
Lower Grande Ronde	Wenaha	Not viable/increasing	SRB	40 miles/fair
Designated Critical Habitats	SRB ESU only	N/A	SRB	284 miles
Wallowa-Whitman				
North Fork John Day	North Fork John Day	Viable/unknown	MCR	70 miles/good
Hells Canyon	Hells Canyon (HCNRA)	Not viable/unknown	SRB	6 miles/poor
Upper Grande Ronde	Upper Grande Ronde/ Catherine Creek	Not viable/increasing	SRB	24 miles/fair
Wallowa	Lostine/Minam	Not viable/increasing	SRB	58 miles/good
Imnaha	Imnaha	Not viable/increasing	SRB	141 miles/fair
Designated Critical Habitats	SRB ESU only	N/A	SRB	1,377 miles

1. NMFS Biological Review Team status and trend conclusions (Ford et al. 2010; Ford et al. 2011).
2. National Forest System conditions based on Blue Mountain Sustainability model outputs, modified by habitat connectivity conditions associated with number and locations of culvert passage concerns in National Forest System lands relative to species habitat distribution.
3. MCR: Middle Columbia River ESU
4. SRB: Snake River Basin ESU

SRB spring Chinook salmon have very little spawning habitat in managed National Forest System lands, other than in the mainstem Grande Ronde River and in the Wenaha River tributary to the Grande Ronde River, which are both managed as Wild and Scenic Rivers. BRT assessments

(USDC-NMFS 2008) concluded that SRB spring Chinook salmon populations in the Grande Ronde and Tucannon subbasins are high risk and not viable, despite very low to moderate habitat risks in these subbasins.

The most recent status and trend assessments by NMFS (Ford et al. 2011) for SRB spring Chinook populations associated with the Umatilla National Forest indicate that their population numbers are increasing.

Wallowa-Whitman National Forest – The Wallowa-Whitman National Forest provides habitat for multiple, well-distributed populations within each of the MCR and SRB spring Chinook salmon ESUs. Spawning and rearing habitat in National Forest System lands for most populations of both ESUs is in fair to good condition.

Culverts impairing fish passage in National Forest System lands are located upstream of reaches used by SRB spring Chinook salmon and do not affect habitat connectivity for this species, based on culvert inventories conducted in 2000 and 2001.

Current habitat quality, quantity and connectivity of spawning and rearing habitats within the Wallowa-Whitman National Forest for multiple populations, when combined with improving habitat trends within National Forest System lands, indicate that habitat connectivity, quantity and quality for spring Chinook salmon within National Forest System lands are being maintained, continue to contribute to viability of MCR spring Chinook salmon, and are contributing to recovery of SRB spring Chinook salmon viability. The most recent status and trend assessments by NMFS (Ford et al. 2011) for SRB spring Chinook populations associated with the Wallowa-Whitman National Forest indicate that their population numbers are increasing.

Bull Trout

Spawning and rearing habitats for bull trout in National Forest System lands range from poor to good condition, depending on the subbasin and national forest. The species is well distributed among multiple subbasins in each national forest. Bull trout local populations in National Forest System lands are moderately connected within most populations, as well as between subbasins and forests. Exceptions will be noted for each forest. Broad scale habitat data analyses indicate improvements are occurring in aquatic and riparian habitats across National Forest System lands throughout the planning area (Archer et al. 2009). Discussions specific to each national forest follow.

Malheur National Forest – Bull trout are present in three subbasins associated with the Malheur National Forest. Within these three subbasins, the majority of bull trout spawning and rearing habitat is located in National Forest System lands and is in variable condition (see table 211). Current habitat quality, quantity and connectivity of spawning and rearing habitats within the Malheur National Forest for multiple bull trout populations, when combined with improving riparian and aquatic habitat trends within National Forest System lands, indicate that habitat connectivity, quantity and quality for bull trout within National Forest System lands are being maintained and are contributing to recovery of bull trout viability. The most recent status and trend assessments by USFWS for bull trout populations associated with the Malheur National Forest indicate that populations in the two John Day subbasins are increasing (USFWS 2008).

Table 211. Affected environment for Columbia River Basin bull trout within the plan area

Subbasin	Population Name	Population Status and Trend (all lands)[2]	Spawning and Rearing Habitat Miles and Condition (NFS lands)[3]
Malheur			
Upper Malheur	Malheur	50-250 adults/declining	76 miles/good
Upper John Day	Upper John Day	0-50 adults/increasing	25 miles/fair
Middle Fork John Day	Middle Fork John Day	Unknown/increasing	19 miles/poor
Designated Critical Habitats	All	N/A	344 miles
Umatilla			
Asotin	Asotin	50-250 adults/unknown	8 miles/fair
Tucannon	Tucannon	2,500-10,000 adults/stable	27 miles/fair
Lower Grande Ronde[1]	Grande Ronde	50-250 adults stable	57 miles/fair
North Fork John Day	North Fork John Day	Unknown/increasing	42 miles/fair
Umatilla	Umatilla	50-250 adults/unknown	8 miles/fair
Walla Walla[1]	Walla Walla	2,500-10,000 adults/stable	37 miles/fair
	Touchet	50-250 adults/stable	18 miles/fair
Designated Critical Habitats	All	N/A	286 miles
Wallowa-Whitman			
Hells Canyon[1]	Sheep Creek	Not viable; unknown/unknown	1 miles/poor
	Granite Creek	Not viable; unknown/unknown	2 miles/poor
Upper Grande	Grande Ronde[1]	Not viable; 50-250 adults/stable	62 miles/fair
Wallowa (excluding Little Minam River)			75 miles/fair
Wallowa	Little Minam	Not viable; 250-1,000 adults/stable	17 miles/fair
North Fork John Day	North Fork John Day	Not viable; unknown/Increasing	42 miles/fair
Imnaha	Imnaha	Not viable;250-1,000 adults/stable	76 miles/fair
Brownlee[1]	Pine, Indian and Wildhorse Creeks	Not viable; 250-1,000 adults/severe decline	33 miles/fair
Powder	Powder	Not viable; 250-1,000 adults/severe decline	21miles/poor
Designated Critical Habitats	All	NA	514 miles

1. Grande Ronde population includes bull trout in the Wallowa subbasin as well as in the Lower Grande Ronde subbasin and portions of the Upper Grande Ronde subbasin; bull trout in the Little Minam River tributary watershed are considered a separate population by USFWS. Bull trout are also split into multiple populations in each of the Walla Walla, Hells Canyon and Brownlee subbasins.
2. From USFWS (2008) status review.
3. National Forest System habitat conditions status based on Blue Mountain Sustainability Model riparian-aquatic "habitat" condition ratings combined with habitat connectivity ratings associated with number and locations of culvert barriers passage concerns on National Forest System lands relative to spawning and rearing habitat distribution.

Umatilla National Forest – Bull trout spawning and rearing habitat within the Umatilla National Forest is in fair condition and supports multiple, well-distributed populations in multiple subbasins, based on species distribution, habitat and local population conditions averaged across National Forest System lands in each subbasin (see table 211). Headwater habitats for bull trout in National Forest System lands in most subbasins are high quality, though the total amount of such habitat varies by subbasin.

An inventory of culverts in National Forest System roads within the Umatilla National Forest in 2000 and 2001 revealed fish passage concerns created by a number of culverts, but very few problems were identified in subwatersheds occupied by bull trout. Current habitat quality, quantity and connectivity of spawning and rearing habitats within the Umatilla National Forest for multiple bull trout populations, when combined with improving riparian and aquatic habitat trends within National Forest System lands, indicate that habitat connectivity, quantity and quality for bull trout within National Forest System lands are being maintained and are contributing to recovery of bull trout viability. The most recent status and trend assessments by USFWS for bull trout populations associated with the Umatilla National Forest indicate that most populations are stable or increasing (USFWS 2005).

Wallowa-Whitman National Forest – Bull trout spawning and rearing habitat within the Wallowa-Whitman National Forest is in fair condition, other than in the Hells Canyon and Powder River subbasins where habitats are extremely limited and fragmented by mainstem dams and reservoirs (table 211). Current habitat quality, quantity and connectivity of spawning and rearing habitats within the Wallowa-Whitman National Forest for bull trout populations, when combined with improving riparian and aquatic habitat trends within National Forest System lands, indicate that habitat quality for bull trout within National Forest System lands is being maintained and is contributing to recovery of bull trout viability. The most recent status and trend assessments by USFWS for bull trout populations associated with the Wallowa-Whitman National Forest indicate that most populations are stable or increasing (USFWS 2005).

Steelhead

Steelhead populations in National Forest System lands comprise portions of larger subbasin-based populations belonging to either the MCR steelhead DPS or the SRB steelhead DPS, both of which are listed independently under the Endangered Species Act as separate “species” for Endangered Species Act purposes. Only the anadromous (steelhead) forms of *O. mykiss* are listed, and effects to each listed steelhead DPS must be analyzed separately under the Endangered Species Act. Steelhead as a whole well distributed among multiple subbasins in each national forest. Habitat conditions for the species in National Forest System lands were considered in each occupied subbasin. Distribution habitat and population conditions, all-lands viability status, and trend were considered for each DPS to aid in assessing focal species conditions within National Forest System lands. All-lands viability analyses for each of these larger steelhead populations were previously conducted by NMFS within each subbasin identified in table 212 (Ford et al. 2011). National Forest System lands were assessed separately for effects to viability from management of National Forest System lands, but considered in the context of these broader, subbasin-based viability analyses. Table 212 provides an overview of steelhead populations across the plan area, their status, trend, and related habitat conditions in National Forest System lands across the Blue Mountains national forests. Discussions specific to each national forest follow.

Table 212. Affected environment for summer steelhead populations within the plan area

Subbasin	Population Name	Population Status and Trend (all lands)[2]	DPS[3,4]	Spawning and Rearing Habitat Miles and Condition (NFS lands)[5]
Malheur				
Middle Fork John Day[1]	Middle Fork John Day	Not viable/declining	MCR	181 miles/good
Upper John Day	Upper John Day	Not viable/declining (South Fork population increasing)	MCR	167 miles/good
Designated critical habitats	MCR DPS only			410 miles
Umatilla				
North Fork John Day	North Fork John Day	Viable/declining	MCR	365 miles/good
Umatilla	Umatilla	Not viable/increasing	MCR	52 miles/good
Walla Walla	Walla Walla	Not viable/increasing	MCR	24 miles/good
	Touchet	Not viable/at risk/stable	MCR	4 miles/fair
Tucannon	Tucannon	Not viable/Unknown	SRB	6 miles/fair
Asotin	Asotin	Not viable/Increasing	SRB	8 miles/fair
Lower Grande Ronde	Lower Grande Ronde	Not viable/maintaining	SRB	104 miles/good
Upper Grande Ronde	Upper Grande Ronde	Not viable/increasing	SRB	204 miles/good
Designated critical habitats	SRB DPS only	N/A	SRB	284 miles
Designated critical habitats	MCR DPS only	N/A	MCR	647 miles
Wallowa-Whitman				
North Fork John Day	North Fork John Day	Viable/declining	MCR	70 miles/good
Asotin	Asotin	Not viable/unknown	SRB	4 miles/good
Hells Canyon	Hells Canyon	Not viable/unknown	SRB	43 miles/fair
Lower Grande Ronde	Joseph	Highly viable/increasing	SRB	181 miles/good
Upper Grande Ronde	Upper Grande Ronde	Not viable/stable	SRB	204 miles/good
Wallowa	Wallowa	Not viable/stable	SRB	86 miles/good
Imnaha	Imnaha	Not viable/stable	SRB	198 miles/good
Designated critical habitats	SRB DPS only	NA	SRB	1,377 miles
Designated critical habitats	MCR DPS only	NA	MCR	76 miles

1. MAL and UMA miles were run through the sustainability model together.
2. NMFS Biological Review Team status and trend conclusions (Ford et al. 2010; Ford et al. 2011).
3, 4. MCR: Middle Columbia River DPS; SRB: Snake River Basin DPS.
5. National Forest System conditions based on model outputs, modified by habitat connectivity conditions associated with number and locations of culvert passage concerns in National Forest System lands relative to species habitat distribution.

Malheur National Forest – Steelhead spawning and rearing habitat in National Forest System lands is in good condition and supports two well- distributed populations in two subbasins. Despite the availability of many miles of good-quality steelhead habitat in National Forest System lands in each subbasin, these populations are declining, according to recent status reviews (Ford et al. 2011), suggesting factors other than habitat quality and quantity on National Forest System lands are affecting these populations.

Current habitat quality, quantity and connectivity of spawning and rearing habitats within the Malheur National Forest for MCR steelhead populations, when combined with improving riparian and aquatic habitat trends within National Forest System lands, indicate that habitat connectivity, quantity and quality for MCR steelhead within National Forest System lands are being maintained or improved, and continue to contribute to restoration of viability for these MCR steelhead populations.

Umatilla National Forest – The Umatilla National Forest provides habitat for steelhead populations within both the Middle Columbia River ESU and the Snake River Basin ESU. Spawning and rearing habitat in National Forest System lands in both basins is in fair to good condition and supports multiple, well-distributed populations in National Forest System lands based on species distribution, habitat and local population conditions averaged across National Forest System lands in each subbasin. The North Fork John Day subbasin population in the MCR steelhead ESU is the only population currently considered viable, however the populations in the main Walla Walla and Umatilla subbasins are considered stable. Population conditions in the Snake River Basin are highly variable between subbasins, but habitat in National Forest System lands is fair to good in all subbasins.

An inventory of fish passage conditions presented by culverts within the Umatilla National Forest in 2000 and 2001 revealed numerous passage concerns created by culverts within the National Forest System roads. Those passage barriers were considered in the habitat condition evaluations. The majority of those concerns are located within the North Fork John Day subbasin. Priority subwatersheds have been identified for restoration in this subbasin. Few barriers were identified in other subbasins.

Current habitat quality, quantity and connectivity of spawning and rearing habitats within the Umatilla National Forest for multiple steelhead populations, when combined with improving habitat trends within National Forest System lands, indicate that habitat connectivity, quantity and quality for steelhead within National Forest System lands are being maintained, and are contributing to recovery of viability for both MCR and SRB steelhead. The most recent status and trend assessments by NMFS (Ford et al. 2011) for MCR and SRB steelhead populations associated with the Umatilla National Forest indicate that their population numbers are maintaining or increasing for the most part. The MCR steelhead population in the North Fork John Day subbasin is viable but declining per the most recent status assessment (Ford et al. 2011), despite good habitat conditions throughout the subbasin.

Wallowa-Whitman National Forest – The Wallowa-Whitman National Forest provides habitat for steelhead populations in both the Middle Columbia River and the Snake River Basin basins. Spawning and rearing habitat in National Forest System lands in both river basins is in fair to good condition, and National Forest System lands support multiple, well-distributed populations in the MCR steelhead DPS and in the SRB steelhead DPS, based on species distribution, habitat and local population conditions averaged across National Forest System land in tributary subbasins. An inventory conducted in National Forest System lands in 2000 and 2001 revealed numerous passage concerns for steelhead created by National Forest System road culverts, particularly in the Upper and Lower Grande Ronde subbasins and the upper Imnaha subbasin. These concerns were factored into the habitat condition ratings for National Forest System lands in each subbasin.

Current habitat quality, quantity and connectivity of spawning and rearing habitats within the Wallowa-Whitman National Forest for multiple populations, when combined with improving habitat trends within National Forest System lands, indicate that habitat connectivity, quantity and quality for MCR and SRB steelhead within National Forest System lands are being maintained, continue to contribute to viability of MCR steelhead, and are contributing to recovery of SRB steelhead viability. The most recent status and trend assessments by NMFS (Ford et al. 2011) for SRB steelhead populations associated with the Wallowa-Whitman National Forest indicate that their population numbers are generally increasing or stable. Habitat in most subbasins is good, and populations are stable or increasing in most. National Forest System lands support two highly viable populations, one each in the MCR and SRB steelhead DPS. The MCR steelhead population in the North Fork John Day subbasin is viable but declining, per the most recent status assessment (Ford et al. 2011), despite good habitat conditions throughout the subbasin.

Interior Redband Trout

Interagency conservation planning efforts have stratified redband populations in the planning area into spatially discrete conservation populations based on geographic clusters of subbasins (May et al. 2012). Those groups of subbasins are termed Geographical Management Units (GMUs). Redband trout populations will be identified by GMU for the remainder of this focal species analysis for redband, with three exceptions: (1) when referencing the Regional Forester's Sensitive Species described as the Malheur Lakes DPS (aka Oregon Closed Basins GMU) for purposes of Sensitive Species analysis; (2) when used by USFWS (2009) to refer to the Great Basin DPS (Oregon Closed Basins GMU); and (3) when discussing findings in Kostow (2003).

Redband trout populations in National Forest System lands in the interior Columbia River Basin portion of the plan area are members of larger subbasin- based resident redband trout populations. Redband trout populations in the Oregon Closed Basins are not listed and constitute their own GMU, long separated from populations in the interior Columbia River Basin. Table 213 displays an overview of redband trout populations within the plan area, their distribution among various geographically distinct GMUs, and related habitat conditions in National Forest System lands across the Blue Mountains national forests. Discussions specific to each national forest follow.

Malheur National Forest – Spawning and rearing habitat for redband trout in National Forest System lands is in fair condition and supports multiple viable populations in seven subbasins and well distributed among four GMUs (see table 213), based on species distribution, habitat and local population conditions averaged across National Forest System lands in each subbasin. The John Day GMU is the only one where steelhead is present, and the only GMU associated with the national forest, that is not currently targeted specifically for redband conservation efforts (May et al. 2012). The Oregon Closed Basins GMU, is otherwise known as the Great Basin DPS by USFWS and is still considered viable by USFWS (USFWS 2009), but the populations are believed to be declining. Redband trout of the Upper Malheur subbasin are considered viable within the subbasin across all ownerships. Their viability is supported within National Forest System lands primarily due to the amount of good-quality habitat available in wilderness and wild and scenic river management areas.

Table 213. Affected environment for redband trout populations within National Forest System lands in the plan area

Subbasin	Population Name	Population Status and Trend (all lands)[1,2]	GMU[3]	Spawning and Rearing Habitat Miles and Condition (NFS lands)[4]
Malheur				
Upper Malheur	Malheur	Viable/unknown	MS-B[1]	83 miles/good
Upper John Day	Upper John Day	Viable/unknown	JD2	310 miles/good
Middle Fork John Day	Middle Fork John Day	Viable/unknown	JD	276miles/good
North Fork John Day	North Fork John Day	Viable/unknown	JD	15 miles/fair
Silvies	Harney-Malheur Lakes	Viable/declining	Oregon Closed Basins	171 miles
Silver	Harney-Malheur Lakes	Viable/declining	Oregon Closed Basins	72 miles/good
Harney-Malheur Lakes	Harney-Malheur Lakes	Viable/declining	Oregon Closed Basins	14 miles/fair
Total Miles Habitat	All		All	257 miles
Umatilla				
Tucannon	Tucannon	Viable/unknown	LS[3]	6 miles/fair
Asotin	Asotin	Viable/unknown	LS	8 miles/fair
Lower Grande Ronde	Wenaha	Viable/unknown	LS	40 miles/good
Upper Grande Ronde	Upper Grande Ronde	Viable/unknown	LS	204 miles/good
North Fork John Day	North Fork John Day	Viable/unknown	JD	365 miles/good
Umatilla	Umatilla	Viable/unknown	MC[4]	52 miles/good
Walla Walla	Walla Walla	Viable/unknown	MC	30 miles/good
Total Miles Habitat	All		All	535 miles
Wallowa-Whitman				
Asotin	Asotin	Viable/declining	LS	4 miles/good
Hells Canyon	Hells Canyon	Viable/declining	LS	43 miles/fair
Lower Grande Ronde	Grande Ronde	Viable/declining	LS	181 miles/good
Upper Grande Ronde	Upper Grande Ronde	Viable/declining	LS	204 miles/good
Wallowa	Wallowa	Viable/declining	LS	86 miles/good
Imnaha	Imnaha	Viable/declining	LS	198 miles/good
Brownlee	Brownlee	Viable/declining	MS-B	33 miles/fair
Powder	Powder	Viable/declining	MS-P[5]	22 miles/fair
Burnt	Burnt	Viable/declining	MS-P	5 miles/poor
North Fork John Day	North Fork John Day	Viable/declining	JD	70 miles/good
Total Miles habitat				842 miles

1. Thurow et al. 2007.
2. May et al. 2012.
3. MS-B/Middle Snake-Boise Geographic Management Unit (GMU); JD/John Day GMU; LS/Lower Snake GMU; MC/Middle Columbia GMU; MS-P/Middle Snake-Powder GMU.
4. National Forest System conditions based on model outputs, modified by habitat connectivity conditions associated with number and locations of culvert passage concerns in National Forest System lands relative to species habitat distribution.

An inventory of fish passage conditions presented by culverts within the Malheur National Forest in 2000 and 2001 revealed numerous passage concerns created by culverts within the National Forest System roads. Those passage barriers were considered in habitat condition evaluations. Those barriers were common in the Silvies River subbasin. The subbasin has priority subwatersheds identified for restoration.

Current habitat quality and connectivity of spawning and rearing habitats within the Malheur National Forest for multiple populations and GMUs are fair to good, based on modeling results. When combined with improving habitat trends in National Forest System lands, these habitat considerations indicate that habitat quantity and quality for redband trout within National Forest System lands are being maintained and continue to support distribution and viability of redband trout in each of the GMUs.

Umatilla National Forest – The Umatilla National Forest provides habitat for redband trout in portions of the John Day, Middle Columbia, and Lower Snake GMUs. Spawning and rearing habitat in National Forest System lands is predominantly in good condition and supports multiple, well-distributed, viable populations at the subbasin scale, based on species distribution, habitat and local population conditions averaged across National Forest System lands in each GMU (see table 213). Population trends are currently unknown.

An inventory of fish passage conditions presented by culverts within the Umatilla National Forest in 2000 and 2001 revealed numerous passage concerns created by National Forest System road culverts in the North Fork John Day subbasin in particular, but scattered throughout the Snake River Basin portion of the forest as well. Those passage barriers were considered in the habitat condition evaluations. Current habitat quality and connectivity of spawning and rearing habitats within the Umatilla National Forest for multiple populations and GMUs are fair to good, based on modeling results. When combined with improving habitat trends in National Forest System lands, these habitat considerations indicate that habitat quantity and quality for redband trout within National Forest System lands are being maintained and continue to support distribution and viability of redband trout in each of the GMUs.

Wallowa-Whitman National Forest – The Wallowa-Whitman National Forest provides habitat for redband trout in portions of four GMUs (table 213). Spawning and rearing habitat in National Forest System lands is in fair to good condition and supports multiple, well-distributed moderately viable, but declining populations at a subbasin scale, based on species distribution, habitat, and local population conditions averaged across National Forest System lands (see table 214). In subbasins with lands in the HCNRA, the management is highly protective of fish habitat for redband populations belonging to the Lower Snake, Middle Snake-Powder, and Middle Snake-Boise GMUs. The Imnaha subbasin provides high-elevation spawning and rearing habitat that is reasonably well connected within the subbasin. The majority of redband spawning and rearing habitat in the Imnaha subbasin is located within the HCNRA and/or within wilderness. Management direction within the HCNRA helps to support continued viability of the Lower Snake and Middle Snake-Powder GMUs, and contributes to the improving habitat trends that are becoming evident at the broader scale (Archer et al. 2009).

An inventory of fish passage conditions presented by culverts within the Wallowa-Whitman National Forest in 2000 and 2001 revealed numerous passage concerns created by National Forest System road culverts, scattered among several subbasins. Those passage barriers were considered in the habitat condition evaluations. Current habitat quality and connectivity of spawning and rearing habitats within the Wallowa-Whitman National Forest for multiple populations and GMUs are fair to good, based on modeling results. When combined with improving habitat trends on National Forest System lands, these habitat considerations indicate that habitat quantity and quality for redband trout within National Forest System lands are being maintained and continue to support distribution and viability of redband trout in each of the GMUs.

Threatened and Endangered Species

Important population segments of individual species have been listed separately as ESUs or DPSs. This analysis therefore considers Endangered Species Act-listed species at the DPS or ESU scale, together with their designated critical habitats. Table 206 through table 208 display listed species present within each national forest in the plan area. Table 210 through table 213 display the status of individual populations of each listed DPS or ESU associated with each of the national forests, the distribution of each species, the total amount of designated critical habitat within each national forest, and current habitat conditions within National Forest System lands. That information will not be repeated in this section.

The most recent status review for listed anadromous species was based on the criterion of self-sustainability (Ford 2010). The majority of the biological review team (BRT) members concluded that the SRB fall Chinook salmon, Snake River spring/summer Chinook salmon, and SRB steelhead are still high risk and “likely to become endangered in the foreseeable future.” The Middle Columbia River steelhead DPS remains listed as threatened. Although most listed spring Chinook salmon and summer steelhead populations are still considered nonviable when all lands are considered in each subbasin, indications are that populations are generally increasing. NMFS describes and monitors population viability for anadromous fish populations and major population groups at different scales: by subbasin, by major tributary watershed, and/or by groups of adjoining subbasins, depending on the population of interest.

Salmon

Sockeye Salmon (Snake River Basin ESU)

Snake River Basin (SRB) sockeye salmon are only present within the Wallowa-Whitman National Forest. They use the mainstem Columbia and Snake Rivers as a migration corridor to reach their spawning areas in Idaho, outside the plan area. For purposes of this analysis, they are considered present only in the Hells Canyon National Recreation Area (HCNRA) for the Wallowa-Whitman National Forest, which is managed under the HCNRA comprehensive management plan (CMP). No revisions to the CMP are proposed. National Forest System lands within the plan area provide no spawning habitat and no early rearing habitat outside the mainstem Snake River. Management strategies and activities analyzed herein for the revised plans for the Blue Mountains national forests would have no effect on this species outside of effects previously considered and consulted for the HCNRA CMP and would not be discussed further in this analysis.

Fall Chinook Salmon (Snake River Basin ESU)

Snake River Basin fall Chinook salmon is listed separately as threatened under the Endangered Species Act and is considered a separate ESU, the equivalent of a species under Endangered Species Act. Their spawning habitat is the Snake River and the lower ends of large tributaries downstream of National Forest System lands in the Snake River Basin. Viability of SRB fall Chinook salmon is primarily influenced by factors outside Forest Service control: mortality associated with upstream and downstream passage over multiple mainstem dams in the Snake and Columbia Rivers, cyclical ocean conditions, commercial, tribal and recreational harvest, and interbreeding with nonnative hatchery stock. Indirect effects to SRB fall Chinook salmon would be determined based on effects to SRB spring Chinook salmon viability as an approximate surrogate.

Spring Chinook Salmon (Snake River Basin ESU)

Snake River Basin spring Chinook salmon are found in the Tucannon, Grande Ronde, Wallowa, Imnaha, and Snake River/Hells Canyon subbasins within the Umatilla and Wallowa-Whitman National Forests. Characteristics of the species were discussed in the earlier section on focal species.

Steelhead

Two Endangered Species Act-listed DPS (Middle Columbia River and Snake River Basin) are located within the plan revision area.[1] The Middle Columbia River DPS consists of steelhead populations in the John Day, Walla Walla, and Umatilla River subbasins. The Snake River Basin DPS includes steelhead in the Tucannon, Asotin, Wallowa, Lower and Upper Grande Ronde, Imnaha, and Snake River/Hells Canyon subbasins. For purposes of Endangered Species Act listing, each DPS is considered a separate species, with recovery goals for component populations at the subbasin scale or comparable scales; therefore, viability for steelhead is described by DPS and by subbasin.

Middle Columbia River Steelhead DPS

Middle Columbia River (MCR) steelhead and designated critical habitats are present in all three Blue Mountains national forests. in the North Fork John Day subbasin, the Forest Service (Umatilla and Wallowa-Whitman National Forests) administers separate, but adjoining, portions of MCR steelhead habitat in the subbasin.

Snake River Basin Steelhead DPS

Snake River Basin (SRB) steelhead and designated critical habitats are present within two of the three Blue Mountains national forests. The Malheur National Forest provides no habitat for SRB steelhead. The Umatilla National Forest provides the majority of habitat in National Forest System lands for some populations (e.g., the Tucannon subbasin). The entire Imnaha subbasin is within the Wallowa-Whitman National Forest. The Umatilla and Wallowa-Whitman National Forests provide approximately equal portions of other subbasins. In the lower Grande Ronde subbasin, the Umatilla National Forest includes lands draining the west side of the subbasin (Wenaha River watershed), and the Wallowa-Whitman National Forest includes lands draining the east side of the subbasin (Joseph Creek watershed), which support two different populations of SRB steelhead within the subbasin.

Bull Trout (Columbia River Basin DPS)

Columbia River Basin (CRB) bull trout are found in all the plan area subbasins except for the Burnt River (NWPPC 2004a), the Oregon Closed Basins, and the South Fork Crooked River subbasin in the south end of the plan area. Bull trout core populations (Whitsell et al. 2004) have been generally identified at the subbasin level. Core populations in all of these subbasins are part of the Columbia River Basin DPS, which is listed under the Endangered Species Act as threatened. For the remainder of this analysis, CRB bull trout will be referred to simply as “bull trout.”

[1] http://www.nwr.noaa.gov/ESA-Salmon-Listings/Salmon-Populations/Steelhead/Index.cfm

Sensitive Species

The Regional Forester's Sensitive Species list identifies fish and aquatic invertebrate species for which viability is a concern as evidenced by significant current or predicted downward trends in population numbers or density, or significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution (FSM 2670.5). These species have not yet reached a threshold for listing under the Endangered Species Act. Table 206 through table 208 include sensitive aquatic species with documented or suspected presence in each of the Blue Mountains national forests, based on the current (2011) Regional Forester's Sensitive Species list.

Aquatic invertebrate species listed as sensitive for one or more national forests in the Blue Mountains plan revision area include the shortfaced lanx, Columbia pebblesnail, the pristine springsnail, the Harney Basin dusky snail, and the Western Ridged Mussel (table 206 through table 208).

Some of these species are found in fast flowing streams or rivers of various sizes, others are found in slow-moving, spring-fed waters. All are known or suspected to occur in high-quality aquatic habitats associated with good condition riparian areas. Small aquatic snails inhabiting springs and spring-fed channels have not been found in the Blue Mountains where springs have been previously developed (Frest and Johannes 1995), but have been found in undeveloped springs and spring runs with high water quality.

Riverine Mollusks

The **shortfaced lanx** is a freshwater limpet that attaches to large, clean, cobble-boulder substrate in large, fast, relatively warm rivers, such as the Snake River below Hells Canyon Dam.

The **western ridged mussel**, in its adult form, is a large, long-lived bivalve mollusk found in clean, gravel-cobble substrates in streams and rivers of the Blue Mountains, typically at higher elevations than other mussel varieties in the interior Columbia River Basin. Once they become local streambed residents, Western Ridged Mussels may live for decades so long as their habitat remains characterized by good water quality and low sediment conditions.

The **Columbia pebblesnail** is an aquatic snail found in large rivers of the Pacific Northwest, including the lower Snake River, the lower Grande Ronde River ten miles or more downstream of the town of Troy, Oregon, and in middle reaches of the Columbia River downstream of the Umatilla National Forest. In National Forest System lands, Columbia pebblesnails have only been documented in portions of the Snake and Salmon Rivers managed by the Wallowa-Whitman National Forest in the HCNRA and are not suspected elsewhere within the Blue Mountains national forests.

Redband Trout, Great Basin/Malheur Lakes DPS (aka Malheur Lakes GMU)

Basic species information and current conditions of population viability and habitat conditions for the Malheur Lakes DPS of redband trout populations are presented in the section on focal species and will not be repeated here.

Spring-dependent Snails

Species dependent upon microhabitats, such as high-quality springs and spring-fed riparian habitats, are not well represented by conditions and trends in habitats for the selected group of focal species. Their viability is much more closely related to conditions and trends in spring fed riparian areas. Conditions and trends for these limited habitats will be used as an indicator of viability for spring- dependent species not otherwise represented by aquatic vertebrate focal species or their habitats.

Based on surveys conducted within the Umatilla National Forest by Forest Service biologists, the **pristine springsnail**, a small aquatic snail, is found only in clear, cold, undeveloped springs and spring creeks within the Walla Walla and Umatilla River basins.

A recent addition to the Regional Forester's Sensitive Species list, the **Harney Basin dusky snail**, is only known to be in one location in the Harney Basin (one of the Oregon Closed Basins), and has not yet been found in National Forest System lands. It is suspected to be present within the Malheur and Ochoco National Forests in the Oregon Closed Basins and Upper Malheur River subbasin portions of those forests, due to their presence in the Harney Basin. Little is known about this small, freshwater snail, other than that it has been found in habitat characterized as cold springs and associated spring channels.

Westslope Cutthroat Trout

Westslope cutthroat trout are a localized endemic of the Upper John Day subbasin within the Malheur National Forest. The species is considered an introduced species in headwaters of subbasins within the Umatilla and Wallowa-Whitman National Forests. Westslope cutthroat trout inhabit high elevation headwater tributaries and typically occur higher in the tributaries than do redband trout, to which they are closely related. Both redband trout and bull trout in the North Fork John Day and Upper John Day subbasins function as focal species surrogates for westslope cutthroat trout because pure cutthroat inhabit higher elevation tributaries than redband trout, and share cold headwater habitats with bull trout. Viability of westslope cutthroat in the Umatilla and Malheur National Forests is uncertain, due to hybridization, the presence of fair to good habitat conditions in the North Fork and Upper John Day subbasins, when considered with the status of steelhead and redband trout populations in those subbasins and the status of bull trout populations in those same subbasins.

Margined Sculpin

Margined sculpin are a small fish requiring clean cool water and clean streambed substrate without much fine-sediment. They are only known to occur in three subbasins, all associated with the Umatilla National Forest: the Tucannon, Walla Walla, and Umatilla. Margined sculpin are known to be present in the mainstem Tucannon River, which is a medium-large river supporting both spring Chinook salmon and steelhead, and are also known to be present in at least one tributary to the Tucannon River that was also occupied by bull trout. Their small size and productivity relative to the amount and quality of available habitat available suggests sculpin populations are viable, however monitoring population trends for this species is difficult because other sculpin species in the Blue Mountains are similar in appearance and accurate identification to the species level during field surveys is difficult for seasonal surveyors less familiar with the species.

Management Indicator Species

A number of aquatic management indicator species were selected for the 1990 plans (see table 206 through table 208). The 1982 Planning Rule required that certain vertebrate and/or invertebrate species present in the area be identified and selected as management indicator species and the reasons for their selection stated. The species chosen as management indicator species for the 1990 forest plans were selected because their population changes were believed to indicate the effects of management activities within National Forest System lands.

Five species or groups of species from the trout and salmon family of fish (salmonids) were selected to serve as management indicator species in the 1990 plans because their habitat requirements encompassed a broad range of aquatic habitat conditions characteristic of the three national forests. In the 1990 forest plans, there was one general objective for management indicator species: to manage National Forest System lands to maintain viable populations of those selected species. However, the 1982 NFMA regulations did not make a direct link between management indicator species and broad-scale species diversity. Population trends of management indicator species were not expected to represent trends in viability for other species.

Each of the 1990 plans addressed monitoring for management indicator species populations at the forest scale in somewhat different ways. The Umatilla National Forest 1990 forest plan intended to monitor populations of redband trout and steelhead populations; the Malheur National Forest 1990 forest plan intended to monitor habitat for redband trout, westslope cutthroat trout, and bull trout; and the Wallowa-Whitman National Forest 1990 forest plan intended to monitor management indicator species populations indirectly based on population data collected by state agencies for resident trout and steelhead. The Ochoco National Forest 1989 forest plan intended to monitor resident trout, including nonnative brook trout where they occurred, as well as native redband trout and steelhead. Only native redband trout are present in the portion of the Ochoco National Forest administered by the Malheur National Forest and analyzed as part of the plan area. Non-native brook trout populations were introduced as desirable game fish in times past and are present in scattered watersheds in the Wallowa-Whitman, but their current status is unknown.

The purpose of management indicator species monitoring is to evaluate the effectiveness of Forest Service management in maintaining habitat for the selected management indicator species; however, several of the management indicator species selected for the 1990 forest plans are significantly affected by human influences outside the management prerogative of the Forest Service. Indicators should be chosen for specific habitats identified as being at risk, where there is a high level of management actions anticipated, and where there is reasonable certainty that management indicator species population changes can be monitored and attributed to Forest Service activities (Hayward et al. 2004). It is this last criterion that the species previously selected and/or considered for continued use as management indicator species, fall farthest from meeting. Population changes in these species have proven difficult to tie specifically to management of National Forest System lands for reasons specific to each of the selected species, as discussed in this section.

None of the chosen aquatic management indicator species was Endangered Species Act-listed at the time the Blue Mountains forest plans were signed in 1990. Several steelhead and bull trout DPS, were subsequently Endangered Species Act-listed as Threatened between 1998 and 2010, along with their designated critical habitats, indicating a loss of viability at the DPS or species scale. Reasons for those listings are provided in the various Federal Registers that announced the listings. No other aquatic management indicator species in the planning area have been listed as Threatened or Endangered since 2010. Redband trout and westslope cutthroat trout are the only remaining native aquatic management indicator species from the 1990 forest plans that are not currently listed under the Endangered Species Act.

Other aquatic species known present in the planning area were considered as candidates for management indicator species, but were not selected for a variety of reasons including lack of information on distribution or biology or current population conditions for the species. Most nongame species are believed to be less sensitive to effects of land management than are coldwater salmonids, particularly water temperatures and sediment levels in streambeds. Other species are anadromous similar to salmon and steelhead and are affected by similar impacts to their populations in the migratory corridors downstream of National Forest System lands.

Other species prefer warmer and/or larger slower waters downstream of National Forest System lands, or may be species which would potentially benefit from land management impacts that would be considered detrimental to listed and Sensitive coldwater species. Other species considered are strongly affected by management of lands downstream of National Forest System lands or are species for which there are no current concerns for viability and not expected to be detrimentally affected by forest management activities. Salmonid species are believed to be more sensitive to the types of land management activities likely to occur on National Forest System lands.

For reasons previously discussed, of the current management indicator species, only bull trout and redband trout were seriously considered as possibilities for carrying forward as management indicator species in the new plan revisions. Redband trout are distributed only partially in subbasins outside the range of steelhead, and are affected by management on both federal and non-federal lands in the subbasins where they are resident, they were not considered a good indicator of management effects. For those reasons, redband trout were not selected to carry forward as management indicator species for the plan action alternatives. Bull trout are high-elevation species and use spawning and rearing habitats in upper watersheds with limited commercial timber management, infrequent high-intensity wildfires as a natural occurrence, limited forage production and suitability for livestock grazing. Most of their spawning and rearing habitat is located in areas predominantly allocated to Wilderness and other low-roaded Management Area allocations. For these reasons bull trout were not considered to be a good indicator of management effects.

The biology and legal status of anadromous steelhead and spring Chinook salmon in the Middle Columbia and Snake River basins demonstrates that anadromous populations are heavily influenced by many factors outside and downstream of National Forest System lands. Steelhead and Chinook salmon both are highly migratory and spend a large portion of their lives in large rivers and oceans downstream of National Forest System lands. They are strongly affected by land and population management factors outside of National Forest System lands, all of which are beyond the management purview of the Forest Service.

Those factors include competition and interbreeding with hatchery stocks; tribal, recreational and commercial harvest; habitat conditions including water quality in the migratory river corridors and estuaries; and impacts of passing through multiple, mainstem hydropower dam operations during both emigration downriver to the ocean as subadults and as adults returning upriver to spawn in their natal streams. These population and ESU/DPS level impacts are described in multiple documents, including the Middle Columbia River Steelhead Recovery Plan (NMFS 2008) and subbasin plans for the Middle Columbia River and Lower Snake River subbasins associated with the plan area (NWPCC 2004[2]).

Steelhead and redband trout juveniles are indistinguishable visually, and their spawning and rearing habitats overlap on National Forest System lands in year-round habitats. In addition, where they co-occur, offspring of female steelhead may mature into resident redband trout, and offspring of female redband trout may ultimately out-migrate to the ocean and return to National Forest System streams as adult steelhead (Carmichael et al. 2005). This uncertainty in adult development further limits reliability of viability assessments for steelhead and redband

[2] http://www.nwcouncil.org/fw/subbasinplanning/home/

populations in National Forest System lands where steelhead and redband juveniles are both present year-round and cannot be distinguished from one another visually.

Conclusions regarding effects of forest management on populations of either steelhead or co-curring redband trout as separate management indicator species from field surveys of spawning and rearing habitats on National Forest System lands, become highly unreliable. Monitoring to detect population trends for the resident life history where steelhead are present is difficult to conduct without conducting expensive and extensive genetic testing of both juveniles and adults of both life histories throughout National Forest System lands, which has not been done for purposes of monitoring effects of forest management on either steelhead or redband populations as management indicator species.

For these reasons, changes in populations of either redband trout or steelhead at subbasin-scale do not necessarily reflect consequences of Forest Service management on either species/life history individually. The fact that redband and steelhead are known to interbreed may support population viability for both life histories where they co-occur, but the extent to which this occurs or the extent to which each life history supports viability of the other, is unknown.

Local populations (subwatershed scale) of interior redband trout across the Blue Mountains national forests are considered depressed, with low numbers, or of unknown status (Thurow et al. 2007; subwatershed-scale population assessment data for the selected focal species; project record). Redband populations within the current range of steelhead are also affected by habitat conditions outside the national forests. They can be seasonally migratory within the subbasin-scale freshwater networks and may winter in larger streams in National Forest System lands and downstream in private and state lands, and are likely impacted by habitat fragmentation across ownerships. Redband trout are presumed present in all Columbia and Lower Snake River subbasins where steelhead are present.

Redband trout populations in subbasins outside the current range of steelhead are heavily impacted by agricultural and urban development in migratory corridors downstream of National Forest System lands, and their habitats are naturally fragmented in the Oregon Closed Basins, and are fragmented by mainstem dams and water diversions in the Upper Malheur, Powder, and Burnt River subbasins downstream of National Forest System lands. The fact that redband trout populations are known to use habitats within National Forest System lands as well as habitats downstream of National Forest System lands, complicates monitoring efforts to detect effects of land management activities within National Forest System lands on these populations as a management indicator species, even in river systems where steelhead co-occurrence is not a confounding factor. Rieman et al. (2000) noted the extreme population fragmentation and related impacts of land management downstream of National Forest System lands in these subbasins, based on analyses conducted for the Interior Columbia Basin Ecosystem Management Project (ICBEMP).

Westslope cutthroat trout are a native species with limited presence in eastern Oregon and Washington, where they are on the outer limits of their natural distribution which is centered in northern Idaho and western Montana. Westslope cutthroat are known to be present within the North Fork John Day and Upper John Day subbasins. Their population numbers within the plan area are unknown, but are likely similar to those of redband and bull trout populations in shared watersheds as their habitat requirements are similar.

Westslope cutthroat, although a true separate species, are closely related genetically to redband trout and steelhead and are known to experience hybridization zones where they overlap with redband trout and steelhead. Hybridization confounds efforts to detect effects of Forest Service management on westslope cutthroat trout as a standalone species. Similar problems may occur where brook trout have been introduced into bull trout streams.

Non-native brook trout are limited to a very few watersheds within the plan area and are not a management indicator species except where noted previously for the Ochoco and Wallowa-Whitman National Forests in tables AS1 and AS3. Current population numbers are unknown, but local populations are suspected to be increasing wherever they occur. Non-native brook trout impact bull trout populations, in particular, through interbreeding which results in sterile hybrids and/or through relatively high reproductive rates which, leads to competitive displacement of bull trout that exhibit much lower reproductive rates. Brook trout also tend to out-compete westslope cutthroat trout for space and food supply where they co-occur. Their presence makes it much more difficult to detect correlations with land management for either bull trout or westslope cutthroat.

Although nonnative brook trout were included in the “resident trout” management indicator species group in the Wallowa-Whitman forest plan in 1990, brook trout are currently considered an undesirable nonnative introduced species in the Wallowa-Whitman National Forest due to their negative impacts on native bull trout and/or westslope cutthroat populations where brook trout co-occur with either of the other two species. Based on the hybridization and competition concerns for Threatened bull trout and Sensitive westslope cutthroat, brook trout are no longer considered a desirable nonnative species suitable for use as a management indicator species for any of the Blue Mountain National Forests for purposes of monitoring population effects of land management on National Forest System lands.

Bull trout populations are a mix of resident and migratory individuals. This mix of life histories is an adaptation to infrequent but catastrophic natural disturbances in their high-elevation habitats. The benefits of such disturbances are that they tend to deliver pulses of large wood and streambed material that provide new spawning gravels and increase habitat complexity, providing for resting places and cover to shelter them from predators and reduce energy demands imposed by fast streamflow. A fresh assortment of large streambed substrate provides spaces in the streambed where juveniles can hide from predators.

The majority of resident bull trout populations and spawning habitats are located in high-elevation habitats limited management is likely to occur, in that these areas are mostly allocated to wilderness, wild and scenic rivers corridors, municipal watersheds, backcountry nonmotorized use where timber harvest, livestock grazing and roaded access are limited. Natural disturbance processes in spawning areas are predominantly operating at natural frequencies, magnitudes and rates to which the species has adapted over centuries. Attempts to monitor bull trout populations are extremely difficult due to difficult access to remote headwater habitats, complex life histories and population networks interacting with large disturbance-prone landscapes to which the species is adapted. The remoteness of their headwater habitats, natural life history complexity of the species and the limited types of land uses in their habitats were some of the combined reasons why bull trout were not chosen for continuation as a management indicator species for the effects of forest management. Other reasons are summarized below.

Bull trout, redband trout, and steelhead populations in and downstream of National Forest System lands have become highly fragmented due to loss of access to migratory corridors and wintering habitats downstream of National Forest System lands through conditions created by impassible dams on main rivers, together with impacts of hybridization and competition with related, introduced species and nonnative hatchery stocks. Subbasin plans and recovery plans indicate that spawning and rearing habitats for Endangered Species Act-listed DPS and ESUs in lands downstream of National Forest System lands are also degraded by past land use and/or accessibility within and among spawning and rearing habitat. The degree to which these species have been affected varies by subbasin and associated population. The cumulative impacts of historic and ongoing management in National Forest System and other lands are represented in the current habitat and population conditions and trends presented in table 210 through table 213.

Both anadromous and resident aquatic species considered here for use as management indicator species are affected by mainstem hydropower dam construction and operation, hatchery management, fishing regulation, (harvest), mining, timber harvest, road building, water development and ongoing water uses in other ownerships downstream of National Forest System lands, as well as by ongoing and legacy habitat impacts of past management in National Forest System lands, particularly management in terms of mining, timber harvest, livestock grazing and road construction. Current population, habitat conditions, and trends both within and outside of National Forest System lands reflect those cumulative impacts to those species and their habitats, and are discussed in Federal Register listings for each Threatened DPS and ESU. They are also described in greater detail in Subbasin Plans for each planning area subbasin and in agency Status Reviews, Recovery Plans and draft Recovery Plans for listed ESUs and DPSs.

Over the years since 1990, in consideration of the numerous Endangered Species Act-listings for populations that operate at scales that extend well beyond NFs lands, state and federal biologists from many agencies have come to recognize that federal land management alone cannot ensure viability for species of conservation concern will not be lost due to factors outside national forest boundaries or beyond agency management authority, even if adequate habitat quality and quantity are available in National Forest System lands. Thus, the management indicator species concept and aquatic species selected as management indicator species have not served their intended management indicator species function well over the years. For the reasons discussed above, no aquatic Management Indicator Species were chosen for any of the Plan Revision action alternatives. Effects to management indicator species will be discussed for alternative A only, in the section titled “Environmental Consequences to Management Indicator Species.”

Management Indicator Species Habitat

Repeatable riparian and stream habitat surveys designed for detecting habitat trends, as required by forest plan biological opinions for listed steelhead, spring Chinook salmon, and bull trout, have been ongoing throughout the Blue Mountains planning area since 2000. The survey areas include watersheds in which only non-listed redband trout are present. Those monitoring surveys are repeated on a five-year schedule, and enough repeat surveys have been completed during the past five years to allow for early indications of trend across the plan area for both riparian and aquatic conditions (Archer et al. 2009). Early results display improving trends in riparian vegetation conditions, with improving trends in physical aquatic habitat conditions following more slowly, as would be expected though indirect effects of natural processes and interactions between vegetation conditions in riparian zones and stream channels indirectly influenced by those conditions.

Environmental Consequences – Aquatic Species Viability

Species Viability – Overview

Management of National Forest System lands affects viability of aquatic species in two ways. The first way is through the effects of active land management to restore riparian and aquatic habitat function and habitat quality. The second way is the extent to which aquatic and riparian habitats and species are protected from detrimental effects of active land management, particularly from long-term detrimental effects of timber production, livestock grazing and/or road construction and motorized access. When riparian areas and aquatic habitats are protected from chronic impacts of these activities, they can typically recover without additional assistance from active restoration, but slowly.

Some types of active restoration that contribute to restoring viability of aquatic species, take place in or near the stream channel, example, restoration of fish passage by removing or upgrading a culvert barrier at a road-stream crossing, or replanting riparian shrubs to restore stream shade to provide cooler water and improve streambank stability to reduce sediment inputs that clog spawning gravels. Such actions contribute to improved viability of aquatic species relatively quickly. The comparison of alternatives for these activities is available in the Watershed section, and these comparisons also apply in terms of benefits to focal species as a group. Other activities to restore watershed function and processes take place in the uplands, and improve species viability less directly and more slowly, when focal species are considered as a group. The preceding section on Watershed Function and Water Quality discloses the effects of alternatives in terms of number of watersheds with improved (upland) condition through combined active restoration of existing roads to reduce impacts, and reduced risks from livestock grazing in uplands. Those effects will not be repeated here. Additional supporting comparisons of discussions of livestock effects on riparian vegetation is provided in the botany and range sections. Effects to riparian areas and aquatic habitats from livestock depend primarily on utilization standard. Relative effects to focal species and their habitats overall, are consistent with the comparison of alternatives for overall improved watershed condition and riparian and aquatic habitats. Those effects are incorporated by reference, with an acknowledgement that active restoration of upland portions of watersheds, particularly of priority watersheds, when combined with active restoration of riparian and aquatic habitats in those same priority watersheds, is expected to contribute long-term to viability of aquatic species of conservation concern within the planning area.

Active restoration of riparian and aquatic habitat, discussed in the Watershed Section, is assumed to complement upland restoration in the same priority watersheds. The greater the number of priority watersheds restored, the greater the benefits of the alternative to viability of aquatic species overall, in terms of active restoration. However, the extent to which active restoration of priority watersheds under any alternative will benefit any particular aquatic focal species is unknown. There is no way to predict exactly which priority watersheds will be selected for active restoration in future under the various alternatives, and the various focal species are non-uniformly distributed among the priority watersheds (table 214). Thus additional analysis is required, to assess how well the Plan alternatives would support viability for each aquatic focal species and ultimately help to maintain a diversity of aquatic species in the plan area.

Protection from detrimental effects from land management activities is as critical to maintaining and restoring viability of individual focal species as is active restoration. These two aspects of restoration can complement one another on the same piece of ground, or may complement each other through application to non-overlapping acreages. Management Area allocations and suitability determinations provide protection through acreages determined not Suitable for uses (roads, grazing, timber production) that present potential risk to aquatic and riparian habitats and aquatic species. Protection on lands determined to be suitable for these uses, is provided through desired conditions, standards and guidelines and monitoring.

Table 214. Distribution of key subwatersheds (KWS) (priority subwatersheds in parenthesis) relative to focal species habitats within the Blue Mountains national forests

Subbasin	Bull Trout	Chinook salmon	Steelhead	Redband Trout[3]	Total KWS[1]	Current KWS** (alternative A)[2]
Malheur National Forest						
Middle Fork John Day	6 (6)	13 (13)	15 (15)	8 (8)	15 (15)	29 (15)
Upper John Day	3 (0)	1 (0)	15 (0)	15 (0)	16 (0)	47 (0)
Upper Malheur	8 (2)	NA	NA	11 (7)	15 (7)	19 (7)
Silvies	NA	NA	NA	8 (0)	9 (0)	0
Silver	NA	NA	NA	4 (4)	4 (4)	0 (4)
North Fork John Day	0	0	0	0	0	4 (0)
Harney-Malheur	NA	NA	NA	0	0	0
South Fork Crooked River-Beaver Creek	NA	NA	NA	0	0	0
Malheur National Forest Totals	17 (8)	14 (13)	30 (15)	46 (19)	59 (26)	99 (26)
Umatilla National Forest						
Middle Fork John Day	NA	NA	0	0	0	1 (0)
North Fork John Day	5 (5)	9 (4)	21 (12)	21 (12)	21 (12)	84 (12)
Lower John Day	0	NA	0	0	0	4 (0)
Willow-Columbia	NA	NA	NA	0	0	2 (0)
Umatilla	5 (0)	4 (0)	6 (0)	6 (0)	6 (0)	15(0)
Walla Walla	5 (0)	2 (0)	4 (0)	4 (0)	4 (0)	10 0)
Tucannon	4 (4)	2 (2)	4 (4)	4 (4)	4 (4)	7 (4)
Asotin	3 (0)	NA	3 (0)	3 (0)	5 (0)	6 (0)
Lower Grande Ronde	11(0)	7 (0)	10 (0)	10 (0)	12 (0)	25 (0)
Upper Grande Ronde	1(0)	NA	1 (0)	1 (0)	1 (0)	9 (0)
Umatilla National Forest Totals	34 (9)	21 (6)	49 (16)	49	53 (16)	163
Wallowa-Whitman National Forest						
Imnaha	15 (4)	18 (4)	23 (4)	22 (4)	27 (4)	27 (4)
Lower Grande Ronde	0	0	15 (0)	15 (0)	15 (0)	23 (0)
Upper Grande Ronde	10 (10)	11 (11)	23 (13)	23 (13)	27 (15)	27 (15)
Lower Snake-Asotin	0	0	0	0	0	1 (0)
North Fork John Day	5 (3)	6 (3)	10 (3)	10 (3)	10 (3)	10 (3)
Brownlee (in the HCNRA)	4 (4)	NA	NA	4 (4)	7 (4)	7 (4)
Powder	7 (0)	NA	NA	0	7 (0)	7 (0)
Burnt	11(0)	NA	NA	11 (0)	11 (0)	0
Wallowa	14 (0)	11 (0)	10 (0)	10 (0)	16 (0)	16 (0)
Totals	66 (21)	44 (18)	81 (20)	95 (24)	112 (26)	292 (26) (Hells Canyon not included)

1. Includes priority (key) watersheds for active restoration as defined for action alternatives. Subwatersheds with multiple species are only counted once for purposes of total KWS count. Totals do not represent sum of KWS for individual focal species.
2. Represents current combined set of key and priority subwatersheds as defined by PACFISH and INFISH criteria.
3.Redband trout are presumed present wherever steelhead are present.

The Blue Mountains Aquatic Species Sustainability Model (Gecy 2013a) assesses alternatives from the perspective of providing protection and reduction of risk of combined effects to fish and their habitats from timber production, livestock grazing and roaded access through land allocations and suitability determinations. The model was designed to assess risk to viability for each of the individual focal species, by alternative, based on the mix of land allocations and suitability for these uses, in each subbasin occupied by the species. Model outputs are described in terms of likelihood that aquatic habitats would be protected, in each subbasin. Protection facilitates passive restoration of aquatic habitats and species through natural processes.

Table 214 displays how key and priority watersheds are distributed by species in each subbasin, however the Model does not take their presence into account as a special consideration as they are not allocations. Each key and priority watershed contains multiple management areas and related suitabilities for timber production, roads and livestock grazing. The allocations within each key and priority watershed vary by alternative. Relative degrees of protection for each focal species is aggregated to the subbasin scale based on the mix of allocations and land use suitabilities within each subbasin.

Assumptions for Species Viability

- PACFISH and INFISH were designed as conservation strategies to prevent further habitat degradation and initiate habitat restoration through natural processes. Protection scores calculated for alternative A are accordingly assumed to represent a baseline of no degradation from existing condition on a species-by-species basis, for purposes of comparison of alternatives.
- A further assumption is that near-natural rates of recovery through natural processes are in progress and would continue under alternative A, considering that PACFISH and INFISH have been implemented since 1995. Protection scores for action alternatives are assumed to represent slightly faster or slower rates of recovery through natural processes, depending on the degree of difference from protection scores for alternative A.
- Viability analyses for focal species or subgroups that are of conservation concern represent effects to viability for other species of conservation concern where the habitats requirements and/or geographic distributions are similar.
- Multiple scale analysis would be conducted to identify and prioritize active restoration needs for priority watersheds.

Environmental Consequences to Species Viability Common to All Alternatives

All alternatives incorporate, to varying degrees, the plan components essential to assuring viability for focal species and other species of conservation concern in National Forest System lands. These plan components include:

- Desired conditions and objectives for watershed condition and function
- Allocation of lands (management areas) considered either Suitable or Not Suitable for grazing, timber management, and/or roaded access, including new road construction
- An emphasis on active restoration of watersheds, riparian, and aquatic habitats
- Watershed, riparian, and aquatic habitat protections provided by standards and guidelines
- Forest plan scale monitoring strategy for riparian and aquatic conditions

All of these components would be in place for all the action alternatives, therefore management of National Forest System lands can be expected to contribute to viability of the various focal species that spawn and rear in National Forest System lands. The action alternatives are strengthened further by establishment of riparian management areas as a land allocation and by standards and guidelines such as ones that ensure redds of listed fish would be protected from trampling by grazing livestock for all alternatives.

The suite of protections provided by desired conditions, standards and guidelines, and suitability determinations for timber production, grazing and road access tailored to each management area would facilitate passive restoration through natural processes, for aquatic and riparian habitats.

Under alternatives B through F, additional protections related to construction of new roads would be provided by additional desired conditions, goals, standards, and guidelines specific to key watersheds. Under alternative A, PACFISH and INFISH direction for key and priority watersheds would continue to apply to all subwatersheds where listed fish are present, as shown in table 214. Protective effects from the alternatives are represented by protection scores, which were calculated through application of the Blue Mountain Aquatic Sustainability Model. The model assumptions and calculations are described in Gecy (2013a).

Relative protection levels for each species are presented by protection scores for that species. Habitat protections integrated into the alternatives through suitability determinations for the various management areas in each subbasin are represented by protection scores calculated through the model. and were based on

- Acres allocated to the various management areas, and their distribution within each subbasin where a species is present
- Standards and guidelines, especially those pertaining to key watersheds and livestock grazing

Brief interpretations of the protection scores are provided by alternative in the tables that follow for each species. Passive restoration is considered to occur when protection scores are the same or greater than protection scores for alternative A, because Alternative A is currently supporting ongoing passive restoration processes at nearly natural rates.

Active Restoration-Effects Common to All Alternatives

The degree to which alternatives would result in watershed and riparian improvements through reduced livestock grazing in both riparian areas and uplands, and active restoration of roads and upland vegetation, will likely benefit aquatic species and their habitats through improved watershed function and natural disturbance processes that are closer to the long-term natural range of variation to which these species are adapted. Active restoration of riparian and aquatic habitats and improved connectivity through removal of passage barriers will result in more immediate benefits than work in uplands. All these activities are assumed to occur in priority watersheds, the aquatic species focal species inhabiting those watersheds will all benefit long term from whole-watershed restoration in these watersheds.

Accelerated restoration in priority would contribute to creating larger connected habitats within the larger landscape. Larger areas of connected key watersheds and habitats would be well distributed among most subbasins and for all focal species in subbasins containing priority watersheds. This long-term improvement in habitat conditions in targeted areas would help offset any short-term detrimental effects from natural disturbances or management activities within those subbasins, by providing refugia from thee disturbances. The more priority watersheds that are restored, the more resilient the networks of habitat and populations will be in the face of natural disturbance, and the more likely that plan activities will contribute to maintaining or restoring viability for focal species as a group.

Actions that would improve quality within and connectivity between spawning reaches are likely to be among the more effective restoration activities that could be undertaken near term in habitat for Chinook salmon and other focal species In watersheds that have been fragmented by man-made modifications, connectivity could be increased by removing barriers associated with road crossings and diversion structures (Steel et al. 2004) or possibly by alleviating high stream temperatures that can act as thermal barriers (Torgersen et al. 1999).

Watershed action plans have been completed for all 14 priority subwatersheds in the Granite and Wall Creek watersheds within the Umatilla National Forest, and for all 8 priority subwatersheds in the Camp Creek watershed within the Malheur National Forest. They have not yet been completed for other watersheds or for other priority subwatersheds within the plan area. The degree of active restoration benefits to individual focal species will depend on which priority watersheds are restored under the selected alternative and the species present in those watersheds. The specific set of priority watersheds that would be restored under each alternative is unknown at this time. Thus the influence of active restoration on viability for any individual focal species is unknown at this time.

Environmental Consequences to Focal Species Viability

Passive Restoration

Effects to individual species for viability are required by law and policy. Active restoration occurs in priority watersheds, and is expected to benefit aquatic species in the long-term, but the extent to which viability of each species is benefited is unknown, due to uncertainty as to which priority watersheds would be restored over the life of the plan. Effects to focal species in general from active restoration parallel the effects to priority watersheds, riparian and aquatic habitats, as disclosed in the preceding section on Watershed Function and Water Quality, as these are the factors that influence riparian and fish habitat quantity, quality and connectivity. These in turn affect viability of aquatic species populations in National Forest System lands.

The Blue Mountain Aquatic Sustainability Model provides a means by which to assess effects of alternatives to viability for individual species, and is consistent with regional direction for analyzing effects to viability for individual species. This model is based on the assumption that the level of risk of habitat degradation implied by land allocations considered suitable for livestock grazing, timber production and/or roaded access is counterbalanced by management allocations where these uses are considered unsuitable. The degree to which allocations within a subbasin are unsuitable for these uses, is the degree to which the model considers aquatic habitat protected in that subbasin. The degree of protection represented by model protection scores is rated on a scale of 0-1.0, with 1.0 being the highest level of protection from these land uses, which have degraded aquatic habitats in decades past.

Methods by which protection scores for each subbasin were calculated are described in Gecy 2013a. This section uses protection score outputs from the Blue Mountain Aquatic Sustainability Model (Gecy 2013a) to discuss effects to individual focal species, and is the only systematic tool used in this revision capable of displaying effects to individual focal species or other species of conservation concern. These species are geographically limited to specific portions of each forest and limited to specific drainages.

Table 215 through table 226 display the relative effects of alternatives on individual species within the Blue Mountains national forests. Environmental consequences to viability of individual focal species are summarized and the effects interpreted for populations in each subbasin in which the national forest is located.

As displayed in table 215 through table 226, the greatest differences in National Forest System management protective effects on viability would be between national forests and by species and/or by major river basin (MCR versus SRB versus Oregon Closed Basins). In some cases, relative effects of alternatives may vary by DPS, ESU and/or by GMU in the same forest and relative effects of the alternatives on each species may be more related to whether the species occurs in the Snake River Basin or in the Middle Columbia River basin. These differences reflect different overall balances of land uses within each major river basin. In all cases, it is the mix of land allocations and balance of risk from timber production, livestock grazing and roaded access posed by alternatives, subbasin by subbasin, that creates relative differences in terms of protection and degree of risk from active management, for each species.

The following observations hold throughout the remainder of the analysis for species viability for each forest and for each individual focal species and each species of concern, including individual DPS, ESU and/or GMU:

- Based on relative differences between protection scores among alternatives, alternative C provides the greatest degree of protection, lowest risk of management effects to species viability from roads, grazing and timber production, and likely provides the most opportunity for natural processes to restore riparian and aquatic habitats throughout the range of each species. This alternative also poses the greatest risk of impacts from wildfire by allowing unnatural fuel conditions to continue to build in dry forest landscapes, relative to other alternatives.
- Based on relative differences between protection scores among alternatives, alternative D poses the greatest degree of aggregate risk to riparian and aquatic habitats throughout the range of each species. This is based on differences between alternatives for levels of timber production, grazing and road construction/access based on suitability for those uses among the various management area allocations.
- As reflected in table 215 through table 226, relative habitat protections provided by alternatives vary by Forest and can also vary by ESU, DPS or GMU for the chosen focal species. The relationship between these alternatives may vary by forest, by individual species and/or by major drainage basin (e.g., Lower Snake River, Middle Snake River, Middle Columbia River, Oregon Closed Basins) within a forest. Alternative C consistently provides the highest levels of protection and support to viability among alternatives for each forest for spring Chinook salmon throughout their range.
- The relative protective differences between alternatives A, B, E and F based on protection scores would generally be small and show little risk of impact on viability for any of the species due to strong protections in place under each of those alternatives. The reduced levels of riparian vegetation use under Alternatives E and F add protections that are not reflected in Model protection scores for anadromous species and bull trout. Where protection scores suggest that Alternative E and F protective benefits are similar or less than benefits of Alternatives A or B, these additional protective benefits likely result in alternatives E and F providing similar or greater benefits than alternatives A and B, but those benefits have not been quantified through application of the Blue Mountain Sustainability Model.

- PIBO monitoring results show habitat recovery through natural processes under current PACFISH and INFISH management directions and additional protections provided by project-level Endangered Species Act consultations for grazing and other management activities (Alternative A).
- Replacement or removal of culverts currently creating problems for fish passage will also reduce hydrologic connectivity and reduce the risk of future sediment inputs from failures at stream crossings and improve habitat and population connectivity as well as connectivity within and between populations of the various focal species where they are present. The relative degree of active restoration for fish passage and other actions taken to increase habitat quantity and connectivity between stronghold watersheds for focal species, which would be anticipated under the alternatives in priority watersheds is described in appendix A for each forest (table A52 through A54, sections 1.1 and 1.2) . The extent of fish passage restoration and increased habitat quantity and connectivity varies by alternative.
- Improvements in aquatic habitat connectivity will benefit one or more focal species wherever these activities are conducted. The extent to which any particular species will benefit, which is unknown at this time. Benefits to any particular species will depend on which priority watersheds receive these improvements and whether the location of such improvements occurs in locations the species is either expected or known to use.
- Active restoration for stream shade, water quality, flow volume and riparian habitat are discussed in the Watershed section. Improvements in all these elements will benefit focal species wherever these activities are conducted. The extent to which any particular species will benefit, will depend on which priority watersheds receive these improvements, which is unknown at this time.

Spring Chinook Salmon

As shown in table 215 through table 218, relative effects of alternatives for spring Chinook salmon from habitat protections vary by Forest and also depend on the spring Chinook salmon ESU in question.

Malheur National Forest – Passive Restoration: As reflected in the protection scores and interpretation shown in table 215, alternatives B, E and F provide intermediate levels of protection and support for passive restoration through landscape-scale natural processes.

A greater number of acres are allocated under alternatives E and F, to management allocations considered suitable for one or more of the primary land uses in subbasins occupied by spring Chinook salmon, thereby increasing the risk of management effects to their habitat from E and F relative to B. Because the model integrates multiple Plan components (suitabilities and allocations) and produces a protection score that integrates the associated management risks from all those factors at subbasin-scale, it is uncertain as to specifically which or how many aspects of Alternatives E and F are outweighed by a corresponding aspect of alternative B.

Alternatives E and F would likely maintain or improve existing conditions and prevent further degradation of MCR Chinook salmon habitat. These two alternatives would provide additional levels of grazing protection to riparian management areas, based on riparian utilization guidelines for anadromous and bull trout watersheds, specific to those two alternatives. Existing project-level biological opinions for grazing in the Malheur National Forest currently require even greater reductions in riparian utilization and bank alternation under certain conditions than the guidelines given for alternatives E and F.

Table 215. Malheur National Forest protection scores, anticipated habitat trends and relative restoration rates through natural processes for spring Chinook salmon, Middle Columbia River ESU

Subbasin	Chinook Salmon Population Name	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F
Upper John Day	Upper John Day	0.62	0.69	0.78	0.55	0.66	0.66
Middle Fork John Day	Middle Fork John Day	0.53	0.54	0.58	0.49	0.53	0.53
Overall NFS trend and relative rate (interpretation of protection scores)	All	Upward trend continues	Upward trend faster than E, F	Fastest upward trend	Slowest; possibly no trend	Upward trend faster than A	Upward trend faster than A

Umatilla National Forest – Passive Restoration: In the Umatilla National Forest, both alternatives E and F may provide equal or greater protections overall than alternative B, as reflected in the protection scores and interpretation shown in table 216.

Both alternatives E and F would support stronger protections and support for MCR spring Chinook salmon viability relative to alternatives A, B, and D, but results for SRB spring Chinook vary slightly in that alternative B would provide stronger protections than alternatives E and F. The relationship between alternatives would be similar for both ESUs when considering alternatives A, C, and D.

Table 216. Umatilla National Forest protection scores, anticipated habitat trends, and relative restoration rates through natural processes for spring Chinook salmon, Middle Columbia River and Snake River Basin ESUs

Subbasin	Chinook Salmon Population Name	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F
Middle Columbia Basin ESU							
North Fork John Day	North Fork John Day	0.62	0.75	0.84	0.67	0.77	0.77
Umatilla	Umatilla	0.70	0.72	0.83	0.60	0.73	0.73
Walla Walla	Walla Walla	0.62	0.75	0.84	0.67	0.77	0.77
Overall NFS trend and rate (interpretation of protection scores)	All	Upward trend continues	Upward trend faster than A	Fastest upward trend	Slowest; possibly no trend	Upward trend faster than B	Upward trend faster than B
Snake River Basin ESU							
Tucannon	Tucannon	0.68	0.72	0.81	0.64	0.72	0.72
Lower Grande Ronde	Wenaha	0.82	0.82	0.84	0.77	0.81	0.81
Upper Grande Ronde	Upper Grande Ronde	0.61	0.63	0.74	0.46	0.60	0.60
Overall NFS trend and rate (interpretation of protection scores)	All	Upward trend continues	Upward trend faster than E,F	Fastest upward trend	Slowest; possibly no trend	Upward trend slower than A	Upward trend slower than A

Wallowa-Whitman National Forest – Passive Restoration: The relative effects of alternatives vary between ESUs in the Wallowa-Whitman National Forest, based on protection scores and interpretation displayed in table 218. Alternatives C and A would provide the stronger protections and associated rates of passive restoration for MCR spring Chinook salmon, which may be attributable to little or no allocations to acres suitable to timber production or motorized access (MA4A and MA 3B) relative to other alternatives. Alternative D would provide the lowest level of protection and would potentially slow rates of restoration through natural processes when compared to alternative A. Protection scores for alternatives B, E and F suggest moderately increased risks to MCR spring Chinook salmon protections compared to alternative A.

In contrast to results for MCR spring Chinook salmon where alternative A provides stronger protections than alternatives B, E and F, for SRB spring Chinook alternative B would provide stronger protections than alternatives A, E and F. The protection score differences may reflect increased allocations to riparian management areas (MA4B) in the Upper and Lower Grande Ronde subbasins and more backcountry motorized (MA3B), which would limit timber production, and maintain limited roaded access. For both ESUs, alternative D would provide the lowest degree of protection of all the alternatives and represents the greatest degree of risk to viability from active management.

Table 217. Wallowa-Whitman National Forest protection scores, anticipated habitat trends, and relative restoration rates through natural processes for spring Chinook salmon, Middle Columbia River and Snake River Basin ESUs

Subbasin	Chinook Salmon Population Name	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F
Middle Columbia River ESU							
North Fork John Day	North Fork John Day	0.72	0.66	0.73	0.52	0.63	0.63
Overall NFS trend and rate (interpretation of protection scores)	All	Upward trend continues	Upward trend slower than A	Fastest upward trend	Slowest; possibly no trend	Upward trend slower than B	Upward trend slower than B
Snake River Basin ESU							
Upper Grande Ronde	Upper Grande Ronde/ Catherine Creek	0.59	0.65	0.75	0.51	0.62	0.62
Lower Grande Ronde	Joseph	0.58	0.67	0.79	0.53	0.64	0.64
Wallowa	Wallowa/ Minam	0.87	0.88	0.89	0.86	0.88	0.88
Imnaha	Imnaha	0.90	0.90	0.90	0.90	0.90	0.90
Hells Canyon	Hells Canyon	0.90	0.90	0.90	0.90	0.90	0.90
Overall NFS trend and rate (interpretation of protection scores)	All	Upward trend continues	Upward trend faster than E, F	Fastest upward trend	Slowest; possibly no trend	Upward trend faster than A	Upward trend faster than A

Bull Trout Viability (Columbia River Basin DPS)

Malheur National Forest – Passive Restoration: Based on protection scores shown in table 218 for bull trout in the Malheur National Forest, alternative A would maintain ongoing passive restoration through natural processes. Alternatives E and F would likely result in slight improvements in restoration rates achieved through natural processes due to fewer acres subject to ground disturbance compared to alternative A. The lower protection score for alternative D reflects potential reductions in riparian and aquatic habitat conditions and habitat recovery rates when compared to alternative A.

Restoration through natural processes would likely happen fastest for alternative C, overall, due to the fewest acres exposed to ground disturbing activities, with alternative B providing the second highest rates of restoration through natural processes. Interpretation of the protection scores expects that alternative C would provide the fastest upward trend in passive restoration. Alternatives E and F would provide stronger protections for bull trout viability relative to alternatives A and D and would enable passive restoration to continue through natural processes, potentially at faster rates than would occur under alternative A.

Table 218. Malheur National Forest protection scores, habitat trends, and relative restoration rates for Columbia River Basin bull trout

Subbasin	Bull Trout Population Name	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F
Malheur	Upper Malheur	0.57	0.63	0.73	0.49	0.59	0.59
Upper John Day	Upper John Day	0.62	0.69	0.78	0.55	0.66	0.66
Middle Fork John Day	Middle Fork John Day	0.53	0.54	0.58	0.49	0.53	0.53
Overall NFS trend and rate (interpretation of protection scores)	All	Upward trend continues	Upward trend faster than E, F	Fastest upward trend	Slowest; possibly no trend	Upward trend faster than A	Upward trend faster than A

Umatilla National Forest – Passive Restoration: Based on protection for bull trout shown in table 219 for the Umatilla National Forest, most of the alternatives generally provide stronger protections and a moderately positive influence on viability from plan protections, when compared to alternative A. Alternative D in the Upper Grande Ronde would be an exception and suggests risks to the Grande Ronde population in terms of slowing progress currently being achieved through passive restoration under PACFISH, as reflected in the lower protection score than shown for alternative A in that subbasin.

Overall, protection scores for alternatives E and F suggest marginally less protections than for alternative B, primarily due to the difference in management allocations between the alternatives along with differing degrees of suitability for timber production, grazing, and roads. However, the stronger standards for riparian grazing utilization would provide greater protections for bull trout under alternatives E and F. Alternative C would contribute the most to improved viability. Alternative D would provide the lowest degree of protection and support to viability, in general terms.

Table 219. Umatilla National Forest protection scores, anticipated habitat trends and relative restoration rates through natural processes for bull trout, Columbia River Basin DPS

Subbasin	Bull Trout Population Name	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F
North Fork John Day	North Fork John Day	0.62	0.69	0.78	0.55	0.66	0.66
Umatilla	Umatilla	0.61	0.61	0.65	0.57	0.62	0.62
Walla Walla	Walla Walla	0.62	0.75	0.84	0.67	0.77	0.77
Walla Walla	Touchet	0.62	0.75	0.84	0.67	0.77	0.77
Tucannon	Tucannon	0.69	0.70	0.73	0.68	0.70	0.70
Asotin	Asotin	0.62	0.62	0.64	0.57	0.60	0.60
Lower Grande Ronde	Grande Ronde[1]	0.75	0.75	0.76	0.74	0.75	0.75
Upper Grande Ronde	Grande Ronde[1]	0.61	0.63	0.74	0.46	0.60	0.60
North Fork John Day	North Fork John Day	0.62	0.69	0.78	0.55	0.66	0.66
Overall NFS trend and rate (interpretation of protection scores)	All	Upward trend continues	Upward trend faster than E, F	Fastest upward trend	Slowest; possibly no trend	Upward trend faster than A	Upward trend faster than A

1. Grande Ronde bull trout population spans both upper and lower Grande Ronde subbasins.

Wallowa-Whitman National Forest – Passive Restoration: Based on protection scores for bull trout shown in table 220, alternatives E and F would provide stronger protections and greater support for more passive restoration processes in bull trout habitat than alternatives A and D, and only slightly less than alternative B. Alternative C would contribute the most protections and support to improved viability through natural processes for bull trout within the Wallowa-Whitman National Forest. Alternatives A and D both would provide lower protection levels than alternatives B, E, and F, primarily due to differences in management area allocations and suitability for timber production, grazing, and roads.

Steelhead Viability (Middle Columbia River DPS)

Malheur National Forest – Passive Restoration: Effects to steelhead parallel effects to spring Chinook salmon discussed earlier, as these species use the same subbasins and will be affected by the same balances of land uses in the subbasin. The protection scores for alternatives B, E and F indicate stronger support for steelhead viability relative to alternatives A and D. The more restrictive riparian utilization guidelines for bull trout and anadromous watersheds in alternatives E and F would further strengthen the protections indicated by protection scores in table 221, and may result in protections as strong or stronger than provided by alternative B.

Table 220. Wallowa-Whitman National Forest protection scores, anticipated habitat trend based on passive restoration through natural processes for bull trout, Columbia River Basin DPS

Subbasin	Bull Trout Population Name	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F
North Fork John Day	North Fork John Day	0.55	0.58	0.61	0.55	0.59	0.59
Upper Grande Ronde	Upper Grande Ronde	0.34	0.36	0.40	0.32	0.35	0.35
Wallowa	Wallowa	0.69	0.70	0.70	0.69	0.70	0.70
Imnaha	Imnaha	0.65	0.65	0.65	0.65	0.65	0.65
Hells Canyon	Hells Canyon	0.61	0.61	0.61	0.61	0.61	0.61
Brownlee	Brownlee	0.60	0.61	0.63	0.59	0.60	0.60
Powder	Powder	0.58	0.60	0.63	0.56	0.60	0.60
Overall NFS trend and rate (interpretation of protection scores)	All	Upward trend continues	Upward trend faster than E, F	Fastest upward trend	Slowest; possibly no trend	Upward trend faster than A	Upward trend faster than A

Table 221. Malheur National Forest passive restoration scores and relative habitat trends for steelhead populations, Middle Columbia River DPS

Subbasin	Steelhead Population Name	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F
Middle Fork John Day	Middle Fork John Day	0.56	0.60	0.70	0.44	0.56	0.56
Upper John Day	Upper John Day	0.62	0.69	0.78	0.55	0.66	0.66
Overall NFS trend and relative rate (interpretation of protection scores)	All	Upward trend continues	Upward trend faster than E, F	Fastest upward trend	Slowest; possibly no trend	Upward trend faster than A	Upward trend faster than A

Umatilla National Forest – Passive Restoration: Effects to steelhead parallel effects to spring Chinook salmon discussed earlier, as these species use the same subbasins and will be affected by the same balances of land uses in the subbasin. The protection scores for alternatives B, E and F indicate stronger support for steelhead viability relative to alternatives A and D. The more restrictive riparian utilization guidelines for bull trout and anadromous watersheds in alternatives E and F would further strengthen the protections indicated by protection scores in table 222, and may result in protections as strong or stronger than provided by alternative B. In subbasin-specific cases, alternative D would provide stronger protections than alternative A, in the Walla Walla subbasin and in the North Fork John Day subbasin. The reason for alternative D outweighing alternative A in the model protection scores may reflect increased acres allocated to Municipal Watershed management area (2J), which receives extremely high protections from active management to conserve drinking water quality for the city of Walla Walla and surrounding area. For the DPS as a whole, alternative A would provide marginally stronger protections than alternative D when model scores are summed across subbasins for the DPS.

Protection scores in table 222 show a different pattern when comparing alternatives B, E, and F than for MCR steelhead. Alternative B would provide stronger protections than alternatives E and F for the SRB steelhead DPS, which may be explained by the shifting balance of land allocations in the Lower Grande Ronde subbasin in terms of more acres in riparian management areas under alternative D. When comparing protection scores for alternatives D and A, protections for alternative A would be consistently stronger than those provided under alternative D when summed for all subbasins, primarily due to a balance of allocations that would reduce risks from roads and timber production.

Table 222. Umatilla National Forest protection scores, anticipated habitat trends and relative restoration rates through natural processes for steelhead populations, Middle Columbia River and Snake River Basin DPS

Subbasin	Steelhead Population Name	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F
Middle Columbia River DPS							
North Fork John Day	North Fork John Day	0.62	0.75	0.84	0.67	0.77	0.77
Middle Fork John Day	Middle Fork John Day	0.56	0.60	0.70	0.44	0.56	0.56
Umatilla	Umatilla	0.70	0.72	0.83	0.60	0.73	0.73
Walla Walla	Walla Walla	0.62	0.75	0.84	0.67	0.77	0.77
Walla Walla	Touchet	0.62	0.75	0.84	0.67	0.77	0.77
Overall NFS trend and rate (interpretation of protection scores)	MCR	Upward trend continues	Upward trend faster than A	Fastest upward trend	Slowest; possibly no trend	Upward trend faster than B	Upward trend
Snake River Basin DPS							
Tucannon	Tucannon	0.68	0.72	0.81	0.64	0.72	0.72
Asotin	Asotin	0.67	0.64	0.73	0.50	0.61	0.61
Lower Grande Ronde	Wenaha	0.82	0.82	0.84	0.77	0.81	0.81
Upper Grande Ronde	Upper Grande Ronde	0.61	0.63	0.74	0.46	0.60	0.60
Overall NFS trend and rate (interpretation of protection scores)	SRB	Upward trend continues	Upward trend faster than E, F	Fastest upward trend	Slowest; possibly no trend	Upward trend faster than A	Upward trend faster than A

Wallowa-Whitman National Forest – Passive Restoration: Discussions for MCR steelhead and SRB steelhead parallel previous discussions for MCR and SRB spring Chinook salmon, as these DPS each the same set of subbasins respectively and protective effects of the allocations will affect aquatic habitats at subbasin scale (table 223).

Table 223. Wallowa-Whitman National Forest protection scores, anticipated habitat trends and relative restoration rates through natural processes for steelhead, Middle Columbia River and Snake River Basin DPS

Subbasin	Steelhead Population Name	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F
Middle Columbia River DPS							
North Fork John Day	North Fork John Day	0.72	0.66	0.73	0.52	0.63	0.63
Overall NFS trend and rate (interpretation of protection scores)	All	Upward trend continues	Upward trend slower than A	Fastest upward trend	Slowest; possibly no trend	Upward trend slower than B	Upward trend slower than B
Snake River Basin DPS							
Hells Canyon	Hells Canyon	0.90	0.90	0.90	0.90	0.90	0.90
Lower Grande Ronde	Joseph	0.58	0.67	0.79	0.53	0.64	0.64
Upper Grande Ronde	Upper Grande Ronde/ Catherine Creek	0.59	0.65	0.75	0.51	0.62	0.62
Wallowa	Wallowa/ Minam	0.87	0.88	0.89	0.86	0.88	0.88
Imnaha	Imnaha	0.90	0.90	0.90	0.90	0.90	0.90
Overall NFS trend and rate (interpretation of protection scores)	All	Upward trend continues	Upward trend faster than E, F	Fastest upward trend	Slowest; possibly no trend	Upward trend faster than A	Upward trend faster than A

Redband Trout

Malheur National Forest – Passive Restoration: As reflected in the protection scores for redband trout and interpretations displayed in table 224 for the Malheur National Forest, alternative B would provide stronger protections for all GMUs compared to alternatives E and F. Alternative D would consistently provide the fewest protections for all GMUs and may slow rates of passive restoration that are ongoing under current management. Alternative C would consistently provide the strongest protections for all GMUs. Alternative B would provide the second highest rates of restoration through protections provided by alternative components.

Alternatives E and F would provide intermediate levels of grazing protection for populations throughout the Middle Columbia River (MCR), Malheur Lakes (ML) and Middle Snake River Basin (MSRB) GMUs since redband habitats in those subbasins overlap habitats occupied by steelhead and bull trout, and the more stringent riparian utilization guidelines for those species would apply.

Redband trout in the South Fork Crooked River/Beaver Creek population are members of the Deschutes geographic management unit (GMU). Although not evaluated through the model due to extremely limited habitat, this population is expected to receive relative benefits to viability from each alternative similar to the relative benefits under each alternative as are anticipated for the Middle Snake GMU. There are similar habitats and similar loss of connectivity to steelhead due to dam construction in the 20th century, but to a lesser degree, as none of the subwatersheds supporting this population have been designated as priority watersheds for investment in active restoration.

Table 224. Malheur National Forest protection scores, anticipated habitat trends, and relative restoration rates for interior redband trout, Middle Columbia River, Deschutes, Middle Snake, Oregon Closed Basins GMUs

Subbasin	Redband Trout Population Name	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F
Columbia River GMU							
Upper John Day		0.62	0.69	0.78	0.55	0.66	0.66
Middle Fork John Day		0.56	0.60	0.70	0.44	0.56	0.56
Overall NFS trend and rate (interpretation of protection scores)	GMU	Upward trend continues	Upward trend faster than E, F	Fastest upward trend	Slowest; possibly no trend	Upward trend faster than A	Upward trend faster than A
Deschutes GMU							
South Fork Crooked River/Beaver Creek (NFS)		Not Rated	Not Rated	Not Rated	Not Rated	Not Rated	Not Rated
Middle Snake River Basin GMU							
Upper Malheur		0.61	0.68	0.77	0.55	0.66	0.66
Overall NFS trend and rate (interpretation of protection scores)	GMU	Upward trend continues	Upward trend faster than E, F	Fastest upward trend	Slowest; possibly no trend	Upward trend faster than A	Upward trend faster than A
Oregon Closed Basins GMU							
Silvies	Silvies	0.49	0.59	0.66	0.42	0.52	0.52
Silver	Silver	0.53	0.59	0.68	0.43	0.56	0.56
Harney-Malheur Lakes	Harney-Malheur Lakes	0.57	0.57	0.69	0.40	0.52	0.52
Overall NFS trend and rate (interpretation of protection scores)	GMU	Upward trend continues	Upward trend faster than E, F	Fastest upward trend	Slowest; possibly no trend	Upward trend faster than A	Upward trend faster than A

Umatilla National Forest – Passive Restoration: For the Middle Columbia River GMU, effects to redband parallel earlier discussions for MCR steelhead in these same subbasins. For redband in the Lower Snake River GMU, protective effects of each alternative parallel the protective effects to SRB steelhead in these subbasins (table 225).

Table 225. Umatilla National Forest protection scores, anticipated habitat trends and relative restoration rates through natural processes for interior redband trout, Middle Columbia River and Lower Snake GMUs

Subbasin	Redband Trout Population Name	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F
Middle Columbia River GMU							
North Fork John Day	North Fork John Day	0.62	0.75	0.84	0.67	0.77	0.77
Umatilla	Umatilla	0.70	0.72	0.83	0.60	0.73	0.73
Walla Walla	Walla Walla	0.62	0.75	0.84	0.67	0.77	0.77
Overall NFS trend and rate (interpretation of protection scores)	All	Upward trend continues	Upward trend faster than A, D	Fastest upward trend	Upward trend continues	Upward trend faster than B	Upward trend faster than B
Lower Snake River GMU							
Tucannon	Tucannon	0.68	0.72	0.81	0.64	0.72	0.72
Asotin	Asotin	0.67	0.64	0.73	0.50	0.61	0.61
Lower Grande Ronde	Lower Grande Ronde	0.82	0.82	0.84	0.77	0.81	0.81
Upper Grande Ronde	Upper Grande Ronde	0.61	0.63	0.74	0.46	0.60	0.60
Overall NFS trend and rate (interpretation of protection scores)	All	Upward trend continues	Upward trend faster than E,F	Fastest upward trend	Slowest; possibly no trend	Upward trend faster than A	Upward trend faster than A

Wallowa-Whitman National Forest – Passive Restoration: Based on protection scores for interior redband trout shown in table 226 for the Wallowa-Whitman National Forest, alternative C would contribute the most to improved viability for redband trout through passive restoration, followed by alternatives B, E and F, then by alternative A in all GMUs except the Lower Snake River GMU. Protections provided to the MCR and Lower Snake River GMU populations parallel effects to MCR and SRB steelhead, previously discussed. Relative protective effects to redband in the Powder and Burnt River GMUs from alternatives, parallel the relative effects to MCR redband, due to similar balances of land allocations and land use suitabilities. Increased riparian grazing utilization Protections afforded to bull trout watersheds would not apply under alternative F for the Burnt River GMU, and increased riparian grazing utilization protections afforded to anadromous watersheds would not apply under alternative E for the Powder River GMU.

Table 226. Wallowa-Whitman National Forest protection scores, anticipated habitat trends, and relative restoration rates through natural processes for interior redband trout, by Geographic Management Unit

Subbasin	Redband Trout Population Name	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F
Lower Snake River GMU							
Hells Canyon	Hells Canyon	0.90	0.90	0.90	0.90	0.90	0.90
Lower Grande Ronde	Lower Grande Ronde	0.58	0.67	0.79	0.53	0.64	0.64
Upper Grande Ronde	Upper Grande Ronde	0.59	0.65	0.75	0.51	0.62	0.62
Wallowa	Wallowa-Minam	0.87	0.88	0.89	0.86	0.88	0.88
Imnaha	Imnaha	0.90	0.90	0.90	0.90	0.90	0.90
Overall NFS trend and rate (interpretation of protection scores)	GMU	Upward trend continues	Upward trend faster than E, F	Fastest upward trend	Slowest; possibly no trend	Upward trend slower than A	Upward trend slower than A
Middle Snake River GMU							
Brownlee	Brownlee	0.75	0.78	0.84	0.71	0.76	0.76
Overall NFS trend and rate (interpretation of protection scores)	GMU	Upward trend continues	Upward trend faster than E, F	Fastest upward trend	Slowest; possibly no trend	Upward trend slower than A	Upward trend slower than A
Powder GMU							
Powder	Powder	0.61	0.68	0.77	0.55	0.66	0.66
Burnt	Burnt	0.53	0.59	0.68	0.43	0.56	0.56
Overall NFS trend and rate (interpretation of protection scores)	GMU	Upward trend continues	Upward trend faster than E, F	Fastest upward trend	Slowest; possibly no trend	Upward trend slower than A	Upward trend slower than A
Middle Columbia River GMU							
North Fork John Day	North Fork John Day	0.72	0.66	0.73	0.52	0.63	0.63
Overall NFS trend and rate (interpretation of protection scores)	GMU	Upward trend continues	Upward trend faster than E, F	Fastest upward trend	Slowest; possibly no trend	Upward trend slower than A	Upward trend slower than A

Environmental Consequences to Threatened and Endangered Species and Designated Critical Habitats

All of the plan alternatives may affect listed species or their designated critical habitats. Effects of projects implemented for any of the alternatives are expected to move the planning area towards desired conditions for watershed function and species diversity and viability, as described in appendix A to this DEIS. Rate of progress towards desired conditions would vary by alternative. Active restoration may have short term effects for any alternative, but the magnitude of those effects at any point in time is likely to be localized as restoration work would not happen in all priority watersheds at the same time. The duration of effects would vary by activity, and would also depend on the sequencing of multiple restoration activities. Fish and habitats would likely respond in positive ways to those restoration activities in subsequent decades in the watersheds targeted as priority for restoration. The effects of roads on streams are documented in the Watershed Function, Water Quality, and Water Uses section of this document. Increased protections related to roads, new standards and guidelines, and/or desired conditions have been included in alternatives B, C, E, and F prohibiting construction of new roads and trails in high elevation riparian areas, adding protection for bull trout and other listed species spawning in high elevation streams. In addition, no increases in road density would be allowed in key watersheds, which would be more beneficial to aquatic species than current requirements under PACFISH or INFISH.

The objectives for road improvements in alternative D would potentially allow for increased maintenance and reconstruction of problem roads relative to the other alternatives, and in relative terms, would thereby reduce road-related water-quality impacts from sediment delivery, and reduce fish passage impacts by culvert upgrades based on current standards for fish passage design. The effects of grazing on streams and aquatic species are well documented. Cattle and sheep can have negative effects when they are in streams, depositing excess nutrients and trampling spawning beds and stream banks. Grazing in riparian zones can reduce vegetation and tree recruitment, affecting stream temperature and sediment delivery via removal of shade and compacted soils (Platts 1991, Armour et al. 1994, Bohn and Kershner 2002).

Plan standards and guidelines for grazing in any of the action alternatives would require grazing to be managed in a way that would avoid redd trampling, and to be managed in ways that would move riparian and aquatic habitats towards desired conditions. While grazing may affect listed species or designated critical habitats, those effects may be reduced as grazing would be managed to meet and maintain desired conditions. Current management is already resulting in improving riparian and aquatic habitat trends (Archer et al. 2009), and this would be expected to continue under any of the action alternatives where AUM stocking levels are similar to or less than current stocking levels. Desired conditions, standards, and guidelines could be met under alternative D, but the heavier stocking levels would likely require relatively more intensive management to achieve desired conditions and to meet standards and guidelines on an annual basis. Reduced impacts to riparian areas and aquatic habitats could be expected to occur under alternatives E and F in the majority of watersheds on each forest due to presence of anadromous species and/or bull trout, and the reduced riparian utilization standards that would apply in those watersheds.

Timber harvest can influence aquatic ecological condition via such activities as removal of trees in the riparian zone, removal of upslope trees, and associated understory or slash burning (Hicks et al. 1991). These activities can affect wood recruitment, stream temperatures, erosion potential, stream flow regime, and nutrient runoff, among others (Hicks et al. 1991). Effects of harvest are likely to be different at different scales. Hemstad and Newman (2006) found few effects of harvest at the site or reach scale, but found that harvest five to eight years earlier resulted in losses of habitat quality and species diversity at the scale of a stream segment (larger than a reach) or at the subwatershed level. Those losses were revealed in terms of increases in bank instability and fine sediment throughout the watershed and increased water temperatures and sediment problems throughout the channel segment. The cumulative effects of widespread harvest within a single drainage in a short period of time resulted in deterioration of the aquatic and riparian habitats, but evidence of effects lagged harvest by several years and different evidences of deterioration showed up at different spatial scales within the watershed.

To minimize risks of unintended effects, ground disturbance in riparian areas would be managed to achieve desired conditions for water quality and fish habitat through use of Best Management Practices (BMPs) and watershed analyses. Watershed-specific objectives for riparian and aquatic habitats would be integrated with watershed-specific objectives for fuels and vegetation management at the project level. Watershed analyses and integration of multiple objectives in project design is likely to contribute to restoration of natural watershed and hydrologic function and processes at watershed-scale over the long term.

Plan alternatives could have indirect effects on designated critical habitat since projects implemented under any of the alternatives would be required to move towards desired conditions for watershed function and maintain or improve species diversity and viability. Restoration actions, such as culvert replacement or floodplain restoration requiring in-channel or near-channel operation of heavy equipment, may affect individuals of listed species or designated critical habitats, or both, in the short term. The long term effects would be expected to be beneficial in terms of habitat response in most cases.

Watershed restoration actions in priority watersheds would serve to recreate larger networks of connected high quality habitats within and between watersheds in each subbasin with identified key watersheds. Building these larger connected networks of good habitat would increase resiliency of listed species to both landscape scale and smaller disturbances by allowing listed and other species to relocate to better habitat when the habitat they are currently using is impacted by episodic natural disturbances. Watershed analyses and Endangered Species Act consultations would help to determine project-level tradeoffs in short-term effects to fish and habitats for the sake of long term benefits of restored natural processes for projects implemented.

Other land management activities could result in short term effects to designated critical habitat or listed species, depending on project design and the frequency and intensity of the activity. Those activities would potentially include livestock grazing, construction of new roads, mining activity, and/or timber harvest within 300 feet of perennial or intermittent fish-bearing streams. Alternative D would experience the highest frequency and intensity of ground disturbing activities that could affect listed species and designated critical habitat over the life of the plan, based on objectives, desired conditions, standards, and guidelines for that alternative. The higher level of vegetation management objectives in alternative D would require retaining higher amounts of system road than would be needed for implementation of the other alternatives and could require retaining key system roads in riparian management areas that would not need to be retained under alternatives with lower levels of vegetation management, particularly in dry forest landscapes. The tradeoff is in achieving reductions in road effects in parts of the landscape where frequent reentries would not be needed for prescribed burning or other forest management activities to maintain desired forest vegetation conditions (Rieman et al. 2000).

Consultation would be undertaken with NMFS and USFWS based on effects of implementing actions for the selected alternative. Actions implemented under a new plan will be consulted at the project level or at program level for specific categories of activities. Modifications will be developed at project or program level if needed, to reduce risks to listed species and their designated critical habitats.

In summary, each of the plan revision alternatives **may affect** any or all of the listed species and/or their designated critical habitats, for the reasons given. A biological assessment for the preferred alternative would be developed in detail and serve as the basis for Endangered Species Act Section 7 Consultation with NMFS and USFWS.

Environmental Consequences to Sensitive Species

Forest Service viability status and effects analyses for redband trout populations in the Harney-Malheur Lakes subbasin within the Malheur National Forest represent status and indirect effects to sensitive redband trout of the Malheur Lakes DPS. Based on the redband protection scores presented in table 224, standards and guidelines, desired conditions for alternatives B, C, E, and F are, in some cases, as strong as or stronger than those elements as they are contained in the 1990 plans, as amended by INFISH. For example, additional guidelines (standards in the case of alternative C) have been added to avoid the risk of grazing livestock trampling redds of listed species during spawning season before young fish have emerged from the gravels (MA 4B, RMA-RNG-5 G-118). Non-listed sensitive aquatic species that spawn in those streams during the same season as either spring and/or fall spawning listed species would likely accrue collateral direct benefits from this guideline. Another guideline, RMA-RNG-6 (a standard under alternative C), to avoid use of pastures during spawning season and thus reduce grazing impacts for listed species, further strengthens alternatives B, C, E, and F relative to alternative A.

Increased protections related to roads are reflected in standards and guidelines for alternatives B, C, E, and F that prohibit construction of new roads and trails in high elevation riparian areas. This requirement would be an added protection for sensitive westslope cutthroat trout and other species spawning in high elevation headwater streams.

Monitoring using protocols developed for the PACFISH/INFISH Biological Opinion (PIBO) Effectiveness Monitoring Program would likely remain in use in future years, and local monitoring would likely employ these same or similar protocols where additional, site-specific monitoring may be needed. PIBO monitoring trend results are currently showing a slowly improving trend in riparian and aquatic habitat conditions across the plan area under the 1990 forest plans and those trends are expected to continue for all alternatives.

Management would potentially affect viability for sensitive species in the Umatilla and Walla Walla subbasins, particularly for the Margined sculpin. A narrow endemic Sensitive species, the Margined sculpin inhabits the Upper Tucannon, Walla Walla and Umatilla subbasin headwaters within the Umatilla National Forest, as well as the mainstem Tucannon River in state lands downstream of the national forest boundary. The known distribution ranges from medium rivers to moderate-elevation headwater tributaries in those systems.

Margined sculpin are a small bodied resident species strongly associated with the stream bed, as are bull trout, but are a spring-spawner similar to redband and steelhead. Fair to mostly good connectivity and condition ratings for redband and bull trout habitats in the Walla Walla and Tucannon subbasins suggest that the Margined sculpin is not trending towards listing within the Umatilla National Forest (see table 216 and table 222).

The Malheur National Forest is the only national forest where management would potentially affect viability for Harney Basin Duskysnail and the Great Basin (Malheur Lakes) DPS of redband trout. Based on current knowledge of its distribution, surveys for presence of the Duskysnail would need to be done prior to development of any natural springs, and a site-specific assessment would ensure any populations located would be protected.

Effects of projects implemented under any of the alternatives would be expected to move towards desired conditions for watershed function, key watersheds, hydrologic connectivity, stream shade, water quality and riparian condition, as described in appendix A. Improvement of any of these factors would help to maintain and improve population viability for the sensitive species considered in this assessment.

Active restoration in priority watersheds would potentially have short-term effects for any alternative, but the magnitude of those effects at any point in time would likely be localized. Road decommissioning in riparian management areas, replacement of culverts for fish passage, and instream habitat restoration are all potential short-term effects that would result in long-term beneficial effects. These actions would be most likely to occur in key watersheds and would serve to recreate larger networks of connected high quality habitats within and between watersheds in each subbasin with identified key watersheds. Long-term effects would be expected to benefit all aquatic species present or potentially present within those project areas.

Best management practices would be applied to all ground disturbing projects to protect water quality and habitat for Sensitive aquatic species; however, research has shown BMPs to lose effectiveness the closer activities are to stream channels, to become less effective the steeper the ground is adjacent to the channel, and to be ineffective or to vary in effectiveness when riparian buffers are not in place (Rashin et al. 2006). Best management practices would be an added protection for bull trout and other listed species spawning in high elevation streams.

Rate of progress towards desired conditions through natural processes would vary by alternative, as indicated by differences in protection scores (see table 215 through table 226). In addition, no increases in road density would be allowed in key watersheds.

For alternative A, all subwatersheds where listed fish species are present would remain key and priority subwatersheds respectively under the 1990 plans as amended by PACFISH or INFISH. A smaller set of key (including priority) subwatersheds would be implemented for any of the action alternatives as discussed previously. For alternatives B, E, and F, riparian management areas would provide the same or greater degrees of protection as currently provided in RHCAs within key and priority watersheds under PACFISH and INFISH (alternative A), because the maximum riparian management area widths would apply in every subwatershed in each national forest. They would not be limited to key and priority watersheds with designated critical habitat or listed species, as now directed by INFISH and PACFISH for RHCAs for alternative A. Practically speaking, the application of these maximum riparian management area widths for alternatives B, E, and F make no difference for the Umatilla National Forest. In the Umatilla National Forest, essentially every subwatershed contains designated critical habitat for one or more listed species. The maximum riparian management area widths are already being applied throughout the Umatilla National Forest for this reason and would continue to be applied for alternative A.

For the Malheur and Wallowa-Whitman National Forests, the application of these maximum riparian management area widths for alternatives B, C, E and F would constitute an increase in acres incorporated in riparian management areas and miles of aquatic habitat receiving passive restoration benefits relative to the number of acres managed within RHCAs in alternative A. The reason for the increase in riparian management area acreage for these two national forests is that they have a substantial number of subwatersheds where only redband trout are present. As a result, these watersheds do not currently contain designated critical habitat for any listed species and therefore the maximum RHCA widths are not currently being applied and would not be applied under alternative A.

The allocation to more acreage to riparian management areas for the Malheur and Wallowa-Whitman National Forests for alternatives B, C, D, E, and F relative to the amount of acres managed as RHCAs in alternative A would potentially result in greater benefits from passive restoration to Great Basin redband trout and other resident species in the Oregon Interior Basins. The increase in riparian management area acres for these alternatives would be added in subwatersheds which do not contain designated critical habitat or listed species, i.e., in subwatersheds located within the Oregon Interior Basins within the Malheur National Forest in particular. Redband trout may also receive added benefits with respect to passive restoration from increased acreages in riparian management areas in subwatersheds upstream of Hells Canyon Dam and in the Crooked River subwatersheds where no listed species or designated critical habitats are present.

Research has shown that effective vegetated filter strips need to be at least 200 to 300 feet wide to effectively capture sediment mobilized by overland flow from outside the riparian management area. Rieman et al. (2001), in analyzing the most aggressive restoration alternative for the Interior Columbia Basin Ecosystem Management Project, determined that the habitat benefits provided during the first 10 years of implementation for restoration of forest vegetation under that alternative were lower than the benefits achieved through less aggressive restoration schedules. They noted that vulnerable aquatic species could be impacted in the short term in ways from which they could not easily recover, even if long-term benefits eventually became evident in later years.

Alternatives B, C, E, and F provide for protections at least as strong as those provided by current management direction under alternative A. Activities are currently permitted within RHCAs, so long as they do not retard habitat recovery through natural processes, thus the difference between alternative D and alternative A is a difference in level of risk of degradation that may occur once the streamside area identified for management for riparian and aquatic habitat values is narrowed. Protections of water quality, aquatic and riparian habitats would be lower for alternative D when compared to alternative A in terms of permitted activities and infrastructure near stream channels, and the narrow riparian management area widths associated with alternative D would pose higher risks of unintended negative effects to aquatic species and habitats, and could interfere with restoration of natural hydrologic processes and watershed function.

The increased risks from activities with alternative D would be associated with roads, livestock management, timber/fuels management, and mining, and would also be potentially associated with other infrastructure-related management activities. These activities potentially affect Sensitive or focal species and their habitat, and, by association, other aquatic species of conservation concern that are not yet Endangered Species Act listed. Such effects would likely be localized and would be unlikely to result in a trend toward listing for Great Basin redband trout, westslope cutthroat trout, margined sculpins or riverine mollusks.

BMP monitoring, aquatic surveys and continued monitoring of conditions and trends in aquatic and riparian habitat conditions are likely to identify any project-level situations detracting from achievement of desired condition. Use of BMP monitoring is expected to facilitate implementation of proactive management changes quickly enough to maintain or restore timely progress towards desired conditions for riparian and aquatic habitats.

Both the regional ARCS and ARS strategies recognized the need to strategically focus scarce restoration funds where they would contribute the most to recreating effective networks of connected watersheds and high quality habitats across the Blue Mountains national forests. The intent behind targeted watersheds for restoration was that they would provide the greatest benefits for recovery of listed species. The above Sensitive species are each known present in at least some of the key watersheds within their range and are likely to benefit to some extent from active restoration in priority watersheds, depending on where work is done relative to the distribution of each species.

Sensitive Species Determinations

Malheur National Forest – Alternatives A, B, C, E, and F may impact individuals or habitat (MIIH), but are not likely to result in a trend towards listing for the Malheur Lakes DPS of redband trout or other sensitive fish and aquatic invertebrate species within the Malheur National Forest for reasons discussed above and in the focal species sections.

None of the plan components completely address risks to potential habitat for the dusky snail with respect to spring development or water diversion out of a spring fed channel flow. However, site surveys and project-specific analyses would likely ensure any newly discovered populations are protected in ways that would avoid a trend towards Federal listing.

Umatilla National Forest – Alternatives A, B, C, D, E, and F may impact individuals or habitat (MIIH), but are not likely to result in a trend towards listing for margined sculpin or other sensitive fish and aquatic invertebrate species within the Umatilla National Forest for reasons discussed above and in the focal species sections.

Wallowa-Whitman National Forest – Alternatives A, B, C, D, E, and F may impact individuals or habitat (MIIH), but are not likely to result in a trend towards listing for sensitive fish and aquatic invertebrate species within the Wallowa-Whitman National Forest for reasons discussed above and in the focal species sections.

Environmental Consequences to Management Indicator Species

Only the no action alternative (alternative A) would be evaluated in terms of the management indicator species listed in the 1990 forest plans. No management indicator species were selected for evaluation for alternatives B, C, D, E, or F (action alternatives), based on factors discussed in the Affected Environment section and expanded upon here. Limiting aquatic management indicator species to alternative A reflects the historic and ongoing cumulative effects to populations and fish habitats in lands in other ownerships within the subbasins occupied by each management indicator species as represented by focal species that served as management indicator species in the 1990 forest plans. Further detail is provided in the Analysis of the Management Situation.

The focal species concept used for alternatives B, C, D, E, and F would use habitat condition and trends as a proxy to monitoring species diversity and viability on National Forest System lands. Population viability status in each subbasin would be tracked at the all-lands scale by USFWS and NMFS and would be based on integration of multiple criteria for each population. Viability for species not tracked by USFWS and NMFS would likely be tracked by state agencies responsible for fish and wildlife resources in their respective states, to the extent that state resources are available.

Within the limits of the Forest Service authority and landbase, alternative A would not likely result in a loss of viability for redband trout or other management indicator species. Riparian and aquatic habitat conditions are beginning to demonstrate statistically supportable trends in improvement resulting from implementation of PACFISH and INFISH standards, guides, goals and objectives, and key and priority watersheds. Implementation of PACFISH and INFISH standards, guides, goals and objectives would continue under alternative A. Active restoration is currently ongoing to restore habitat quality and quantity in select subwatersheds and is expected to continue to the extent funding and staffing are available. Those trends would likely continue with continued implementation of PACFISH and INFISH.

Monitoring conducted under the PIBO effectiveness monitoring program would continue. Additional analysis over time would serve to strengthen these conclusions or reduce statistical "noise" enough to detect whether the apparent trends are genuine and continuing. PIBO effectiveness monitoring may provide the means to project rates of recovery of aquatic habitats across the landscape as enough data accumulates to provide stronger statistical assessments of trends and rates of recovery in riparian and aquatic habitat conditions.

Malheur National Forest

Westslope cutthroat trout are a management indicator species for the Malheur National Forest for the 1990 forest plan, as amended by PACFISH and INFISH (alternative A), and viability for the species needs to be considered at the scale of the Malheur NF for alternative A. Outcomes for redband trout as a focal species are considered to represent outcomes for westslope cutthroat trout and other resident trout, aside from bull trout, but effects to westslope cutthroat are represented specifically by effects to redband trout in the Upper John Day subbasin, since westslope cutthroat do not occur elsewhere within the Malheur NF. Viability for redband trout in the Upper John Day subbasin is good, therefore viability for westslope cutthroat trout is currently considered good within the Malheur National Forest under alternative A. The Malheur National Forest's contribution to viability of westslope cutthroat trout is moderate, as the proportion of spawning and rearing habitat within that national forest is nearly 70 percent and much of that habitat is located within Wilderness areas.

Effects to viability of bull trout for alternative A are discussed and disclosed in the Species Viability section. An assessment of short and long term implications to viability for each alternative is disclosed in the Threatened and Endangered Species discussion. Loss of viability for species or component populations in National Forest System lands would not be expected if current management direction (alternative A) were to be continued under PACFISH and INFISH direction, given current improving trends for riparian and aquatic habitat conditions at the scale of the plan area.

Umatilla National Forest

Redband trout and steelhead are management indicator species for the Umatilla National Forest for the 1990 forest plan, as amended by PACFISH (alternative A). Viability for both species needs to be considered at the scale of the Umatilla National Forest for alternative A.

Effects to viability of steelhead for alternative A are discussed and disclosed in Effects to Viability in the Focal Species section. Effects to viability of redband for alternative A are discussed and disclosed in the Effects to Species Viability section. An assessment of short and long term implications of alternatives to steelhead viability is disclosed in the Threatened and Endangered Species discussion above.

Viability for redband trout and steelhead in Umatilla NF subbasins currently is fair or good, and the loss of viability for species or component populations at in National Forest System lands would not be expected if current management direction were to be continued under PACFISH and INFISH direction, given current improving trends for riparian and aquatic habitat conditions at the scale of the plan area.

Wallowa-Whitman National Forest

Because westslope cutthroat trout are a management indicator species for the Wallowa-Whitman National Forest for the 1990 forest plan, viability for the species needs to be considered at the scale of the national forest for alternative A. Outcomes for redband trout as a focal species are considered to represent outcomes for westslope cutthroat trout and other resident trout, aside from bull trout. Steelhead and bull trout are also management indicator species for the Wallowa-Whitman National Forest for the 1990 forest plan, and viability for both species needs to be considered at the national forest scale for alternative A.

Effects to viability of steelhead and redband trout with alternative A are discussed and disclosed in Effects to Viability in the Focal Species section. Assessments of short and long term implications of alternatives to steelhead viability are disclosed in the threatened and endangered species discussion.

Viability for redband trout, westslope cutthroat trout, and steelhead in subbasins of the Wallowa-Whitman National Forest currently is fair or good for the 1990 forest plan as amended by PACFISH and INFISH (alternative A) and loss of viability for species or component populations on National Forest System lands would not be expected if current management direction were to be continued under PACFISH and INFISH direction, given current improving trends for riparian and aquatic habitat conditions at the scale of the plan area.

Environmental Consequences to Magnuson-Stevens Act Species (Pacific Salmon)

A determination of "may affect" under the Magnuson-Stevens Act is made when a determination of "no effect" cannot be made with certainty. Since plan components and other plan direction, either together or separately, may indirectly affect Endangered Species Act-listed SRB Chinook salmon and may affect other non-listed spring Chinook salmon stocks wherever they occur for reasons similar to those given for listed salmon species, a finding of "may affect" under the Magnuson Stevens Act would apply to each plan action alternative for each national forest where SRB or MCR spring Chinook salmon are present. The "may affect" determination applies to spring Chinook salmon in either ESU, and a "no effect" determination would apply to SRB fall Chinook salmon, as well as to SRB sockeye.

Pursuant to requirements of the Magnuson-Stevens Act that include an assessment of effects, consultation would be conducted with National Marine Fisheries Service concurrently with Endangered Species Act Section 7 Consultations to ensure protection of all Pacific Ocean salmon species within the Blue Mountains national forests.

Cumulative Effects

Cooperative fish habitat and native fish population restoration work is ongoing between Forest Service ranger districts, tribes, and local stakeholders represented by soil and water conservation districts, watershed councils and nongovernmental organizations. Cooperation across administrative boundaries is increasingly important in efforts to meet increasing demands and competing values for natural resources placed by a growing human population with ultimate impacts on fisheries resources. This cumulative effects analysis considers actions in lands of all ownerships within the full subbasins in which National Forest System lands are found over the next 10 to 20 years, unless otherwise specified.

Cumulative Effects on Species Viability

The biology and legal status of anadromous steelhead demonstrates that steelhead populations are heavily influenced by many factors outside and downstream of National Forest System lands. These factors include competition and interbreeding with hatchery stocks; tribal, recreational and commercial harvest; habitat conditions including water quality in the migratory river corridors and yearly and decadal changes in the ocean rearing environment; and, impacts of passing through multiple main-stem hydropower dam operations during both emigration downriver to the ocean as subadults and as adults returning upriver to spawn in their natal streams. These population- and ESU/DPS-level impacts are described in multiple documents including the Middle Columbia River Steelhead Recovery Plan (NMFS 2008) and subbasin plans for the Middle Columbia River and Lower Snake River subbasins associated with the Blue Mountains national forest planning area (NWPCC 2004 online).

Current habitat conditions and connectivity at the subbasin scale were considered in lands of all ownership for each component population of the selected focal species using the Blue Mountain sustainability model for Plan Revision (Gecy (2013a). Those conditions influence resident species as well as the anadromous species, since freshwater resident populations move seasonally within the drainage network and larger fluvial individuals of resident species are known to winter in the larger, lower elevation portions of the stream network downstream of National Forest System lands.

Current connectivity and habitat conditions in National Forest System lands are the result of past natural disturbances, particularly floods and wildfire, and past land management activities including grazing, mining, timber harvest and road construction, in particular. Those disturbances, along with fires and floods, have also taken place within private and state lands, including the small, private-ownership inholdings that checkerboard within the forest boundaries, and the habitat condition scores in each subbasin reflect those past effects. Habitat connectivity has been disrupted by culverts, dams, water withdrawals for irrigation. More than 3,700 miles of fish habitat for one or more focal species within National Forest System lands are blocked, or seasonally blocked, by National Forest System road culverts. Existing loss of connectivity within subbasins appears to a primary impact to current viability for any of the species, but particularly for resident bull trout. Timber harvest, grazing and mining have contributed to degradation of stream channels and floodplains, resulting in less water storage and release for instream flows during the summer season.

Seasonal barriers created by loss of stream flow and/or thermal barriers created by water temperatures can exceed species tolerances. Impassible dams and diversions disrupt habitat and population connectivity downstream of national forest boundaries and between subbasins, and other diversions and water withdrawals have partially disrupted connectivity within National Forest System lands in some subbasins. Many of those effects would continue for the foreseeable future. Grazing and timber production are likely to continue on private lands, and small-scale mining operations are likely to continue on private lands in places where they already occur.

As in the case of anadromous species, the quality, size, and accessibility of spawning and rearing habitat in National Forest System lands play but a partial role in terms of ensuring long-term viability of bull trout as a species. As Nelson et al. (2002) discovered, even where other associated salmonids, such as redband trout and westslope cutthroat trout, retained fluvial life histories, bull trout populations in the same drainage may exhibit only the resident life history, even where the fluvial life history may have been present in the drainage in times past. Various theories for this divergence in life history capabilities between species in the same drainage were posited, but further research on loss and recovery of the expression of the fluvial bull trout life history would be needed to help answer the uncertainties that remain.

A study of long-term (10-plus years) effects of fire was conducted by Rosenberger et al. (2011). Their findings suggest that general characteristics of stream ecosystems may recover more quickly than the underlying processes from which they are derived. They concluded that detecting more subtle long-term ecosystem impacts from wildfire disturbance and correlating condition of fish populations may require more in depth analyses. This is particularly important considering increased water temperatures, wildfire occurrence, and the accompanying shifts in ecosystem function that could be exacerbated by ongoing climate warming.

Recovery plans are in place for Middle Columbia River steelhead (NMFS 2008). Private stakeholder and state agencies in Oregon and Washington within the range of Middle Columbia River steelhead are implementing recovery actions in subbasins identified in the recovery plan, and are contributing to and complementing Forest Service restoration efforts in these subbasins. The Southeast Washington Recovery Plan for listed Snake River steelhead, sockeye, fall Chinook salmon and spring Chinook salmon (NMFS 2005) is being implemented by private stakeholders and Washington state agencies. Bull trout receive recovery benefits from actions taken to restore salmon and steelhead populations where their habitats coincide within the implementation of restoration activities.

Operation of the many dams on the main-stem Columbia and Snake rivers would continue to affect listed steelhead and salmon species within the cumulative effects analysis area, as would recreational and tribal harvest. State and tribal hatcheries for steelhead and salmon would continue to provide hatchery fish for harvest as mitigation for loss of wild fish due to the dams, but hatchery management at individual hatcheries is shifting to support recovery of wild anadromous stocks. Recreational fishing would continue to affect bull trout to an unknown degree. In subbasins where National Forest System lands provide no spawning and rearing habitat, cumulative effects of Forest Service management on species viability on National Forest System lands are minor at best.

So far as plan revision alternatives would contribute to cumulative effects to viability of aquatic focal species, alternatives B, C, E, and F would reduce effects to these species from past and present management in National Forest System lands, and alternative A would maintain or continue to reduce effects at rates that may be slower or faster than would occur under other alternatives, depending on the species, the number and location of priority subwatersheds restored under each alternative, and the degree of riparian and aquatic habitat protection afforded by each alternative, both short term and long term. Alternative D may create greater cumulative effects than the other alternatives, but the balance of risks from combined short-term effects of landscape protections and active restoration in priority watersheds relative to long-term benefits of landscape protection and active restoration in priority watersheds is unknown, since the same desired conditions apply to all alternatives.

Cumulative Effects to Focal Species

Alternative A would continue 1990 forest plan direction, as amended by PACFISH and/or INFISH, and support ongoing passive restoration processes at nearly natural rates and ongoing active restoration at current budget rates. Active restoration in watersheds and subbasin where more than one national forest is contributing to recovery of listed species and their habitats would continue. Non-listed redband trout would receive cumulative positive effects from actions taken to restore listed species. The contribution of the Umatilla and Wallowa-Whitman National Forests to viability of redband trout and steelhead in an all lands context would continue to be moderate with alternative A for all subbasins.

There would be cumulative positive effects from active restoration to benefit multiple focal species present in priority watersheds under all alternatives. Passive and active restoration combined across each national forest would complement restoration efforts undertaken by stakeholders including tribes, local nongovernment organizations and state agencies to restore listed species and habitats in those watersheds and would cumulatively contribute to restoration of entire watersheds over time.

The biology and legal status of steelhead and spring Chinook salmon, particularly in the Snake River and Middle Columbia River basins, demonstrate that anadromous populations are heavily influenced by many factors outside and downstream of National Forest System lands. Competition and interbreeding with hatchery stocks; tribal, recreational and commercial harvest; habitat conditions including water quality in the migratory river corridors and yearly and decadal changes in the ocean rearing environment; and impacts of passing through multiple main-stem hydropower dam operations during both emigration downriver to the ocean as subadults and as adults returning upriver to spawn in their natal streams influence focal species viability. These population and ESU/DPS level cumulative impacts from historic and ongoing factors outside the scope of Forest Service management authority are described in multiple documents, including Federal Registers in which steelhead and spring Chinook salmon were listed as threatened species, the Middle Columbia River Steelhead Recovery Plan (NMFS 2008), and subbasin plans for the Middle Columbia River and Lower Snake River subbasins (NWPCC 2004). Federal Registers that listed Columbia River Basin bull trout and their designated critical habitats describe similar cumulative impacts to bull trout in subbasins where bull trout occur. Subbasin plans describe similar cumulative impacts and threats to redband populations where redband populations occur.

Alternative C would create the most substantive reductions in risk from major land management activities relative to the other alternatives, and would reduce cumulative effects slowly through passive restoration methods for all focal, listed, sensitive species. Alternative D focuses on maximum commodities production, with a concomitant greater risk of adverse effects and loss of viability, in part due to the number of acres of potential disturbance, narrow riparian management areas, and decreased potential protection of habitat elements including water temperature, sediment, large wood inputs and stable streambanks.

Alternative A would continue the baseline for no net habitat degradation on National Forest System lands and slow improvement in riparian and aquatic habitats through natural processes. Alternative D would not necessarily result in cumulative effects in terms of net degradation of aquatic habitat, but may slow natural recovery rates to the point that degraded habitat conditions remain static. Protection scores are lower for alternative D than for alternative A, which is currently creating conditions resulting in a detectable upward trend in various habitat features and static trends for others within the Blue Mountains national forests. Other analyses of landscape scale planning efforts have resulted in similar findings for management alternatives, which emphasize intensive ground disturbing restoration activity relative to alternatives posing a more moderate balance between passive and active restoration (Rieman et al. 2001).

The positive cumulative effect of active restoration in the Umatilla National Forest may be highest with alternative C, followed by alternative E, then alternative F. In all cases, alternative D would potentially contribute the least cumulative restoration benefits when passive and active restoration benefits are considered together. There would be little or no difference in cumulative effects to bull trout within the Umatilla National Forest from the intensified grazing requirements, as bull trout spawning and rearing streams receive virtually no use under current management direction. Reduction in cumulative effects for bull trout populations and habitat from grazing may be more measurable for the Malheur and Wallowa-Whitman National Forests as more spawning and rearing reaches are accessible and grazed currently in those allotments than are accessible and grazed on the few spawning and rearing reaches located within Umatilla National Forest allotments.

When active restoration is combined with restoration through passive protection measures, alternatives A, B, C, E, and F are all likely to result in reductions of cumulative effects through time. Relative to each other, the rate of reduction in cumulative effects under each alternative is uncertain and is likely to vary for each focal species, and would depend upon the types of activities funded, the level of activity funded and undertaken for each of those activity types, and when and where those activities are accomplished during the life of the plan on each forest.

Cumulative Effects to Threatened and Endangered Species

Restoration actions are ongoing on private, state and tribal lands in subbasins supporting listed steelhead, bull trout and Chinook salmon populations within the cumulative effects analysis area, including changes in hydropower operations, hatchery operations, harvest management by the states and habitat improvement activities. Those actions are guided by individual subbasin plans developed for the Northwest Power Planning Council and by Recovery Plans for listed bull trout and anadromous species. Restoration actions are likely to continue for the foreseeable future as a continuation of recovery plan implementation through state, Federal, and private partnerships and other collaborative efforts.

Cumulative Effects to Sensitive Species

Cumulative effects of alternatives to redband trout and steelhead were discussed in the focal species section. Redband and bull trout serve as focal species surrogates for westslope cutthroat trout and margined sculpin, and cumulative effects of the alternatives on these species constitute the cumulative effects analyses for redband trout, westslope cutthroat trout and margined sculpin as sensitive species. There would be no cumulative trends towards Federal listing for these species from management actions for any of the alternatives.

Cumulative Effects to Management Indicator Species

Cumulative effects to redband trout, steelhead, bull trout, westslope cutthroat trout and other resident trout were discussed as focal species or are represented by cumulative effects to focal species. No cumulative effects to these management indicator species from management actions are expected to occur for alternatives B, C, D, E, or F. Net reductions in cumulative effects are likely to occur for alternative A, given current indications of improving trends in aquatic habitat and riparian conditions across the Blue Mountain forests' planning area, and improving trends in population viability (all-lands) scale in many subbasins and stable populations in other subbasins, at the all-lands scale. Those improving trends are expected to continue at nearly natural rates for alternative A, which would continue current management under PACFISH and INFISH direction.

Climate Change Implications for Species Diversity and Viability

McElhany et al. (2000), noted "…processes contributing to extinction risk (catastrophes and large scale environmental variation) …need to be assessed at the larger temporal and spatial scales represented by ESUs or other entire collections of populations (i.e., scales larger than the Blue Mountains planning area). More recently, climate change effects can be projected at the scale of the plan area and even by subbasin (Haak 2010, Hamlet et al. 2010. Some subbasins and species would be affected more quickly than others (see table 227 through table 229).

Fall spawning species, such as salmon and bull trout, whose eggs overwinter in streambed gravels, are likely to be impacted by increased winter flooding and greater movement of streambed gravels and cobbles during winter rain-on-snow events. Steelhead and redband trout are spring spawners; their spawning activity typically occurs as winter and spring flood flows are declining. Their eggs are less likely to be damaged than the eggs of fall-spawning salmon and bull trout. Some subbasins that are currently snow-dominated (spring snowmelt) systems, are expected to shift to transitory-snow (winter rain-on-snow) dominated systems, as climate change progresses. These would be the subbasins where spring Chinook salmon and bull trout spawning habitats would be most at risk. Other subbasins may experience limited change in timing of runoff and fish populations would be less affected by shifts in timing of runoff. Other subbasins may shift to winter rain-dominated systems from their current transitory-snow dominated regimes (table 227 through table 229).

The science panel that reviewed the ARCS made the general observation that:

> Climate-related factors, such as temperature and streamflow, could affect habitat in different ways and at different scales depending on local site characteristics. Therefore a diversity of conditions is needed for population stability (Crozier and Zabel 2006).

Effects of ongoing climate change on riparian and aquatic habitats and species of conservation concern could be reduced by active restoration measures described in appendix A. Improvements in fish passage would enable fish to recolonize drainages impacted by uncharacteristically severe fires. Redband trout and bull trout have been shown to recolonize severely burned drainages within two years, provided the drainages were physically accessible (i.e., no culvert barriers, and provided that other fish in unburned areas were close enough to discover and move back into the recently burned habitat (Rieman et al. 1997)).

Table 227 through table 229 summarize the elevated risks from projected climate change for subbasins occupied by MCR steelhead and spring Chinook salmon, Snake River Basin steelhead and spring Chinook salmon, interior redband trout, and bull trout. With anticipated effects of climate change during the next 20 to 40 years, increased winter and early spring flooding effects on fall spawning species, such as Chinook salmon and bull trout, are likely to be exacerbated where streams are deficit of large wood and where large wood inputs are below natural rates of recruitment. Research has shown that flooding has limited impacts on survival of redds and fry when sufficient large wood is present in the channel to mediate flow velocities and create naturally sheltered areas of slower water that act as refugia for older juveniles. Flooding would also have less impact where fish are able to move freely through the system due to passage barriers having been removed.

Interactions between restoration activities and natural disturbances would influence resiliency of fish habitat and community diversity in different ways which cannot be known fully at this time. For example, fish are more likely to be resilient to a stand-replacing fire and/or atypical flooding if fish passage to adjoining drainages is restored prior to the disturbance, thereby providing timely access to alternative habitat from while habitat recovers in the watersheds affected by the disturbance.

In subwatersheds where barriers have not yet been removed, fish habitat may be more resilient to fire if riparian vegetation structure and composition, particularly in subwatersheds dominated by dry forest, are in a condition that would enable habitat to maintain or improve in the presence of frequent low intensity fire, high road density and frequent stand entries for mechanical fuels management. In subwatersheds and larger drainage networks (5th and 4th HUCs) dominated by mixed severity or stand-replacing fire regimes, fish are more likely to be resilient to climate change where restoration of instream large wood, habitat complexity, restored fish passage and storm proofed road systems contribute to resiliency to flooding and reduced summer stream flows. As Rieman et al. (2000) noted, every subbasin is different due to different climatic characteristics, and the risks to fish and habitat from management impacts including retention and maintenance of existing road networks, versus impacts of wildfire, flood or drought exacerbated by climate change, may balance out in most of the blue mountain province.

Most researchers expect bull trout to be the least resilient to climate change of any of the focal species, in that they are likely heavily impacted by warmer waters which would constrict their habitat by warmer water encroaching further upstream, and further constricted by greater declines in stream flow on the upper colder ends of their habitat high in the watersheds due to earlier loss of snowpack. Lack of connectivity within and between subbasins may be more impactive to bull trout than to the other species.

Bull trout, with their dependence on cold water, are expected to be severely affected; losses of habitat in the Columbia River Basin are estimated at 22 to 92 percent (ISAB 2007, Hixon et al. 2009). The practical implication is that some sensitive fish populations are likely to “blink out” or become isolated.” Although the temporary blinking out of local populations is a natural that bull trout are adapted to, given their highly stochastic natural environments, the species is currently struggling to maintain viability in the face of existing core population numbers, loss of migratory life histories and loss of physical connectivity within and between core populations. Most core populations within the plan area are not able to easily accommodate additional “blinking out” given existing challenges to which they are not well adapted, given their current status (USFWS 2005). The chronic threats posed by climate change would only exacerbate the challenges to recovery the species already faces.

Spring Chinook salmon may be impacted by drought and high water temperatures more than bull trout, steelhead or redband, due to more of their habitat being located within warmer lower elevations of the subbasins. Elevated water temperatures are expected to contract spawning reaches on the lower boundary of those reaches. Across the plan area as a whole, steelhead and redband are likely to be the most resilient of any of the focal species to effects of climate change, as they are the most widespread species with the widest range of habitat available, not all of which would likely be impacted simultaneously. Good connectivity within and between subbasins in terms of fish passage would enable juveniles and adults to move freely through the system to access cooler tributaries during summer heat, and to access slower side channels during floods. Steelhead, Chinook salmon, and bull trout have all been found to recolonize burned drainages within two years post fire and flooding, where they had access to move back into the watershed (Howell 2006, Rieman et al. 1997).

While there would be elevated risks to fish habitat that would likely vary by subbasin and therefore by species, not all of the anticipated trends would necessarily be harmful to aquatic habitats. A distinguished panel of scientists who reviewed the scientific basis for the regional ARCS, noted that climate change scenarios include an increase in large flood events, wildfires, and pathogen outbreaks. Haak et al. (2010) assessed the probability and likely magnitude of such effects within plan area subbasins over the next 50 years (see table 227 through table 229). The science panel reviewing the ARCS noted that these trends have some potential to improve habitat complexity in some areas as a result of floodplain reconnection and large wood recruitment.

Table 227. Elevated risks from projected climate change for subbasins occupied by Middle Columbia River steelhead and spring Chinook salmon

Projected timing and direction of shifts in hydrologic regimes[1]					Increased habitat risks by 2050-2060[3] from 3 degree C increase in mean air temperature			
		2020		2040 (2020-2059)				
Subbasin	National Forest	Snow to Transitory	Transitory Shifting to Rain	Transitory Shifting to Rain	Winter Flooding	Wildfire	Risk of Unsuitable Summer Temperatures	Increasing Drought Risk Through 2060 Modified for Elevation and Precipitation by Subbasin
Walla Walla	UMA		X		Moderate	No change	Moderate	Low
Umatilla	UMA			X	Moderate	Low/no change	Moderate	Moderate
Upper John Day	MAL		X		Moderate	Low/no change	Moderate	Moderate
North Fork John Day[2]	MAL, UMA, and WAW			X	Moderate; risk increases with elevation	Low/no change (high at highest elevations)	Low	Moderate
Middle Fork John Day[2]	MAL and UMA			X	Moderate	Low/no change	Moderate	Moderate
Lower John Day River	MAL and UMA	No change	No change	No change	No change	No change	Moderate	Moderate
Walla Walla	UMA		X		Moderate	No change	Moderate	Low

1. Mantua et al. 2010;Tohver and Hamlet undated. Maps available at http://warm.atmos.washington.edu/2860/r7climate/study_report/CBCCSP_chap7_extremes_final
2. Subbasins with priority subwatersheds targeted for restoration.
3. Haak et al. 2010

Table 228. Elevated risks from projected climate change for subbasins occupied by Interior redband trout

	Projected timing and direction of shifts in hydrologic regimes[1]			Increased habitat risks by 2050-2060[3] from 3 degree C increase in mean air temperature			
	2020		2040 (2020-2059)				
Subbasin	Snow to Rain-on-Snow	Rain-on-Snow to Rain	Rain-on-Snow to Rain	Winter Flooding	Wildfire	Higher Summer Temperatures	Drought Risk (Modified for Elevation and Precipitation)
Upper John Day		X		Moderate	Low/no change	Moderate	Moderate
North Fork John Day[2]			X	Moderate (risk increases with elevation)	Low/no change (high at highest elevations wilderness/scenic area)	Moderate	Moderate
Hells Canyon			X	Moderate	Low/no change (high at highest elevations east)	Moderate	Moderate
Silver Creek[2]			X	Moderate (high on NFS lands)	High at highest elevations, otherwise low/no change	Moderate	Moderate
Silvies			X	Moderate (high on NFS lands)	High/moderate on national forest, otherwise low/no change	Moderate	Moderate
Harney-Malheur Lakes			X	Moderate	Low/no change	Moderate	Moderate
South Fork Crooked			X	Moderate	High at highest elevations, otherwise low/no change	Moderate	Moderate
Upper Malheur[2]	No change	No change	No change	High risk	High/moderate on national forest, otherwise low/no change	Moderate	Moderate
Willow (Snake)	No change	No change	No change	Moderate	Low/no change	Moderate	Moderate
Powder River	No change	No change	No change	No change	No change	Moderate	No change
Burnt River	No change	No change	No change	High (on NFS lands)	Low/no change except high at highest elevations	Moderate	Moderate
Brownlee Reservoir	No change	No change	No change	Moderate	Low. no change	Moderate	Moderate

1. Mantua et al. 2010;Tohver and Hamlet undated. Maps available at http://warm.atmos.washington.edu/2860/r7climate/study_report/CBCCSP_chap7_extremes_final
2. Subbasins with priority subwatersheds targeted for restoration.
3. Haak et al. 2010

Table 229. Elevated risks from projected climate change for subbasins occupied by bull trout

Subbasin	Projected timing and direction of shifts in hydrologic regimes[1]: 2020: Snow to Transitory	Projected timing and direction of shifts in hydrologic regimes[1]: 2020: Transitory Shifting to Rain	Projected timing and direction of shifts in hydrologic regimes[1]: 2040 (2020-2059): Transitory Shifting to Rain	Increased habitat risks by 2050-2060[3] from 3 degree C increase in mean air temperature: Winter Flooding	Increased habitat risks by 2050-2060[3] from 3 degree C increase in mean air temperature: Wildfire	Increased habitat risks by 2050-2060[3] from 3 degree C increase in mean air temperature: Higher Summer Temperatures	Increased habitat risks by 2050-2060[3] from 3 degree C increase in mean air temperature: Drought Forecast	Relative Risk of Extirpation by 2050[4]
Wallowa	X	NA	No change	High	High/moderate, risk decreases as elevation drops	Moderate	Low	Low/moderate
Walla Walla		X		Moderate	No change	Moderate	Low	High/high
Upper John Day		X		Moderate	Low/no change	Moderate	Moderate	Moderate/high
Tucannon		X		Moderate	Low/no change	Moderate	Low	High/high
Asotin	No change	No change	No change	Moderate	Low/no change	Moderate	Moderate	High/high
Lower Grande Ronde		X		Moderate	Low/no change	Moderate	Moderate	High/high
Imnaha[2]	No change	No change	No change	High in upper subbasin, moderate in lower subbasin	No change	Moderate	Moderate	Low/moderate
Hells Canyon (in the HCNRA)			X	Moderate	Low/no change (high at highest elevations east)	Moderate	Moderate	High/high
North Fork John Day			X	Moderate; risk increases with elevation	Low/no change (high at highest elevations)	Moderate	Moderate	Low/moderate
Middle Fork John Day			X	Moderate	Low/no change	Moderate	Moderate	High/high
Umatilla			X	Moderate	Low/no change	Moderate	Moderate	High/high
Upper Grande Ronde	No change	No change	No change	High	High	Moderate	Moderate	Moderate

	Projected timing and direction of shifts in hydrologic regimes[1]			Increased habitat risks by 2050-2060[3] from 3 degree C increase in mean air temperature				
	2020		2040 (2020-2059)					
Subbasin	Snow to Transitory	Transitory Shifting to Rain	Transitory Shifting to Rain	Winter Flooding	Wildfire	Higher Summer Temperatures	Drought Forecast	Relative Risk of Extirpation by 2050[4]
Upper Malheur	No change	No change	No change	High	Low/no change (high/moderate on national forest)	Moderate	Moderate	Moderate/high
Powder River	No change	No change	No change	No change	No change	Moderate	Moderate	Low/high
Brownlee Reservoir (in the HCNRA)	No change	No change	No change	Moderate	Low/no change	Moderate	Moderate	High/high
Little Salmon (in the HCNRA)	No change	No change	No change	Low/no change	Low/no change	Moderate	Moderate	Moderate/high
Lower Salmon (in the HCNRA)	No change	No change	No change	Moderate	Moderate	Moderate	Moderate	Moderate/high

1. Mantua et al. 2010;Tohver and Hamlet undated. Maps available at http://warm.atmos.washington.edu/2860/r7climate/study_report/CBCCSP_chap7_extremes_final
2. Subbasins with priority subwatersheds targeted for restoration.
3. Haak et al. 2010
4. Rieman et al. 2007

If Mote (2003) stated that the extent to which restoration of stream habitat and altered dam operations would contribute to restoration of focal species and species of conservation concern, or the extent to which such actions would increase species resilience to climatic stresses, is an unknown. He stated his belief that it is impossible to say broadly (let alone for specific stocks) how those changes would compare with other environmental changes salmon have faced and would face in future. Steelhead are likely to experience challenges similar to those faced by salmon of similar ages, but due to seasonal differences in timing of migratory movement, spawning and egg residence periods in natal gravels relative to stream flows and water temperatures, the two species are likely to experience climate change in somewhat different ways.

With a warming climate, increased frequency of winter rains and an earlier snowmelt, “a higher frequency of severe floods would probably result in increased egg mortality due to gravel scour. Winter snowpacks would likely retreat and run off earlier in the spring (Mote et al. 2003a and 2003b), potentially impacting species whose migration to the ocean is timed to coincide with plankton blooms (Pearcy 1997). Summer base flows would probably be lower and the network of perennially flowing streams in a drainage system is likely to shrink during the summer dry period, forcing fish into smaller wetted channels and less diverse habitats (Battin et al. 2006). Warmer water temperatures would increase physiological stresses and lower growth rates. Summer peak temperatures may approach or exceed lethal levels for salmon and trout (Crozier and Zabel 2006, Crozier et al. 2008). Higher temperatures would also favor species that are better adapted to warmer water, including potential predators and competitors (Reeves et al. 1987).

Climate change would likely force shifts in the distribution of fish populations affecting their ability to cope with natural disturbances, particularly drought (Battin et al. 2006). Streams located high in watersheds that historically provided some of the best habitat may no longer be accessible to migratory fishes if snowpack is reduced, thus limiting available rearing areas and access to thermal refugia in summer. Even moderate climate induced changes may significantly increase the risk of extirpating local populations of Chinook salmon (Crozier et al. 2008). Climate related factors, such as temperature and streamflow, could affect habitat in different ways and at different scales depending on local site characteristics. Therefore, a diversity of conditions is needed for population stability (Crozier and Zabel 2006).

“Existing well connected, high elevation habitats on public lands would be important to supporting salmon survival and recovery as the climate continues to warm (Martin and Glick 2008). As stated in the ARCS:

> Maintaining and restoring these areas is a fundamental purpose for establishment of key watersheds. Active restoration actions would achieve objectives that would increase resiliency of aquatic habitat and populations to climate change, by reducing flood peaks by enhancing floodplain connectivity and disconnecting roads from streams, reconnecting isolated habitats by removing or replacing culverts, managing riparian forests to provide shade and other functions, and improving watersheds where aquatic habitats and water quality have been degraded. Actual impacts to aquatic ecosystems would be highly dependent on the degree to which these adaptation actions are implemented now and in the future.

Without these types of restoration actions the ARCS postulated that aquatic habitats and species are likely to become increasingly isolated, simplified, and less likely to recover after significant disturbance events.

At a smaller scale, warmer stream temperatures associated with climate change are likely to exacerbate the extent and frequency of lethal temperatures in reaches occupied during low flow.

Resident salmonids have been shown to move extensively within the stream network during periods in spring and fall when flows are either rising or falling, and tend to become sedentary during summer months when spring flows drop (Mellina et al. 2005), which puts them at risk from lethal temperatures they are not wired to escape. However, such extinctions would be dispersed, and resident trout move enough in cool seasons to keep populations connected. That population interconnectivity may contribute to long-term viability of local populations even of resident species, where that connectivity between populations exists or where it can be restored.

Two foundational assumptions for this analysis have been: (1) Those species utilizing an aquatic ecosystem should benefit when it is functioning properly or when it is improving; and should be negatively impacted if aquatic habitats are degraded or in a downward trend; and (2) The most immediate potential for irreversible and irretrievable commitments of aquatic resources, are associated with threatened and sensitive aquatic species. Land management can positively or negatively affect aquatic resources. The magnitude of effect commonly relates to the scope (size of area) and intensity of an action; its proximity to aquatic resources, the type of activity and the effectiveness of mitigation standards applied.

Considering adaptation of aquatic species habitat to climate change, differences between alternatives are relatively small. Alternatives C, E and F have more area in riparian management areas, and carry the lowest risk from management impacts, and may provide more opportunities for riparian habitat protection than other alternatives. Alternative D has the lowest number of miles and acres of stream structure and riparian restoration, and the least reduction in hydrologic connectivity of roads, and thus would have the lowest potential for maintaining aquatic habitat resiliency and habitat network connectivity in the face of climate change. Alternative C would have the greatest number of miles of riparian restoration and stream channel enhancements, and the greatest reduction in hydrologic connectivity of roads, thus providing the greatest potential for maintaining aquatic habitat resiliency and network connectivity that would enable fish to relocate to the most suitable habitats seasonally, and would maintain habitable stream temperatures for aquatic species as air temperature rises.

Cumulative Effects on Species Diversity

Forest plan level decisions for any alternative are expected to maintain and improve habitats and maintain viability for aquatic species on National Forest System lands. These decisions include desired conditions, objectives, standards and guidelines for maintaining or improving all watersheds, priority watersheds, protecting key watersheds, protecting and restoring riparian management areas, Water Quality, decisions regarding Suitability of riparian management areas for various management uses, investment in active restoration of National Forest System lands in priority watersheds, monitoring of watershed, riparian and aquatic habitat conditions, combined with designation of key watersheds, active restoration, and monitoring of watershed, riparian and aquatic habitat conditions,

When combined with other components of the regional restoration and conservation strategy that are outside the scope of the plan decision, (multiple scale assessments, designation of key watersheds), implementation of those components of the strategy that constitute plan level decisions, (restoration, riparian management areas, and monitoring) are not expected to prevent the listing of any species or DPS, mainly because Federal land management agencies are responsible only for the habitat they manage. State agencies are responsible for populations on all lands and for the regulation of activities that affect populations and habitats on other ownerships. For listed salmon and trout, factors outside the responsibility of Federal land managers contribute to the status and trends of populations. These include changes in freshwater and estuarine habitats; harvest in commercial and recreational fisheries; management of dams; and the effects of hatchery practices and introductions (NMFS 2008).

Per Kostow (2003), fish-bearing streams in the John Day River Basin historically relied on extensive headwater beaver meadows for water storage and related maintenance of base flows which contributed to cooler water temperatures during the low flow season. These headwater meadows were largely lost in the late 1800s which changed the hydrology of the lower mainstem. The lower Umatilla and Walla Walla rivers are severely modified by irrigation diversions which have resulted in elevated water temperatures and abnormally low flows during the low flow season. In the years since 2003, a bucket-for-bucket program has begun providing water from the Columbia River for Umatilla Basin irrigators, which allows more water to remain in the Umatilla River mainstem during the low flow season, thereby contributing to suitable migration and spawning conditions for the Chinook salmon stock reintroduced by the Confederated Tribes of the Umatilla Indian Reservation in recent years. Kostow (2003) speculated that all major rivers in the Middle Columbia River basin once provided rearing habitat for resident redband trout historically, based on current redband trout populations present in the lower mainstem Deschutes River, but that those other river populations have gone extinct as a result of water withdrawals for irrigation and other purposes, leading to poor rearing habitat quality and quantity in summer and fall due to low flows and elevated water temperatures. This possible loss of mainstem habitats and populations may have contributed to reduced viability of redband populations on National Forest System lands due to loss of spatial and genetic connectivity and diversity within each subbasin.

The entire Crooked River is above the Pelton-Round Butte and Bowman dams and was probably the major steelhead production area historically. Much of the mainstem Crooked River, and the entire South Fork, are now severely impacted by irrigation and cattle grazing. These activities have lowered water tables, caused passage blockages, dewatered reaches, and decreased water quality (Kostow 2003). Many of the headwater areas still have good desert trout habitats, although the best remaining habitats are limited. If habitat has been fragmented or lost and the potential for dispersal and recolonization is limited by barriers or by loss of the migratory life history in the case of bull trout, lagged extinctions in presently occupied habitat may be anticipated. When habitat is lost more rapidly than populations, a ‘‘debt of extinction’’ is incurred (Hanski 1996), so even if further habitat loss is prevented, local extinctions would continue to occur until a new equilibrium between extinction and recolonization is established. The implication is that conservation of existing habitats alone may not be adequate for the long term conservation of some species.

Active cooperation between the Forest Service, other Federal agencies, the states, tribes, and local interest groups and organizations is important to national forest fish and wildlife programs, and programs integrated between different parties promote a synergy that leads to faster restoration of fish and fish habitats at the landscape scale than would likely occur only with funds appropriated to the Forest Service by Congress for these purposes.

Forested Vegetation, Timber Resources, and Wildland Fire

Introduction

The Blue Mountains of northeastern Oregon range from approximately 1,000 to nearly 10,000 feet in elevation. Most of the higher elevations have been glaciated. The landscape includes mountains with narrow valleys, basins, alpine meadows, and break lands. Maritime climate, westerly winds, and mountainous terrain yield less than 10 inches of precipitation at the lowest elevations to more than 80 inches in mountainous areas. The dry upland forest, moist upland forest, and cold upland forest potential vegetation groups are currently dominated by Douglas-fir, ponderosa pine, western larch, subalpine fir, Engelmann spruce, lodgepole pine, and grand fir cover types. Soils in many areas are only moderately productive because of shallow depths associated with cold temperatures and low precipitation. The most productive soils occur in valleys and basins where soils are often deep and have high water-holding capacity due to their increased volcanic ash content. The dominant valley bottom settings include both steep, confined valleys with step-pool and rapids dominated streams, and broad, gently sloping valleys with meandering streams in well-developed floodplains at lower elevations (Quigley et al. 1996). Approximately 80 percent of the National Forest System lands in the Blue Mountains are dominated by upland forest potential vegetation groups.

Disturbance processes, including fire, insects, diseases, and wind, were, and continue to be, significant drivers of ecosystem resilience (Agee and Maruoka 1994) and agents of change in vegetation. These impacts can be both positive and negative. For example, fire exclusion and suppression has been one of the main factors that has resulted in a decrease in the extent of ponderosa pine and aspen, increased stand densities, lengthened fire return intervals, and increased fire severity within the dry and moist upland forest potential vegetation groups. However, the increased stand densities resulting from fire exclusion and suppression have also favored some wildlife species.

Wildland fire is a disturbance process in the Blue Mountains that contributes to ecosystem structure, process, and function (Agee 1993). However, unlike disturbance processes such as wind, insects, disease, and flood, fire is often used as a tool to manage natural resources. Like all disturbance processes, fire effects are often highly variable and can result in a wide range of outcomes. Wildland fire as a tool is most often used to modify fuels to reduce the risk of undesirable fire effects or to help achieve desired conditions for vegetation. Fire is also used to contribute to ecosystem processes and functions, such as nutrient cycling. In many areas within the national forests, the management objective is to restore the natural role of fire and to use fire as a key ecological process. The underlying assumption of this objective is that ecosystems are most resilient and resistant to disturbance, including climate change, when they exist in a condition closest to that under which they evolved (Morgan et al. 1994). However, though Blue Mountains forests evolved with wildland fire, it is neither possible nor desirable to restore the historical role of fire or historical conditions everywhere. In some cases, high severity fire, which is the historical fire regime in some ecosystems, may not be desirable. For example, high severity fire is particularly undesirable in places like the wildland-urban interface, regardless of the historical context.

History

Historically, the dry upland forest potential vegetation group was dominated by ponderosa pine and Douglas-fir. These forests are located at low to moderate elevations. The dry upland forest potential vegetation group was characterized by predominantly frequent, low severity surface fires occurring at intervals of less than 20 to 25 years (Barrett et al. 1997, USDA Forest Service 2002). While larger-diameter, old trees typically survived these low severity fires, younger, smaller-diameter trees and less fire-tolerant species were killed. The historical fire regime created and maintained a generally open forest structure, with a small-scale mosaic pattern of clumps or patches of trees dominated by large diameter, old ponderosa pines, scattered individual trees, and openings that contained an abundance of native grasses and shrubs (Churchill et al. 2013, Larson and Churchill 2012, and Franklin et al. 2008). This spatial heterogeneity is a key structural element of the historical dry upland forest (Franklin et al. 2008). Crown fires may have occurred historically in mid- to late-seral closed canopy structural stages. However, these events were limited in extent due to the predominance of open canopy forest (Barrett et al. 2010). The frequent fires in the dry upland forest potential vegetation group also contributed to relatively low fuel loadings.

The moist upland forest potential vegetation group was dominated by Douglas-fir, western larch, western white pine, grand fir, and sub-alpine fir, and generally located at moderate elevations. The moist upland forest potential vegetation group was characterized by mixed-severity fires occurring every 40 to100 years (USDA Forest Service 2002). In a mixed-severity fire regime, fire alternates between stand-replacing crown fires that kill all trees to nonlethal, low-intensity surface fires that leave patches of living trees. According to Perry et al. (2011), mixed-severity fires create a patchiness of forest structure, composition, and seral status that can be observed and quantified at an intermediate or meso-scale, with patch sizes ranging from a few hundredths up to tens or hundreds of a hectare, depending on locale and climatic drivers. In forest types that were historically dominated by mixed-severity fire regimes, surface and canopy fuels, topography, climatic conditions, and ignitions worked in concert to influence variation in fire frequency, severity, spatial extent, and seasonality. The result was a complex spatial-temporal mix of low, moderate, and high severity patches. Due to patterns of burning, this type of historical fire regime created a complex mosaic pattern across the landscape, resulting in high levels of diversity in both plants and animals (Perry et al. 2011).

The cold upland forest potential vegetation group was dominated by Engelmann spruce and subalpine fir. These forests are located at higher elevations. The cold upland forest potential vegetation group was characterized by stand-replacing fire events that occurred very infrequently, generally at return intervals of 150 to 300 years (Barrett et al. 2010). All or most trees were killed in both the overstory and understory across large areas (USDA Forest Service 2002).

On drier high-elevation sites, high-severity fires sometimes perpetuated forests of lodgepole pine. These stand-replacing fires usually occurred every 100 to 200 years. When large fires did not occur, these stands succumbed to attacks by mountain pine beetle and were replace by more shade-tolerant species, such as grand fir and white fir (USDA Forest Service 2002).

Other high elevation dry sites were dominated by whitebark pine. Historical fire frequencies and severities were highly variable, but trended toward mixed-severity and stand-replacing fires with longer return intervals, generally 100 to 200 years or more (Barrett et al. 2010).

Within each potential vegetation group, historical fire return intervals and severity varied, depending on several factors, such as fuel loadings, aspect, elevation, and weather conditions before and during fires (Heyerdahl et al. 2001).

Over the past century, numerous factors, including fire exclusion and suppression, timber harvest, introduction of nonnative plant species, and livestock grazing, have altered the historical fire regimes in the Blue Mountains (USDA Forest Service 2002). The dry upland forest potential vegetation group has experienced the greatest amount of departure from historical conditions (USDA Forest Service 2002). Dry upland forests that historically experienced frequent, low severity fires have now missed several fires due to over a century of fire exclusion and suppression, which has resulted in substantial increases in fuel loadings and the number of smaller trees. Additionally, historic grazing removed the fine fuels that carried low severity surface fires. Without competition from grasses, tree regeneration increased substantially. Tree regeneration that historically would have been thinned by fire continued to grow into dense stands and form multi-storied, closed canopies. The historically open stands within the dry upland forest potential vegetation group, with their mosaic pattern of tree clumps or patches and openings, have now filled in with younger trees, resulting in a more uniform stand structure, increased ladder fuels, increased stand densities, increased fuel continuity, and decreased spatial heterogeneity. Increased stand densities and a reduction in low severity fire events on dry sites has also contributed to a shift from shade intolerant/fire tolerant tree species, such as ponderosa pine, to more shade tolerant/fire intolerant species, such as grand fir. Increased stand densities have also contributed to a decrease in the abundance and diversity of understory grasses, forbs, and shrubs. As a result of these changes, fires are now larger and more severe than historical levels, especially in the dry forest types (Quigley and Arbelbide 1997). Between 1960 and 1979, the average annual acres burned (wildfire) in the Blue Mountains was 4,400 acres. This increased to 26,500 acres per year during the period of 1980 to 2000 (more information is available from the project record).

Commercial logging began in the 1870s when the transcontinental railroad linked the Blue Mountains to national lumber markets. Logging accelerated during the 1890s. Timber companies extended railroad lines into several drainages and sawmills began to appear across the Blue Mountains (Wickman 1992). With the establishment of the national forests, harvest slowed on public lands. National forest timber was difficult to access and more costly to acquire. From 1905 until 1916, most commercial timber harvest in the Blue Mountains came from private lands. This situation changed in the 1920s. National forests began offering large timber sales that focused on removal of commercially valuable stands of old ponderosa pine. Heavy logging occurred throughout the decade and was only abated by the drop in the national economy and the oversupply of lumber that occurred in the 1930s (Langston 1995). Logging on the national forests increased again in the 1940s. Harvest levels remained relatively high throughout the next four decades (1950s through 1980s) as forest managers raced to salvage insect-killed timber and provide lumber for a growing national market.

From its beginning, logging preferentially removed large, old ponderosa pine trees. Management of the national forests emphasized efficient and productive forests capable of meeting the nation’s demands into the future. The emerging discipline of forestry at the time held that inferior diseased and decadent trees needed to be removed and replaced with young, healthy, rapidly growing trees. Generally, this meant replacing stands of slower growing, old ponderosa pine with young, faster growing stands. Logging of pine was so intense during the logging boom that started in the 1920s that it exceeded sustainable rates. Two large timber sales from the Malheur National Forest made 2 billion board feet of pine available out of an estimated supply of 7 billion board feet in the forest. As harvest of large, old ponderosa pine continued, the size of available pine gradually decreased on national forests. The average ponderosa pine harvested from the Wallowa-Whitman National Forest in 1912 was 33 inches d.b.h. (diameter at breast height). In 1992, the average size harvested was 19 inches d.b.h. The quantity of ponderosa pine harvested also decreased over time. In the Wallowa-Whitman National Forest, 57 percent of the timber by volume in 1906 was ponderosa pine; in 1991, ponderosa pine volume was less than 20 percent. From the Umatilla National Forest, ponderosa pine was 34 percent of the harvest volume in 1931 (Weidman and Silcox 1936) and 16 percent in 1981.

As the more drought tolerant and shade intolerant ponderosa pine was harvested, it was replaced in many areas by less drought tolerant species that are more shade tolerant, such as grand fir and Douglas-fir. The more open, single-storied ponderosa pine stands were converted to multi-storied stands. As stand densities increased and species compositions and forest structures were altered, the frequency and intensity of insect outbreaks increased. In the Blue Mountains, annual precipitation averages 30 inches on National Forest System lands and ranges from 10 to 80 inches. Drought is a common occurrence. Under the Blue Mountains' normal moisture-limited conditions, densely-stocked stands of grand fir and Douglas-fir trees become stressed, increasing their vulnerability to insect infestation. Similarly, on pine sites, multi-storied, densely stocked ponderosa pine stands are at risk of insect infestation under drought conditions. As these densely stocked and moisture-stressed stands became more abundant during the last half of the 20th century, localized insect infestations quickly blossomed into outbreaks covering thousands of acres (Gast et al. 1991). Insects which attack Douglas-fir and grand fir include western spruce budworm (*Choristoneura occidentalis*), Douglas-fir tussock moth (*Orgyia pseudotsugata*), Douglas-fir beetle (*Dendroctonus pseudotsugae*), and fir engraver (*Scolytus ventralis*). Although insect outbreaks likely occurred prior to the time of the first Euro-American settlers, the frequency and size of outbreaks caused by western spruce budworm species and possibly other insects that attack Douglas-fir and grand fir appear to have increased as a result of the proliferation of fir-dominated forests (Swetnam et al. 1995). Similarly, the multi-storied ponderosa pine stands that replaced the single-storied stands on pine sites have also increased the potential for outbreaks of the western pine beetle (*Dendroctonus brevicomis*) and mountain pine beetle (*D. ponderosae*) (Hessburg et al. 1994). During the past 50 years, tree mortality from insect disturbances in some stands has exceeded 80 percent of all overstory trees (Swetnam et al. 1995). Several large-scale insect outbreaks, including spruce budworm, spruce bark beetle, and Douglas-fir tussock moth, occurred from the 1970s to the 2000s and caused extensive defoliation and mortality. Most tree diseases are increasing in occurrence and severity due to changes in tree species composition (increased grand fir within the dry upland forest potential vegetation group), stand structures (increases in multi-storied structure), and increased stocking levels (Scott and Schmitt 1996). Although each outbreak was followed by an effort to salvage dead trees, low merchantability and limited access prevented removal of dead trees from many areas. The abundance of insect-killed trees substantially increased the surface fuel loads for thousands of acres across the Blue Mountains. Conditions became conducive for the occurrence of large, high-intensity wildfires. From 1985 until 1994, lightning-caused wildfires burned more than 445,000 acres in the Blue Mountains. Many of these fires were high severity, stand-replacing events that killed most of the trees across large areas.

As a consequence of the past history of timber harvest, fire suppression, and grazing, the national forests within the Blue Mountains are substantially different from those that existed a century earlier (Munger 1917). Open, single-storied ponderosa pine stands have decreased, while dense, multi-storied stands of Douglas-fir and true fir have increased. Today, more stands are dominated by a uniform distribution of young to mid-aged trees as a result of selective harvesting of larger trees, salvage logging, and regeneration harvests that followed insect and fire mortality. The risk of insect outbreak has increased due to an abundance of densely stocked mixed-species stands. The probability of large, high-severity wildfire has also increased due to the increase in insect-induced tree mortality, increased fuel loadings, and the large acreage of densely stocked, multi-storied stands composed of shade-tolerant and fire-intolerant tree species.

Affected Environment – Forested Vegetation, Timber Resources, and Wildland Fire

This section describes the affected environment related to the forested vegetation, insects and disease, wildland fire, and timber resource contribution to ecological resilience. Resilience is defined as the ability of a social or ecological system to absorb disturbances while retaining the same basic structure and ways of functioning, the capacity for self-organization, and the capacity to adapt to stress and change (FSM 2020 interim directive). An ecologically resilient landscape is less susceptible to uncharacteristic wildfire (Averill et al. 1995, Gunderson 2000, Walker 2004), is at lower risk from uncharacteristic insect and disease infestations and epidemics, provides a full range of habitats for native terrestrial and aquatic species, protects water quality and abundance, provides a full range of uses, products and services, and is more adaptable to changes in climate. Affected environment and environmental consequences topics include:

Forested vegetation (includes background description of rangeland/herbland/shrubland vegetation):

- Forested structural stages
  Indicator: percent of upland forest potential vegetation group in each forested structural stage
- Forested tree species composition
  Indicator: percent of upland forest potential vegetation group in each species composition tolerance class
- Forested stand density
  Indicator: percent of upland forest potential vegetation group in open and closed canopy forest

Wildland fire:

- Fire regime (fire severity and fire frequency)
  Indicator: Fire regime condition class departure score
- Acres of prescribed fire
  Indicator: acres treated with fire

Insects and disease:

- Predicted mortality
  Indicator: percent of upland forest potential vegetation group in each forested structural stage, species composition tolerance class, and stand density class

Timber resource:

- Acres suitable for timber production
  Indicator: acres suitable for timber production
- Allowable sale quantity (ASQ)
  Indicator: ASQ
- Total sale program quantity (TSPQ)
  Indicator: TSPQ
- Acres of harvest treatment
  Indicator: acres of harvest treatment

Forested Vegetation

For the purpose of this analysis, vegetation in the Blue Mountains was classified into broad categories of forest, woodland, herbland, or shrubland. Categories were further classified as upland or riparian vegetation. The riparian vegetation is described in more detail in the watershed section of the EIS chapter 3. Shrubland, woodland, and herbland are discussed in the "Livestock Grazing" section of chapter 3. Upland and riparian vegetation were categorized into potential vegetation groups. Potential vegetation groups are aggregations of plant associations found in the Blue Mountains (Johnson and Simon 1987, Johnson and Clausnitzer 1992, Powell et al. 2007) and represent a combination of temperature and moisture regimes. The potential vegetation groups represent areas on the landscape that evolved under similar disturbance regimes and which would respond to management in a similar manner. Approximately 500 plant associations were grouped into 60 plant association groups (PAG), which were classified into 20 potential vegetation groups for this analysis, following procedures from Powell et al.(2007) (see table 230).

Table 230. Classification of potential vegetation groups (PVG) used in the analysis

Category		PVG Definition	PVG Code
Forest	Upland	Cold upland forest	Cold UF
Forest	Upland	Moist upland forest	Moist UF
Forest	Upland	Dry upland forest	Dry UF
Forest	Riparian	Cold riparian forest	Cold RF
Forest	Riparian	Low soil moisture riparian forest	Low SM RF
Forest	Riparian	Warm riparian forest	Warm RF
Woodland	Upland	Moist upland woodland (juniper)	Moist UW
Woodland	Upland	Dry upland woodland (juniper)	Dry UW
Shrubland	Upland	Cold upland shrubland	Cold US
Shrubland	Upland	Moist upland shrubland	Moist US
Shrubland	Upland	Dry upland shrubland	Dry US
Shrubland	Riparian	Cold riparian shrubland	Cold RS
Shrubland	Riparian	Warm riparian shrubland	Warm RS
Shrubland	Riparian	Low soil moisture riparian shrubland	Low SM RS
Herbland	Upland	Cold upland herbland	Cold UH
Herbland	Upland	Moist upland herbland	Moist UH
Herbland	Upland	Dry upland herbland	Dry UH
Herbland	Riparian	Cold riparian herbland	Cold RH
Herbland	Riparian	Warm riparian herbland	Warm RH
Herbland	Riparian	Low soil moisture riparian herbland	Low SM RH

Table 231 displays the percent of each national forest within each of the potential vegetation groups. The national forests within the Blue Mountains consist of mostly upland forest potential vegetation groups (approximately 70 to 87 percent), with an additional 13 percent to 30 percent comprised of shrubland, herbland, and nonvegetation (rock, water). The forested environment in the Blue Mountains is dominated by dry upland forest (34 percent to 72 percent), followed by moist upland forest (6 to 31percent) and cold upland forest (8 to 18 percent). The Malheur National Forest contains the highest percent of dry upland forest (72 percent). The Umatilla

National Forest contains the highest percent of moist upland forest (31 percent) and the lowest percent of cold upland forest (8 percent) due to a Columbia River maritime influence. The largest percentage of the Wallowa-Whitman National Forest consists of dry upland forest but it also contains a substantial percentage of moist (18 percent) and cold (18 percent) upland forest.

Table 231. Percent of each national forest within each potential vegetation group

Potential Vegetation Group	Malheur	Umatilla	Wallowa-Whitman
Cold upland forest	9%	8%	18%
Moist upland forest	6%	31%	18%
Dry upland forest	72%	43%	34%
Cold riparian forest	T*	T	T
Low soil moisture riparian forest	T	T	T
Warm riparian forest	T	T	T
Moist upland woodland (juniper)	3%	1%	1%
Dry upland woodland (juniper)	T	T	1%
Cold upland shrubland	T	T	1%
Moist upland shrubland	T	2%	1%
Dry upland shrubland	6%	1%	2%
Cold riparian shrubland	T	T	T
Warm riparian shrubland	T	T	T
Low soil moisture riparian shrubland	T	T	T
Cold upland herbland	T	T	T
Moist upland herbland	T	1%	3%
Dry upland herbland	2%	13%	15%
Cold riparian herbland	T	T	T
Warm riparian herbland	T	T	T
Low soil moisture riparian herbland	T	T	T
Non-vegetation or other	T	T	4%
Totals	100% (1,700,000 acres)	100% (1,400,000 acres)	100% (1,800,000 acres)

* T indicates trace (less than 1 percent).

Historical Range of Variability (HRV) Analysis

Powell (2012) compiled and summarized research and background information on the topic of range of variation. The following information was obtained from this white paper, which can be found in the project record.

Reference conditions provide an ecological basis from which to compare existing conditions and management options. “Considerable attention has been focused on natural disturbance processes as a guide for forest management. Concepts such as the historical range of variability (Landres et al. 1999) suggest that successful management of ecosystems may best be achieved by mimicking natural disturbance patterns and processes (Wright and Agee 2004:443; Arno and Fiedler 2005, Perera et al. 2004)”. The historical range of variability (HRV) has become a common reference condition for assessing landscapes because it provides a context for understanding the conditions under which plants and animals evolved (Keane 2009). The HRV concept is used to characterize fluctuations in ecosystem conditions and processes over a period of time (Powell 2012). Ecosystem conditions change as the result of disturbance processes. When disturbance processes occur with characteristic frequency and intensity, ecosystems respond by exhibiting predictable behavior and complexity (Aplet and Keeton 1999, Morgan et al. 1994). The effects of repeated disturbances cause ecosystem conditions to fluctuate between upper and lower limits (Powell 2012). The HRV concept recognizes that ecosystem components have a range of conditions within which they are resilient and self-sustaining (Egan and Howell 2001, Holling and Meffe 1996). Uncharacteristic disturbance processes can cause ecosystem effects to fluctuate outside of the HRV, resulting in a state of disequilibrium that is not sustainable.

HRV is not intended to portray a static, unchanging condition. Ecosystems within the Blue Mountains evolved with disturbances, including wildfire, insects, disease, landslides, human uses, changing weather patterns, and other factors (Powell 2012). The HRV was designed to characterize the range of vegetation composition, structure, and density produced by these disturbance agents (Morgan et al. 1994). The type and frequency of presettlement disturbances can serve as a management template for maintaining sites within their historical range of plant composition and vegetation structures – if landscapes can be maintained within their HRV, then they stand a good chance of maintaining their biological diversity and ecological integrity through time (Aplet and Keeton 1999, Holling and Meffe 1996). An HRV approach ensures that management activities are consistent with the conditions under which native species and ecosystem processes evolved (Delong and Tanner 1996). It is typically assumed that presettlement conditions represent optimum habitats for native plants and animals, and that the best way to recover an endangered or threatened species is to restore its habitat to some semblance of presettlement conditions (Botkin 1995). Since a key premise of HRV is that native species have evolved with, and are adapted to, the historical disturbance regimes of an area, ecosystem components occurring within their historical range are believed to represent sustainable conditions (Aplet and Keeton 1999, Swanson et al. 1994).

Some believe that presettlement conditions should not be used as reference conditions to guide management activities because climate change projections anticipate a warmer and drier climate. Future climates may trigger major changes in disturbance processes, plant species dynamics, and hydrological processes. However, others believe that using HRV may still be the most viable approach for the near-term because it has the least amount of uncertainty (Keane et al. 2009), particularly as compared to the uncertainty associated with the magnitude, timing, scale, and spatial extent of climate change impacts. Keane et al. (2009) states that, given the uncertainties in predicting climatic and ecological responses to increasing CO2, using an HRV based on the past may provide more certainty than attempting to simulate the future until technology has improved and models have been significantly validated. Keane et al. (2009) further states that the use of HRV to guide management efforts would be unlikely to result in inappropriate activities because HRV projections involve a broad range of conditions which consider the large genetic variation in most species and the robustness inherent in regional landscapes. Fulé (2008) states that the use of historical reference conditions to guide management remain valid because forests were historically resilient to disturbance and drought. Adapting reference conditions to future climates is valid, for example, historical characteristics of lower elevation, southerly, and drier sites may be more applicable to higher elevation, northerly, and currently wetter sites.

Reference conditions for forested vegetation are based on a 300-year time period (Steele 1994 and Hann et al. 1993) prior to Euro-American settlement (circa 1850) (Jaindl et al. 1993). Estimates of the HRV for forested structural stages, species composition, and stand density were developed for this analysis in 2007 through modeling using the Vegetation Dynamics Development Tool (VDDT). The VDDT model is a nonspatial state and transition model developed by ESSA Technologies, Ltd., of Vancouver, British Columbia and is a user-friendly computer tool that provides a modeling framework for examining the role of succession, various disturbance agents, and management actions for vegetation (Beukema and Kurz 2000). The states within the model are described by combinations of vegetation structure and composition including: structural stage, species composition, number of tree layers, stand density (canopy cover), and tree diameter. The combinations of structure and composition for all of the models produced 403 different states. The transitions part of the model describes how vegetation transitions between the different states through time. The transitions are described as either deterministic or probabilistic. Deterministic transitions are those that occur due to vegetation growth over time. Probabilistic transitions are those that occur due to disturbances, such as fire, insects, and disease. Probabilities and time intervals for the probabilistic transitions were developed through literature searches, expert opinion, and current vegetation survey (CVS) data modeled in the Forest Vegetation Simulator (FVS). VDDT modeling results were summarized for 30 different modeling simulations from model year 200 to year 500. The mean value for this 300-year time period was calculated. HRV was calculated as two standard deviations around the mean. Models were summarized into three potential vegetation groups (cold, moist, and dry upland forest) for the purpose of developing the forest plan and effects analysis. The analysis process is available in the analysis file.

The VDDT reference conditions/HRV were used as the primary basis for developing the desired conditions for forested vegetation. Broad-scale assessments completed for the Blue Mountains physiographic province and the interior Columbia River basin suggest that upland forest ecosystems could be characterized as healthy, sustainable, and resilient if three of their ecosystem components – species composition, forest structure, and tree density – are within the HRV (Caraher et al. 1992, Gast et al. 1991, Lehmkuhl et al. 1994, Quigley et al. 1996, USDA Forest Service 2002). The underlying assumption of this goal is that ecosystems are most resilient and resistant to disturbance, including climate change, when they exist in a condition closest to that under which they evolved (Morgan et al. 1994). When the range of natural variation in a system is reduced, the system loses resilience. When faced with either natural or human-induced perturbations, a system in which natural levels of variation have been reduced will be less resilient than an unaltered system (Holling and Meffe 1996). The HRV for forested structural stages, species composition, and stand density was used as the desired conditions for this analysis in order to create and/or maintain forest conditions that more closely resemble the historical conditions that existed prior to interruption of the historical fire regimes. By restoring and/or maintaining the historical forest structure, density, and species compositions that evolved under the historical fire regimes, forest health, sustainability, and ecological resilience would be improved across the landscape.

Forested Structural Stages

Vegetation for the Blue Mountains national forests plan revision was classified using structural stages similar to those described in O’Hara et al. (1996), Oliver and Larson (1996), and Hessburg et al. (1999). Figure 1 in appendix A and describes the structural stages used in this analysis.

Table 232 displays the existing forested structural stages as a percent of each upland forest potential vegetation group by national forest. Much of the analysis area is dominated by the understory reinitiation stage, which is characterized by overstory trees at low to moderate density, with a new age class of small trees in the understory.

Table 232. Existing forested structural stages as a percent of each upland forest potential vegetation group (PVG) by national forest

Upland Forest PVG/Structural Stage	Malheur	Umatilla	Wallowa-Whitman
Cold/SI	24	30	14
Cold/SE	12	21	10
Cold/UR	44	18	41
Cold/OFSS	1	0	1
Cold/OFMS	20	30	34
Dry/SI	6	12	14
Dry/SE	18	26	16
Dry/UR	54	50	54
Dry/OFSS	3	4	1
Dry/OFMS	20	8	14
Moist/SI	1	9	12
Moist/SE	5	10	11
Moist/UR	41	26	50
Moist/OFSS	5	23	1
Moist/OFMS	47	32	25

SI = stand initiation; SE = stem exclusion; UR = understory reinitiation; OFSS = old forest single story; OFMS = old forest multi-story

Within the Malheur National Forest, the cold and dry upland forest potential vegetation groups are currently dominated by the understory reinitiation structural stage. The Malheur moist upland forest potential vegetation group is currently dominated by the old forest and understory reinitiation structural stages.

Within the Umatilla National Forest, the cold upland forest potential vegetation group is currently dominated by the old forest multi-story and stem initiation structural stages. The Umatilla dry upland forest potential vegetation group is currently dominated by the understory reinitiation stage. The Umatilla moist upland forest potential vegetation group is currently dominated by the old forest structural stages.

Within the Wallowa-Whitman National Forest, the cold upland forest potential vegetation group is currently dominated by the understory reinitiation and old forest structural stages. The Wallowa-Whitman dry upland forest potential vegetation group is also dominated by the understory reinitiation stage. The Wallowa-Whitman moist upland forest potential vegetation group is currently dominated by the understory reinitiation stage.

Historical Range of Variability Estimates for Forested Structural Stages

Table 233 displays the estimated HRV for forested structural stages by upland forest potential vegetation group within the Blue Mountains forests analysis area. The desired conditions for each structural stage within each upland forest potential vegetation group were based upon the HRVs.

Within the cold upland forest potential vegetation group, the largest percent of the landscape historically consisted of the stand initiation (SI) and old forest structural stages. Approximately 20 to 45 percent of the cold upland forest potential vegetation group historically consisted of the SI stage, while approximately 15 to 45 percent of the cold upland forest potential vegetation group historically consisted of the old forest stages (OFSS and OFMS). Approximately 15 to 30 percent of the cold upland forest potential vegetation group historically consisted of the SE stage and approximately 10 to 25 percent historically consisted of the understory reinitiation stage.

Table 233. The HRV/desired conditions for forested structural stages (percent of each upland forest potential vegetation group)

Potential vegetation Group	Stand Initiation	Stem Exclusion	Understory Reinitiation	Old Forest Single Story	Old Forest Multi-story
Cold Upland Forest	20-45	15-30	10-25	5-20	10-25
Moist Upland Forest	20-30	20-30	15-25	10-20	15-20
Dry Upland Forest	15-30	10-20	0-5	40-65	1-15

Within the moist upland forest potential vegetation group, the landscape historically was relatively evenly distributed between each of the forested structural stages, with a slightly higher percent of the landscape in the two old forest structural stages.

Within the dry upland forest potential vegetation group, the landscape was historically dominated by old forest structural stages. Approximately 40 to 65 percent of the dry upland forest potential vegetation group consisted of the old forest single story structural stage. Approximately 1 to 15 percent of the dry upland forest potential vegetation group consisted of the old forest multi-story structural stage. Only a small percent of the dry upland forest potential vegetation group (0 to 5 percent) consisted of the UR structural stage.

Existing Condition Departure Analysis (Departure of Existing Condition from Estimated Historic Range of Variability)

The departure analysis examines the degree to which existing conditions have departed from estimates of the HRV. Within the dry upland forest potential vegetation group, the old forest multi-story (OFMS) structural stage is within the HRV at the scale of the Blue Mountains, but varies from slightly above to within the HRV when viewed at the scale of the individual national forest (see Figure 16, Figure 17, and Figure 18). The old forest single-story (OFSS) structural stage is below HRV, both at the scale of the Blue Mountains and for each national forest.

Within the cold and moist upland forest potential vegetation groups, the old forest multi-story (OFMS) structural stages are generally within to above the HRV. The old forest single-story (OFSS) structural stage is generally below the HRV.

Within most of the potential vegetation groups, the SI structural stage is slightly below to within HRV at the scale of the individual national forest. However, some individual watersheds within the dry and moist upland forest potential vegetation groups are above the HRV due to recent large-scale, high severity fires on portions of the Umatilla National Forest.

The stem exclusion stage is generally within HRV but at the low end of the range. The mid-age multi-story stage (understory reinitiation) is well above HRV for most potential vegetation groups.

Figure 16 displays the amount of departure from the HRV within the cold upland forest potential vegetation group by comparing the existing and historical forested structural stages within each national forest. In general, existing conditions within the cold upland forest potential vegetation group exhibit a lesser amount of departure from the HRV, in comparison to the moist and dry upland forest potential vegetation groups. The historical fire regime in the cold upland forest potential vegetation group was characterized by high severity, stand-replacing fire events that occurred every 100 years or more. With such infrequent fire events, the cold upland forest potential vegetation group has perhaps missed approximately one fire. Therefore, fire suppression has had less noticeable effects on existing forest structures.

Within the Malheur cold upland forest potential vegetation group, the existing percent of the landscape in the SI and OFMS structural stages is within the HRV. However, the percent of the cold upland forest potential vegetation group in the SE and OFSS stages is currently below the HRV, while the percent in the UR stage is above the HRV.

Within the Umatilla cold upland forest potential vegetation group, the existing percent of the landscape in the SI, SE, and UR structural stages is within the HRV. However, the percent of the cold upland forest potential vegetation group in the OFSS stage is below the HRV, while the percent in the OFMS stage is above the HRV.

Within the Wallowa-Whitman cold upland forest potential vegetation group, the existing percent of the landscape in all of the structural stages is departed from the HRV. The percent of the cold upland forest potential vegetation group in the SI, SE, and OFSS structural stages is currently below the HRV, while the UR and OFMS structural stages are above the HRV.

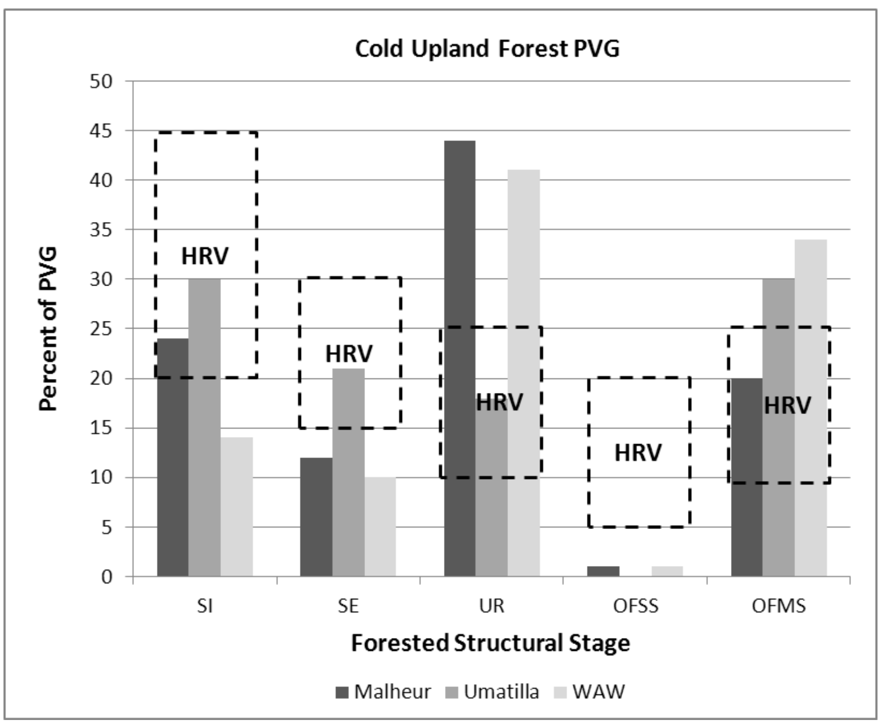

Figure 16. Existing forested structural stages (percent of potential vegetation group) and the HRV/desired conditions by national forest within the cold upland forest potential vegetation group

Figure 17 displays the amount of departure from the HRV within the moist upland forest potential vegetation group by comparing the existing and historical forested structural stages within each national forest. In general, existing conditions within the moist upland forest potential vegetation group exhibit a greater amount of departure from the HRV when compared to the cold upland forest potential vegetation group (figure 16). The historical fire regime in the moist upland forest potential vegetation group was characterized by mixed-severity fire events that occurred every 40-100 years. After over a century of fire suppression, some of these areas may have perhaps missed approximately one to three fires. Therefore, fire suppression has had more noticeable effects on existing forest structures, compared to the cold upland forest potential vegetation group.

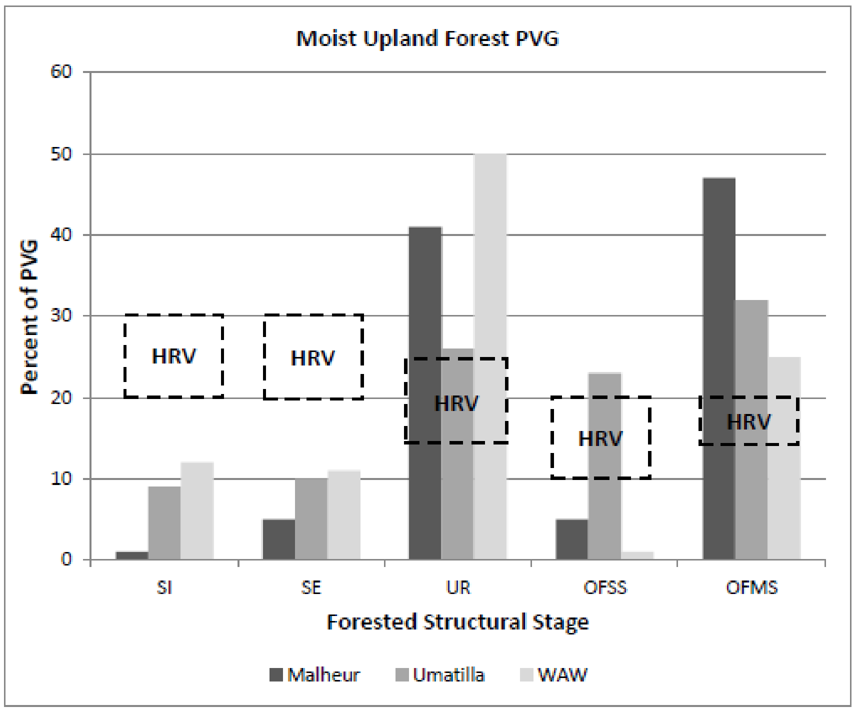

Figure 17. Existing forested structural stages (percent of potential vegetation group or PVG) and the HRV/desired conditions by national forest within the moist upland forest potential vegetation group

Within the Malheur moist upland forest potential vegetation group, the existing percent of the landscape in all of the structural stages is departed from the HRV. The existing percent of the moist upland forest potential vegetation group in the SI, SE, and OFSS structural stages is currently below the HRV. The existing percent of the moist upland forest potential vegetation group in the UR and OFMS structural stages is currently above the HRV.

Within the Umatilla moist upland forest potential vegetation group, the existing percent of the landscape in all of the structural stages is departed from the HRV. The existing percent of the moist upland forest potential vegetation group in the SI and SE structural stages is currently below the HRV. However, portions of the Umatilla National Forest contains some individual watersheds that are currently above the HRV in the SI structural stage due to recent large-scale, high severity fires. The existing percent of the moist upland forest potential vegetation group in the UR, OFSS, and OFMS structural stages is currently above the HRV.

Within the Wallowa-Whitman moist upland forest potential vegetation group, the existing percent of the landscape in all of the structural stages is departed from the HRV. The existing percent of the moist upland forest potential vegetation group in the SI, SE, and OFSS structural stages is currently below the HRV, while the UR and OFMS structural stages are above the HRV.

Figure 18 displays the amount of departure from the HRV within the dry upland forest potential vegetation group by comparing the existing and historical forested structural stages within each national forest. In general, existing conditions within the dry upland forest potential vegetation group tend to exhibit the greatest amount of departure from the HRV. The historical fire regime in the dry upland forest potential vegetation group was characterized by low severity, surface fires that occurred at a frequency of less than 25 years. After over a century of fire suppression, the dry upland forest potential vegetation group has missed perhaps five to seven fires, which has had substantial effects on existing forest structures and resulted in more highly departed landscapes.

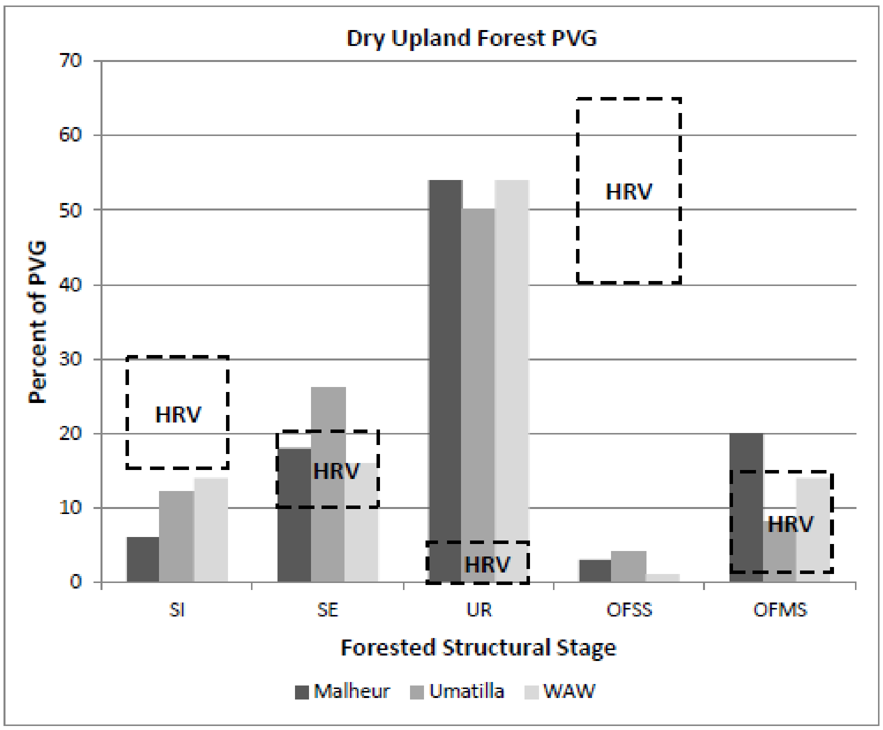

Figure 18. Existing forested structural stages (percent of potential vegetation group or PVG) and the HRV/desired conditions by national forest within the dry upland forest potential vegetation group

Within the Malheur dry upland forest potential vegetation group, the existing percent of the landscape in the SE structural stage is currently within the HRV. The existing percent of the dry upland forest potential vegetation group in the SI and OFSS structural stages are currently below the HRV, while the percent of the dry upland forest potential vegetation group in the UR and OFMS structural stages are currently above the HRV.

Within the Umatilla dry upland forest potential vegetation group, the existing percent of the landscape in the OFMS structural stage is currently within the HRV. The existing percent of the dry upland forest potential vegetation group in the SI and OFSS structural stages is currently below the HRV, while the percent of the dry upland forest potential vegetation group in the SE and UR structural stages is currently above the HRV.

Within the Wallowa-Whitman dry upland forest potential vegetation group, the existing percent of the landscape in the SE and OFMS structural stages are currently within the HRV. The existing percent of the dry upland forest potential vegetation group in the SI and OFSS structural stages are currently below the HRV, while the percent of the dry upland forest potential vegetation group in the UR structural stage is above the HRV.

Forested Species Composition

Shade tolerance is a relative measure of a species' ability to grow and regenerate in the shade, in comparison to other tree species. In general, tree species that are more shade intolerant are also more fire tolerant, making them better adapted to low and mixed-severity fire. These species tend to have thicker bark, which insulates the cambium from heat and results in decreased fire-related mortality. Shade intolerant tree species also self-prune their lower branches, which increases their crown base height, increases the wind speed required to initiate crown fire, decreases the likelihood of a ground fire transitioning to a crown fire, and decreases fire severity. Shade intolerant tree species such as ponderosa pine also tend to be more drought tolerant. Species that better withstand drought and moisture stress are also less susceptible to attack by bark beetles because of natural defense mechanisms, such as the production of pitch. Tree species that are more shade intolerant include ponderosa pine, western larch, western white pine, and whitebark pine. Tree species that are relatively shade tolerant include Engelmann spruce, subalpine fir, and grand fir. Douglas-fir is intermediate along the shade tolerance ranking continuum. Because shade tolerance is a relative ranking, Douglas-fir may be included in either a shade tolerant or a mixed tolerance class, depending on the other tree species used in comparison.

The analysis of species composition for forested vegetation was conducted using the current vegetation survey (CVS) points. Each of the CVS points was classified into a species composition class of shade intolerant, mixed tolerance, and shade tolerant. The species composition was determined by the dominant tree species based on basal area (see analysis file for a complete definition of species composition classes). In the dry upland forest potential vegetation group, the shade intolerant species class may be dominated by ponderosa pine or western larch, while the shade tolerant species class may be dominated by grand fir or Douglas-fir. In the moist upland forest potential vegetation group, the shade intolerant species class may be dominated by western larch, western white pine, or lodgepole pine, while the shade tolerant species class may be dominated by Englemann spruce, grand fir, or subalpine fir. In the moist upland forest potential vegetation group, the mixed tolerance species class may be dominated by Douglas-fir. In the cold upland forest potential vegetation group, the shade intolerant species class may be dominated by whitebark pine, lodgepole pine, western white pine, or western larch, while the shade tolerant species class may be dominated by subalpine fir or Englemann spruce. In the cold upland forest potential vegetation group, the mixed tolerance species class may be dominated by Douglas-fir.

Table 234 displays the existing species composition as a percent of each upland forest potential vegetation group by national forest. Table 235 displays the VDDT modeling results of the HRV for species composition by upland forest potential vegetation group within the Blue Mountains. A comparison of these two tables shows a change in species composition over time due to over a century of fire exclusion and suppression. Historically, the dry upland forest potential vegetation group was dominated by shade intolerant species, such as ponderosa pine and western larch, with approximately 75 to 90 percent of this forest type consisting of shade intolerant species. When current conditions are compared to the HRV within the dry upland forest potential vegetation group, shade intolerant species have been reduced from an estimated 75 to 90 percent historically (table 235) to current estimates of approximately 45 to 76 percent across the three national forests (table 234). Shade tolerant species have increased from an estimated 5 to 20 percent historically to current estimates of approximately 24 to 55 percent across the three national forests.

Table 234. Existing species composition as a percent of each upland forest potential vegetation group (PVG) by national forest

Upland Forest PVG/Species Composition	Malheur	Umatilla	Wallowa-Whitman
Cold/shade intolerant	63	70	38
Cold/mixed tolerance	31	10	24
Cold/shade tolerant	7	20	38
Dry/shade intolerant	76	45	45
Dry/shade tolerant	24	55	55
Moist/shade intolerant	21	15	27
Moist/mixed tolerance	6	21	27
Moist/shade tolerant	73	65	46

Table 235. The percentage range of HRV/desired conditions for species composition by upland forest potential vegetation group within the Blue Mountains

Potential Vegetation Group	Shade-intolerant Species Composition	Mixed-tolerance Species Composition	Shade-tolerant Species Composition
Dry Upland Forest	75-90	NA	5-20
Moist Upland Forest	30-60	20-40	10-30
Cold Upland Forest	40-60	5-20	25-50

Species compositions in the dry upland forest potential vegetation group exhibit a greater amount of departure from historical conditions due to a greater number of missed fires. In low severity fire regimes, grand fir was historically maintained at relatively low numbers because of its thin bark and decreased fire tolerance (Van Pelt 2008). Due to fire exclusion and suppression, shade tolerant species have increased in abundance, resulting in decreased wind speeds required to initiate and sustain a crown fire, altered fire behavior, a landscape that is less resilient to fire, and a landscape more prone to larger scale fire events than what would have occurred historically. Altered species compositions also result in increased moisture stress, increased susceptibility to insects and disease, and decreased forest health. Although species composition within the moist upland forest potential vegetation group exhibits departure from the HRV, the amount of departure is less than the dry upland forest potential vegetation group because the historical fire regimes were characterized by a longer fire return interval. Therefore, more than a century of fire exclusion and suppression has resulted in a fewer number of missed fires, in comparison to the more frequent fire regime in the dry upland forest potential vegetation group.

Aspen

Aspen populations within the Blue Mountains currently exist as small, scattered, remnant stands of rapidly declining trees. Although aspen is widespread, it is an uncommon species in the Blue

Mountains (Swanson et al. 2010). According to Swanson et al. (2010), detailed inventories performed in some ranger districts have located hundreds of aspen stands broadly distributed within the Blue Mountains. Although these aspen stands are numerous, they are invariably small. An inventory of approximately 25 percent of the 1.7-million-ac Malheur National Forest has revealed 1,327 stands, with a median stand area of less than 1 acre. Only 5 percent of the stands are greater than 10 acres. Within the Umatilla National Forest, an inventory of 514 stands also shows a median area of less than 1 acre and only 1 percent of the stands larger than 10 acres. The total basal area of aspen is also quite low (Swanson et al. 2010).

Within the Blue Mountains, aspen stands have declined over the past century due to fire suppression and browsing pressure from large ungulates (Shirley and Erickson 2001). Fire suppression results in succession of aspen to conifer species or grass/shrubland. Although succession is a natural event, the alteration of fire regimes and a lack of successful aspen recruitment have promoted a more consistent landscape level succession to conifers or grass/shrubland. In most aspen stands, regeneration has been suppressed to some degree by both fire suppression and browsing. A decline in the area occupied by aspen can be inferred from observations of dead aspen representing former groves with no survivors, the predominance of clones where many individuals are decadent or dead, and the rarity of unbrowsed aspen suckers or young age cohorts (Swanson et al. 2010). Although little is known about the historic distribution of aspen in Oregon, it is believed that stands were once larger and more widely distributed (Shirley and Erickson 2001). However, historical photography (Skovlin and Thomas 1992) and early accounts (Bright 1994) indicate that aspen forests were never as widespread in the Blue Mountains as in other parts of the West.

Aspen communities are a critical element within forested ecosystems, representing one of the most biologically diverse and ecologically-unique sites, and serve as an indicator of ecological integrity (Di Orio et al. 2005). Mortality of mature aspen coupled with fire exclusion and continued browsing pressure by large ungulates is expected to result in continued vegetation changes, with eventual type conversion from aspen to conifers or grassland within the next 80 to 200 years across its range (Strand et al. 2009). Loss of aspen clones at a landscape scale results in decreased biological diversity, with aspen decline cascading into losses of vertebrate species, understory vascular plants, and likely species from a myriad of other organismal groups (Strand et al. 2009).

Whitebark Pine

Whitebark pine has a limited distribution within the Blue Mountains and is strongly associated with higher elevation areas within the cold forest potential vegetation group and within wilderness areas. The Wallowa-Whitman National Forest contains the largest acreage of whitebark pine, with an estimated 49,000 acres. The Malheur National Forest contains an estimated 7,000 acres of whitebark pine. The Umatilla National Forest contains an estimated 1,000 acres of whitebark pine. Whitebark pine was encountered during the installation of the CVS plots and was found on approximately 140 of the 10,000 plots. Locations include the Eagle Cap Wilderness, the Elkhorn Mountains, areas near the Strawberry Wilderness, and Hells Canyon (Seven Devils Mountains).

The four major threats to whitebark pine populations within the Blue Mountains are white pine blister rust (*Cronartium ribicola*), mountain pine beetle (*Dendroctonus ponderosae*), fire, and climate change (Aubry et al. 2008). Monitoring transects within the Blue Mountains analysis area exhibit white pine blister rust infection within the majority of checked sites, with higher levels of infection in the Elkhorn Mountains, compared to the Wallowa Mountains. Increased levels of whitebark pine mortality have altered high-elevation community composition and ecosystem processes (Keane et al. 2012).

Whitebark pine is now a candidate species for listing under the Endangered Species Act. Whitebark pine is an important component of western high-elevation forests. Large, nutritious seeds produced by whitebark pine are an important food for many bird and small mammal species, as well as grizzly (*Ursus arctos horribilis*) and black bears (*Ursus americanus*). Whitebark pine communities provide habitat for many additional wildlife species. Whitebark pine seed dispersal by Clark's nutcrackers (*Nucifraga columbiana*) combined with hardy seedlings results in early whitebark pine community development after fire and other disturbances. Whitebark pine seedlings survive on harsh, arid sites and may act as nurse trees to less hardy conifers and vegetation. At high elevations where it is common, it helps regulate snow melt and reduce soil erosion. For these collective functions, whitebark pine is considered both a keystone species for promoting community diversity and a foundation species for promoting community stability (Keane et al. 2012).

The Pacific Northwest Region has currently developed a whitebark pine restoration strategy that contains a comprehensive 5-year restoration plan (Aubry 2008). This plan includes several possible management strategies, such as collecting whitebark pine seed, planting seed or seedlings, thinning competing trees, pruning tree limbs infected with blister rust, increasing genetic resistance to blister rust, evaluating areas where health, stand conditions, and restoration needs are unknown, and working collaboratively to increase understanding of impacts affecting whitebark pine communities.

Forested Stand Density

Stand density, as used in this analysis, refers to a measure of the amount of tree vegetation of a unit of land area (Curtis 1970, Ernst and Knapp 1985, and Powell 1999). Canopy cover was used as the stand density measure in the current analysis. Canopy cover refers to the proportion of the forest floor covered by the vertical projection of tree crowns (Jennings et al. 1999). Within the dry upland forest potential vegetation group, closed canopy stands were defined as those having 40 percent canopy cover or greater. Within the moist and cold upland forest potential vegetation group, closed canopy stands were defined as having 60 percent canopy cover or greater. The canopy cover values in the VDDT model are a generalization, and the actual boundaries between open and closed canopy are based on site potential for each plant association (more information is available from the project record).

Table 236 displays existing forested stand densities as a percent of each upland forest potential vegetation group by national forest. Table 237 displays the VDDT modeling results of the HRV for density classes within the Blue Mountains. Across the three national forests, approximately 44 to 88 percent of the cold upland forest potential vegetation group currently contains open stand densities (table 236), compared to an estimated 20 to 30 percent historically (table 237). Approximately 12 to 56 percent of the cold upland forest potential vegetation group currently contains closed stand densities, compared to 65 to 80 percent historically.

Table 236. Existing stand densities as a percent of each upland forest potential vegetation group (PVG) by national forest

Upland Forest PVG/Stand Density	Malheur	Umatilla	Wallowa-Whitman
Cold/open	88	44	62
Cold/closed	12	56	38
Dry/open	60	30	32
Dry/closed	40	70	67
Moist/open	58	55	41
Moist/closed	42	45	59

Table 237. The HRV/desired conditions for stand density (percent of landscape) by upland forest potential vegetation group (PVG)

Potential Vegetation Group	Open Stand Density	Closed Stand Density
Dry upland forest*	80-90	5-20
Moist upland forest **	30-40	60-80
Cold upland forest **	20-30	65-80

* Dry UF forest closed is 40 percent canopy cover or greater.

** Cold and moist upland forest closed is 60 percent canopy cover or greater.

Historically, an estimated 80 to 90 percent of the dry upland forest potential vegetation group was characterized by a generally open forest structure. The historical fire regime created and maintained this open forest structure, with a mosaic pattern of tree clumps dominated by larger diameter, old ponderosa pines, scattered individual trees, and grassy openings. This spatial heterogeneity is a key structural element of the historical dry upland forest. The pattern of tree clumps, separated by openings, affected the way fire moved across the landscape by providing breaks in the canopy to limit the spread of crown fire. It also limited the spread of diseases such as dwarf mistletoe. Due to over a century of fire exclusion and suppression, stand densities in the dry upland forest potential vegetation group have increased from historical levels. Within the three national forests, approximately 30 to 60 percent of the dry upland forest potential vegetation group contains open stand densities, compared to an estimated 80 to 90 percent historically. Approximately 40 to 70 percent of the dry upland forest potential vegetation group currently contains closed stand densities, compared to an estimated 5 to 20 percent historically. This increase in stand densities within the dry upland forest potential vegetation group has resulted in decreased tree health, growth, and vigor, decreased sunlight to the forest floor, decreased regeneration of shade intolerant/fire tolerant tree species, increased regeneration of shade tolerant/fire intolerant tree species, decreased understory productivity and diversity, increased crown continuity across the landscape, increased spread of diseases such as dwarf mistletoe, increased risk of insect attack and mortality, an increased incidence of uncharacteristically severe wildfire, and a less ecologically resilient and less sustainable forest structure.

Within the three national forests, approximately 41 to 58 percent of the moist upland forest potential vegetation group contains open stand densities, compared to an estimated 30 to 40 percent historically. Approximately 42 to 59 percent of the moist upland forest potential vegetation group contains closed stand densities, compared to 60 to 80 percent historically.

Wildland Fire Regime

A fire regime is a generalized description of the role fire plays in the ecosystem (Agee 1993). It includes the characteristics of frequency, severity, and seasonality of fire. The historical fire regime is described according to fire severities that occurred before significant European influence began in approximately 1850 (Jaindl et al. 1993) and includes fires ignited by Native Americans. Fire regimes, especially fire frequency and intensity characteristics, strongly influence which species will prevail in the vegetation complex of a given area. Fire has been a significant process within the plan area historically and is essential to proper ecosystem function. Land managers can mimic many of the effects of fire using management actions (timber harvest, prescribed fire, managing wildfire), but not always at the same scale or frequency as in historical disturbance regimes. Land managers have the ability to choose, to some extent, what relationship with fire is desirable (Agee and Maruoka 1994).

Barrett et al. (2010) recognize five historical fire regimes (I – V). These five regimes include:

I – 0 to 35 year frequency and low (surface fires most common) to mixed severity (less than 75 percent of the dominant overstory vegetation replaced);

II – 0 to 35 year frequency and high (stand replacement) severity (greater than 75 percent of the dominant overstory vegetation replaced);

III – 35 to 100+ year frequency and mixed severity (less than 75 percent of the dominant overstory vegetation replaced);

IV – 35 to 100+ year frequency and high (stand replacement) severity (greater than 75 percent of the dominant overstory vegetation replaced);

V – 200+ year frequency and high (stand replacement) severity.

Table 238 displays desired fire regimes for the major vegetation types within the plan area and ranges of how often and to what degree fires historically affected the area. Historical fire regime refers to the combination of fire frequencies and severities under which plant communities evolved and were maintained (Schmidt et al. 2002; Hardy et al. 2001). Frequency is expressed as a range of time between fire events. Effects on the dominant vegetation are expressed as fire severity and amount of high severity fire.

Historical fire regimes I to IV were common and integral components of forested ecosystems in the Blue Mountains. Fire regime V (200+ year fire frequency) was relatively rare in this area (Heyerdahl and Agee 1996; Powell 2011).

Noteworthy fire history research has been accomplished within the last 25 years in the Blue Mountains (Hall 1977, Crane and Fischer 1986, Agee and Maruoka 1994, Maruoka 1994, Heyerdahl and Agee 1996, Heyerdahl 1997, and Olson 2000). These studies have aided local efforts to establish historical fire return intervals. Fire size and patch size created within the perimeter of a historical fire have been the least studied element of fire history. Heyerdahl and Agee (1996) were able to identify fire perimeters in the Upper Imnaha drainage that ranged from 117 to 3,086 acres, and averaged 818 acres.

Table 238. Severity and frequency of fire (desired condition)

Potential Vegetation Group	Fire Regime	Fire Frequency (Years)	High Severity Fire (percent of acres burned)
Cold upland forest	IV	100-200	40-80%
Moist upland forest	III	30-150	20-40%
Dry upland forest	I	5-10	5-15%
Dry upland woodland	III	80-160	25-45%
Cold upland shrubland	III - IV	30-60	30-100%
Moist upland shrubland	II - III	10-40	30-100%
Dry upland shrubland	II	20-40	20-80%
Cold upland herbland	IV	30-80	55-100%
Moist upland herbland	II	20-40	20-80%
Dry upland herbland	II	5-20	40-80%
Cool/cold riparian forest	III - IV	100-200	40-90%

The results of this analysis are similar to those previously identified in broad-scale analyses that included the Blue Mountains (e.g. Quigley et al. 1996, Quigley and Arbelbide 1997, and MacDonald et al. 2005). Available data describe the Blue Mountains as having evolved with frequent, low and mixed severity fire. Approximately 88 percent of the Blue Mountains are classified as historical fire Regime I, II, or III, which are short to mixed return interval ecosystems (see table 239). Sixty percent of the Blue Mountains are classified Fire Regime I, which are sites historically dominated by low to mixed severity frequent fires. Historically, approximately 5 to 15 percent of the acres burned within the dry upland forest potential vegetation group were high severity fire. Based on modeling of forest inventory data using the FVS fire and fuels extension (Reinhardt and Crookston 2003), approximately 40 to 60 percent of the acres burned within the dry upland forest potential vegetation group now have the potential for high severity fire. Increased fire severity in the dry upland forest potential vegetation group is due to the abundance of multi-storied stands with high stand densities. An increased potential for high severity fire in the dry upland forest potential vegetation group threatens the attainment of desired conditions for vegetation structure and economic outputs. The potential for high severity fire in the moist and cold upland forest potential vegetation groups (Fire Regimes III and IV) is currently close to what is estimated for historical levels (Countryman 2008).

Table 239. Percent of each national forest area in each fire regime

Fire Regime	MAL	UMA	WAW
I	60	55	53
II	23	3	5
III	15	28	25
IV	2	14	17
V	0	0	0

Wildland Fire Return Interval

The fire return interval is defined as the period of time between fires within a potential vegetation group in a specific area. For example, if a specific area consists of 10,000 acres and has a fire return interval of 100 years, then it would take approximately 100 years for a total of 10,000 acres within the area to burn. It does not mean that every acre within the area would have a fire every 100 years. Because of the variability of fire processes, a specific site within the area could have a fire every 20 years, while other sites might not have fire reoccur for periods of greater than 100 years. The fire return interval is a generalized indicator of how much fire is on the landscape. Higher numbers (longer fire return intervals) would mean that there is a greater period of time between fires, less area would burn, and there is less fire within the landscape. This is based on the total accumulation of fire within a specific area for a period of time.

Table 240 displays the current fire return intervals by potential vegetation group for each national forest, in comparison to reference conditions. The current fire return interval and the departure from reference conditions (LANDFIRE values) (The Nature Conservancy 2005) were calculated using the Blue Mountains GIS layer for wildfires and prescribed fire since 1980. The return interval was calculated by dividing the analysis area size by the average acres burned per year for each potential vegetation group (see table 240).

Table 240. Current fire return intervals (in years, since 1980) for each national forest, in comparison to reference conditions, by potential vegetation group

Potential Vegetation Group	MAL	UMA	WAW	Blue Mountains National Forests	LANDFIRE Reference (years)	Blue Mountains Forest Plan Revision Reference (years)*
Cold upland forest	38	158	141	126	113	100-200
Whitebark pine forest	45	-	301	182	63	30-120
Moist upland forest	186	665	332	338	71	30-150
Dry upland forest	236-445	159-294	83-214	144-242	7-50	5-25
Juniper woodland	265	1,667	161	250	48	80-160
Dry herbland	70	364	42	61	8	5-20
Dry shrubland	169	1,175	71	125	74	75-125
Cold shrubland	56	608	781	310	20	30-60
Cold herbland	115	-	175	180	239	30-80
Moist herbland	86	329	52	60	30	20-40
Moist shrubland	52	223	841	149	20	10-40

*The reference values were derived from version 2.1 of the LANDFIRE reference condition modeling manual (The Nature Conservancy, 2005) and associated reference condition summary tables. Reference values were also based on work by Crane and Fischer (1986), Agee (1993 and 2003), Maruoka (1994), Heyerdahl and Agee (1996), Olson (2000), and Catherine Macdonald (2005).

Fire return intervals within most of the potential vegetation groups currently exceed reference condition ranges due to fire exclusion and suppression. This is especially evident in the dry upland forest potential vegetation group. Currently, the fire return interval in the dry upland forest potential vegetation group ranges from 144 to 242 years at the scale of the Blue Mountains. Historically, the dry upland forest potential vegetation group was characterized by predominantly frequent, low severity surface fires occurring every 5 to 25 years. While larger-diameter, old ponderosa pine and Douglas-fir typically survived these low severity fires, younger, smaller-diameter trees and less fire-tolerant species were killed. The historical fire regime created and maintained a generally open forest structure, with a small-scale mosaic pattern of clumps or patches of trees dominated by large diameter, old ponderosa pines, scattered individual trees, and openings that contained an abundance of native grasses and shrubs (Churchill et al. 2013, Larson and Churchill 2012, and Franklin et al. 2008). This spatial heterogeneity is a key structural element of the historical dry upland forest (Franklin et al. 2008). Crown fires may have occurred historically in mid- to late-seral closed canopy structural stages. However, these events were limited in extent due to the predominance of open canopy forest (Barrett et al. 2010). The frequent fires in the dry upland forest potential vegetation group also contributed to relatively low fuel loadings. Due to over a century of fire exclusion and suppression, the dry upland forest potential vegetation group in general has experienced a greater number of missed fires. As a result, the dry upland forest potential vegetation group has experienced the greatest amount of departure from the HRV.

The current fire return interval is closer to the historical reference condition range in the cold upland forest potential vegetation group. The cold upland forest potential vegetation group was characterized by stand-replacing fire events that occurred very infrequently, generally greater than 100 year return intervals. Due to a fewer number of missed fires, the cold upland forest potential vegetation group tends to be less departed from the HRV.

Within the moist upland forest potential vegetation group, the current fire return interval is approximately 338 years at the scale of the Blue Mountains. Historically, the moist upland forest potential vegetation group was characterized by mixed-severity fires occurring every 30 to 150 years. Mixed-severity fires alternated between stand-replacing crown fires, which killed all trees, to nonlethal, low-intensity surface fires that left patches of living trees. According to Perry et al. (2011), mixed-severity fires created a patchiness of forest structure, composition, and seral status that could be observed and quantified at an intermediate or meso-scale, with patch sizes ranging from a few hundredths up to tens or hundreds of a hectare, depending on locale and climatic drivers. In forest types that were historically dominated by mixed-severity fire regimes, surface and canopy fuels, topography, climatic conditions, and ignitions worked in concert to influence variation in fire frequency, severity, spatial extent, and seasonality. The result was a complex spatial-temporal mix of low, moderate, and high severity patches. Due to patterns of burning, this type of historical fire regime created a complex mosaic pattern across the landscape, resulting in high levels of diversity in both plants and animals (Perry et al. 2011). Due to over a century of fire exclusion and suppression, the moist upland forest potential vegetation group in general has experienced a fewer number of missed fires than the dry upland forest potential vegetation group but a greater number than the cold upland forest potential vegetation group. As a result, the moist upland forest potential vegetation group tends to exhibit a relatively moderate amount of departure from the HRV.

In most cases, fire has become more frequent since 1980 than in the last 100 year time period. Some of this is possibly due to variations in the climate and some is due to the buildup in fuels and multi-storied, dense stands. The result of having the current, less frequent fire return interval in the dry vegetation types is that vegetation and fuel loading can build up and lead to more severe and larger fires than historical levels. At some point, this can reduce resiliency.

Table 241 displays the frequency and severity of fire for each national forest. These figures are based on the number of acres burned per year, with each year then categorized as normal, high, or severe.

Since 1980, approximately 22 percent of the years experienced high severity wildfires that burned between 2,500 to 50,000 acres per year. Approximately 11 percent of the years experienced severe wildfires that burned 50,000 acres or more per year. Approximately 67 percent of the years experienced normal severity wildfires that burned less than 2,500 acres per year. Since 1980, the average number of acres burned in wildfires per year in the Blue Mountains was approximately 22,000 acres. According to fire managers, the time period from 1980 to 2005 better represents potential fire behavior for future fires, compared to data since 1960, due to the build-up of fuels and recent climate change patterns. The data indicates that the amount of fire has increased since 1980, which has decreased fire return intervals. However, current fire return intervals continue to exceed the historical range of variability for natural fire return intervals associated with the different potential vegetation groups. The frequency of years with acres of fuel loading that would contribute to a severe fire has increased since 1980. Much of the fire that has occurred recently in the warm-dry systems has been high severity fire, as opposed to the low severity and some mixed severity fires that historically dominated these areas.

Table 241. Frequency of normal, high, and severe fire years for each national forest*

Fire Year Type	Last 45 Years			Last 25 Years			
	MAL	UMA	WAW	MAL	UMA	WAW	Blue Mts.
Normal	89	78	67	81	65	54	67
High	9	20	18	15	31	19	22
Severe	2	2	15	4	4	27	11

* Percent of years where fire acres burned was normal, high, or severe.

**Normal is less than or equal to 2,500 acres burned per year; high is 2,500 to 50,000 acres per year; severe is 50,000 acres or more per year.

Wildland Fire Severity

Fire severity, as discussed in this section, is a measure of the potential effects of fire on vegetation:

- **Low severity fire:** less than 25 percent mortality in the overstory vegetation.
- **Mixed severity fire:** 25 to 75 percent mortality in the overstory vegetation.
- **High severity fire:** greater than 75 percent mortality in the overstory vegetation.

Current vegetation survey (CVS) inventory plot data for the Blue Mountains plan area was used to estimate potential mortality from fire. The summary of CVS data for percent high severity fire at the scale of each national forest is summarized in table 242. Values were obtained using the FVS fire and fuels extension.

Table 242 displays the potential for high severity fire effects by potential vegetation group and national forest. Fire severity data indicate that under severe fire weather conditions (90th percentile), much of the analysis area has the potential for high severity fire effects. The moist upland forest potential vegetation group exhibits the least amount of departure from reference conditions. Currently, approximately 32 to 40 percent of the moist upland forest potential vegetation group in the three national forests has the potential for high severity fire, compared to a reference value of 35 percent. Approximately 52 to 55 percent of the cold upland forest potential vegetation group in the three national forests has the potential for high severity fire, compared to a reference value of 84 percent. Even though the cold and moist upland forest potential vegetation groups show the potential for a moderate to high amount of high severity fire, this amount of fire is consistent with the mixed to infrequent high severity fire regimes that historically dominated these systems. Approximately 50 to 55 percent of the dry upland forest potential vegetation group has the potential for high severity fire, compared to a reference condition of 10 percent. This increased potential for high severity fire in the dry upland forest potential vegetation group results in a less resilient ecosystem. High potential for high severity fire can be attributed to stands that have canopy cover greater than the desired conditions, an abundance of small diameter understory trees that act as ladder fuels and carry wildfire from the ground into the overstory tree crowns, or a level of down woody material that exceeds the desired condition.

Table 242. Potential percent high severity fire by potential vegetation group* for each national forest

Potential Vegetation Group	LANDFIRE Reference Value (high severity fire)	MAL	UMA	WAW
Cold upland forest	84%	55%	52%	55%
Moist upland forest	35%	38%	40%	32%
Dry upland forest	10%	50%	55%	50%
Juniper woodland	37%	89%	100%	94%

* Value: percent of the potential vegetation group that has the potential (based on CVS data) for greater than 75 percent basal area loss in the event of a fire at 90th percentile conditions. Greater than 75 percent basal area mortality is defined as a high severity fire.

Fire Regime Condition Class

In 2003, fire regime condition class assessments were made nationally to assess vegetation conditions and the amount of departure from historical conditions (Hann et al. 2003). The fire regime condition class tool allows natural resource managers to compare historical natural vegetation, their associated disturbance regimes, and current vegetation succession class to inventory the amount of departure from historical conditions. Succession class is defined as a seral stage classification based on descriptions of structure and composition, disturbance processes, and pattern (Barrett et al. 2010). There are three condition classes for each fire regime and each classification is based on a relative amount of departure from the historical natural fire regime (Hann et al. 2003; see table 243). The departure score can be thought of as being a product of two major elements: the condition of vegetation succession class and fire frequency/severity. The existing departure of fire severity is described as a part of the affected environment, but is not described for each alternative as a quantitative part of condition class. In most cases, the departure of fire frequency overwhelms the departure of vegetation, making interpretation of changes in vegetation structure difficult. For the current analysis, the fire regime condition class modeling focuses on vegetation so that the effects of proposed management on vegetation attributes, such as structure, density, and species composition, can be displayed more easily and clearly.

Table 243. Description of fire regime condition classes

Fire Regime Condition Class	Description	Risk
Condition Class 1	Within the natural (historical) range of variability of vegetation characteristics, fuel composition, fire frequency, severity and pattern, and other associated disturbances. **Departure score is less than 33 percent.**	• Fire behavior, effects, and other associated disturbances are similar to those that occurred prior to fire exclusion (suppression) and other types of management that do not mimic the natural fire regime and associated vegetation and fuel characteristics. • Composition and structure of vegetation and fuels are similar to the structure that existed under the natural (historical) fire regime. • Risk of loss of key ecosystem components (e.g., native species, large trees, and soil) is low.
Condition Class 2	Moderate departure from the natural (historical) range of variability of vegetation characteristics, fuel composition, fire frequency, severity and pattern, and other associated disturbances. **Departure score is between 33 and 66 percent.**	• Fire behavior, effects, and other associated disturbances are moderately departed from HRV (more or less severe). • Composition and structure of vegetation and fuel are moderately altered. • Uncharacteristic conditions range from low to moderate. • Risk of loss of key ecosystem components is moderate.
Condition Class 3	High departure from the natural (historical) range of variability of vegetation characteristics, fuel composition, fire frequency, severity and pattern, and other associated disturbances. **Departure score is greater than 66 percent.**	• Fire behavior, effects, and other associated disturbances are highly departed from HRV (more or less severe). • Composition and structure of vegetation and fuel are highly altered. • Uncharacteristic conditions range from moderate to high. • Risk of loss of key ecosystem components is high.

Fire Regime Condition Class Estimates

The existing fire regime condition class succession class by potential vegetation group for each national forest was compared to the historical reference condition and is displayed in table 244. The difference (ecological similarity index) between those two values was then summarized into a condition class departure score based on the range of values in table 243. The results of condition class modeling by alternative are discussed in the effects section.

Table 245 displays the forestwide departure scores of the existing succession class versus the historical/reference succession class distribution. The higher the number, the greater the potential vegetation group or forest vegetation-fuel condition has departed from the HRV. Much of the landscape is currently moderately departed from historical conditions for vegetation-fuel conditions. This indicates a landscape that is currently less ecologically resilient than what occurred historically.

Table 244. Existing fire regime condition class succession class distribution for each national forest and the historical succession class for the Blue Mountains

Potential Vegetation Group	Succession Class Distribution (average)*				
	A	B	C	D	E
Malheur (existing condition)					
Cold UF	24%	8%	47%	17%	4%
Moist UF	1%	19%	28%	29%	23%
Dry UF	6%	22%	49%	5%	18%
Umatilla (existing condition)					
Cold UF	30%	24%	15%	9%	22%
Moist UF	9%	17%	20%	27%	28%
Dry UF	12%	56%	19%	2%	10%
Wallowa-Whitman (existing condition)					
Cold UF	15%	23%	27%	21%	14%
Moist UF	12%	41%	21%	8%	18%
Dry UF	14%	55%	17%	2%	12%
Blue Mountains national forests combined historical reference condition					
Cold UF	32%	33%	8%	3%	26%
Moist UF	25%	26%	15%	6%	28%
Dry UF	21%	4%	14%	53%	9%

*See definition for succession class (see page 93).

Table 245. Existing condition fire regime condition class vegetation departure score (zero-100) for each national forest

Potential Vegetation Group	MAL	UMA	WAW
Cold upland forest	54	13	37
Dry upland forest	62	60	56
Moist upland forest	36	23	23

The dry upland forest potential vegetation group consistently exhibits vegetation departure scores at the high end of fire regime condition class 2 with all three national forests, ranging from approximately 56 to 62. As table 243 displays, the departure for fire regime condition class 2 is between 33 and 66 percent. These fire regime condition class departure scores indicate that vegetation conditions are nearing a highly departed state, in comparison to the HRV, and are less ecologically resilient in the dry upland forest potential vegetation group. Based on available data, the amount of departure within the dry upland forest potential vegetation group is typically caused by an overabundance of shade tolerant tree species, overabundance of closed canopy conditions, overabundance of multi-storied stands, an overabundance of stands classified as fire regime condition class mid seral (understory reinitiation and stem exclusion) closed canopy, and a deficit of stands in the late seral fire regime condition class open condition (OFSS).

Within the moist upland forest potential vegetation group, fire regime condition class vegetation departure scores vary by national forest. Within the Umatilla and Wallowa-Whitman National Forests, vegetation departure scores are in fire regime condition class 1 (approximately 23) and within the HRV. These scores indicate that the composition and structure of vegetation and fuels are similar to the characteristics exhibited under the natural (historical) fire regime and are more ecologically resilient in the moist upland forest potential vegetation group. However, within the Malheur National Forest, vegetation departure scores are in fire regime condition class 2 (approximately 36), which is within the lower range of moderate departure. This score indicates that the composition and structure of vegetation and fuels are becoming more departed from the characteristics exhibited under the natural (historical) fire regime and are becoming less ecologically resilient in the moist upland forest potential vegetation group within the Malheur National Forest.

Within the cold upland forest potential vegetation group, fire regime condition class vegetation departure scores also vary by national forest. Within the Umatilla National Forests, vegetation departure scores are in fire regime condition class 1 (approximately 13) and within the HRV. These scores indicate that the composition and structure of vegetation and fuels are similar to the characteristics exhibited under the natural (historical) fire regime and are more ecologically resilient. However, within the Wallowa-Whitman and Malheur National Forests, vegetation departure scores are in fire regime condition class 2 (approximately 37 and 54, respectively), which is within the range of moderate departure. These scores indicate that the composition and structure of vegetation and fuels are more departed from the characteristics exhibited under the natural (historical) fire regime and are less ecologically resilient.

The trend and existing conditions of vegetation in the Blue Mountains is similar to those described by Quigley (1996) and Macdonald et al. (2005). Data show that the Blue Mountains are dominated by ecosystems that evolved with frequent, low and mixed severity fire. Approximately 88 percent of the Blue Mountains are classified as historical Fire Regime 1, 2, or 3, which are the short to mixed return interval systems. Much of this landscape is currently moderately to highly departed from historical/reference conditions for vegetation and fuel conditions. The total percent of fire regime condition class 2 and 3 (moderate to high departure) ranges from 28 percent in the moist upland forest potential vegetation group to 100 percent in the dry upland forest potential vegetation group. Most of the condition class 1 (low departure) occur in the cold or moist upland forest types. The dry upland forest potential vegetation group exhibits the greatest departure from historical/reference conditions. The departure is caused by an abundance of stands classified as mid seral (understory reinitiation and stem exclusion) closed canopy and a deficit of stands in the late seral (old forest) open condition.

Insects and Disease

Beginning in the early 1900s, forest insects and diseases were traditionally considered pests in that control was aimed at reducing their effects on their hosts or at reducing their numbers to as low as possible (Scott and Schmitt 1996). This philosophy is still applied to nonnative insects and diseases, such as the balsam wooly adelgid and white pine blister rust (*Cronartium ribicola*), which were inadvertently introduced into the United States from other continents. In some situations, native insect populations can rapidly build in response to a major forest disturbance and threaten the loss of a resource or place other non-timber resources at high risk to damage or loss, thus prompting action to suppress these populations before they reach damaging levels.

Ecosystem management often strives to maintain an endemic level of insects and disease consistent with historical levels of activity within the natural range of variability for those plant communities. Insects and diseases play a natural role in the ecosystem. They create snags and down logs. Trees with decay and witches' brooms provide habitat for a variety of forest-dwelling flora and fauna including microbes, fungi, invertebrates, small animals, and cavity-nesting birds. The levels of these ecosystem components contributed by insects and diseases may sometimes far exceed the levels that would constitute a healthy ecosystem. During the past several decades, it has become increasingly more common for levels of insect and disease -created habitats to exceed presettlement conditions (Scott and Schmitt 1996). According to Campbell (1996), several broad scale trends have been observed in the Blue Mountains.

- Outbreaks of defoliating insects, such as western spruce budworm and Douglas-fir tussock moth, are now larger, more intense, and more frequent than in the past.
- Bark beetle-related mortality, associated with tree stress and overstocked stands, is more prevalent.
- Drought in the late 1980s and early 1990s, coupled with overstocked stands, has contributed to increased mortality from bark beetles, other insects, fire, and disease.
- Many root diseases and dwarf mistletoes are more widespread and destructive because of past harvesting practices and the resulting changes in forest structure and species composition.

An insect and disease risk hazard assessment was conducted for the Malheur, Umatilla, and Wallowa-Whitman National Forests using CVS data and is available in the project record (Countryman 2009). This risk hazard assessment predicts the level of tree mortality over a period of 15 years. Protocols from the Oregon and Washington pest model risk assessment process were utilized as the basis for the process used by the plan revision team. A variety of factors, such as ecoclass, stand density, species composition, stand structure, and observations for insect and disease activity were used in the modeling process to predict tree mortality. Plots were classified into a risk rating for each of 24 risk models used. Each of the plots were then classified into a predicted mortality category by the percentage of volume loss and summarized by upland forest potential vegetation group, by national forest, and by structural stages.

Table 246 displays the percent of CVS plots within predicted mortality categories by upland forest potential vegetation group for the Malheur, Umatilla, and Wallowa-Whitman National Forests. Predicted mortality is described as a percentage of volume loss over a period of 15 years. The dry upland forest potential vegetation group exhibits the highest insect and disease risk hazard, compared to the other upland forest potential vegetation groups. Within the dry upland forest potential vegetation group, approximately 18 percent of the plots are in the 50 percent plus predicted mortality category. In other words, modeling predicts that nearly one-fifth of the plots within the dry upland forest potential vegetation group would lose over half of their volume to insect and disease-related mortality over the next 15 years. Within the dry upland forest potential vegetation group, approximately 23 percent of the plots are in the 25 to 50 percent predicted mortality category, predicting that nearly one-fourth of the plots within the dry upland forest potential vegetation group would lose between one-quarter to one-half of their volume to insect and disease-related mortality over the next 15 years. The dry upland forest potential vegetation group tends to exhibit the greatest amount of departure from historical forest conditions in terms of stand structure, density, and species composition due to the frequency of the historical fire regime and the greatest number of missed fires. Increased tree densities resulting from fire exclusion and suppression have resulted in overstocked stands, increased competition between trees for moisture, nutrients, and sunlight, decreased tree health, growth, and vigor, increased regeneration of shade-tolerant tree species, and altered species compositions and stand structures. Due to this alteration of stand conditions and the greater amount of departure from HRV, the dry upland forest potential vegetation group currently exhibits the highest insect and disease risk hazard, compared to other upland forest potential vegetation groups.

Table 246. Percent of CVS plots within predicted mortality categories (percentage of volume loss) by upland forest potential vegetation group within the Malheur, Umatilla, and Wallowa-Whitman National Forests

Potential Vegetation Group	Predicted Mortality Category (Percentage of Volume Loss)				
	0-5%	5-15%	15-25%	25-50%	50% Plus
	Percent of CVS Plots				
Dry upland forest	17	24	18	23	18
Cold upland forest	32	40	18	8	2
Moist upland forest	16	33	34	17	1

The cold upland forest potential vegetation group exhibits the lowest insect and disease risk hazard, compared with the other upland forest potential vegetation groups. Within the cold upland forest potential vegetation group, approximately 2 percent of the plots are in the 50 percent plus predicted mortality category and approximately 8 percent of the plots are in the 25 to 50 percent predicted mortality category. The greatest number of plots, approximately 72 percent, is in the 0-15 percent predicted mortality categories. As such, the cold upland forest potential vegetation group tends to exhibit less departure from historical forest conditions in terms of stand structure, density, and species composition. Under the historical fire regime, fires burned very infrequently. Due to fire exclusion and suppression, the cold upland forest potential vegetation group has experienced a fewer number of missed fires, in comparison to other potential vegetation groups.

Within the moist upland forest potential vegetation group, approximately 1 percent of the plots are in the 50 percent plus predicted mortality category and approximately 17 percent of the plots are in the 25 to 50 percent predicted mortality category. Within the moist upland forest potential vegetation group, the insect and disease risk hazard is higher than the cold upland forest potential vegetation group but lower than the dry upland forest potential vegetation group. In general, the moist upland forest potential vegetation group tends to exhibit more departure from HRV than the cold upland forest potential vegetation group due to the historical fire regime (mixed frequency and severity) and a greater number of missed fires.

Table 247 displays the percent of CVS plots within predicted mortality categories by national forest. Predicted mortality is described as a percentage of volume loss over a period of 15 years. The Malheur National Forest exhibits the highest insect and disease risk hazard, in comparison with the other national forests. Within the Malheur National Forest, approximately 28 percent of the plots are in the 50 percent plus predicted mortality category. Modeling predicts that approximately one-fourth of the plots within the Malheur National Forest would lose over half of their volume to insect and disease-related mortality over the next 15 years. Within the Malheur National Forest, approximately 20 percent of the plots are in the 25 to 50 percent predicted mortality category. Modeling predicts that approximately one-fifth of the plots within the Malheur National Forest would lose between one-quarter to one-half of their volume to insect and disease-related mortality over the next 15 years. The Malheur National Forest contains the highest percent of the landscape in the dry upland forest potential vegetation group and the lowest percent of the landscape in the cold upland forest potential vegetation group, in comparison to the other national forests.

Table 247. Percent of CVS plots within predicted mortality categories (percentage of volume loss) by national forest

	Predicted Mortality Category (Percentage of Volume Loss)				
	0-5%	5-15%	15-25%	25-50%	50% Plus
National Forest	**Percent of CVS Plots**				
Malheur	17	21	14	20	28
Umatilla	20	30	29	20	2
Wallowa-Whitman	21	35	24	19	2

Within the Umatilla and Wallowa-Whitman National Forests, only approximately 2 percent of the plots are in the 50 percent plus predicted mortality category. Within the Umatilla National Forest, approximately 20 percent of the plots are within the 25 to 50 percent predicted mortality category and approximately 29 percent of the plots are in the 15 to 25 percent predicted mortality category. Within the Wallowa-Whitman National Forest, approximately 19 percent of the plots are in the 25 to 50 percent predicted mortality category and approximately 24 percent of the plots are in the 15 to 25 percent predicted mortality category. Overall, the Wallowa-Whitman National Forest displays the lowest insect and disease risk hazard, with approximately 56 percent of the plots in 0 to 15 percent predicted mortality categories. This is because the Wallowa-Whitman National Forest contains the lowest percent of the landscape in the dry upland forest potential vegetation group and the highest percent of the landscape in the cold upland forest potential vegetation group.

Table 248 displays the percent of CVS plots within predicted mortality categories by structural stages for the Malheur, Umatilla, and Wallowa-Whitman National Forests. Predicted mortality is described as a percentage of volume loss over a period of 15 years. Structural stages that exhibit the highest insect and disease risk hazard include the old forest multi-story (OFMS) and stem exclusion (SE) stages, in comparison with other structural stages. Approximately 12 percent of OFMS plots are in the 50 percent plus predicted mortality category and 19 percent are in the 25 to 50 percent predicted mortality category. Approximately 17 percent of the stem exclusion plots are in the 50 percent plus predicted mortality category and 24 percent are in the 25 to 50 percent predicted mortality category. Much of the predicted mortality is the result of having a landscape with too many fir dominated stands and overly dense stands within the dry upland forest potential vegetation group. High stand densities and altered species compositions within the dry upland forest potential vegetation group are the result of fire exclusion and suppression. The stand initiation (SI) stage exhibits the lowest predicted mortality. Approximately 72 percent of the SI plots are in the 0 to 15 percent predicted mortality categories.

Table 248. Percent of CVS plots within predicted mortality categories (percentage of volume loss) by structural stage for the Malheur, Umatilla, and Wallowa-Whitman National Forests

	Predicted Mortality Category (Percentage of Volume Loss)				
	0-5%	5-15%	15-25%	25-50%	50% Plus
Structural Stage	**Percent of CVS Plots**				
OFMS	9	31	29	19	12
OFSS	4	29	29	31	7
SE	9	28	22	24	17
SI	52	20	7	14	7
UR	13	36	28	14	10

Characteristic levels of insect and disease activity consistent with the HRV would contribute to diverse landscape conditions and provide important wildlife habitat components, such as hollow trees, dead wood, and mistletoe brooms. The desired conditions for vegetation structure, stand density, and species composition would create stand conditions with low to moderate susceptibility to insects and diseases across the majority of the upland forest potential vegetation groups. These stand conditions result in resilient forests capable of absorbing disturbances while retaining the same basic structure and ways of functioning, the capacity for self-organization, and the capacity to adapt to stress and change.

Timber Harvest

Figure 19 displays timber harvest volume in Baker, Grant, Harney, Union, Wallowa, and Wheeler counties from 1980 to 2000. The average annual harvest volume has declined significantly from 1990 forest plans' projected average for the Blue Mountains of 450 million board feet per year to the current level of less than 100 million board feet per year. The use of even-aged regeneration methods of timber harvest (clearcut, seed tree, and shelterwood) has been reduced to less than 5 percent of the acres that were projected in the1990 forest plans. Total harvested acres (even and uneven-aged management) between the three national forests in the Blue Mountains declined to 76,000 acres for the period of 1998 to 2002. The 1990 projected level for that time period was 260,000 acres. The number of acres planted has been declining since the early 1990s to levels that are 130,000 acres less than what was projected from 1990 to 2001. The focus for planting has shifted from acres needing regeneration after timber harvest to acres needing regeneration following wildfires.

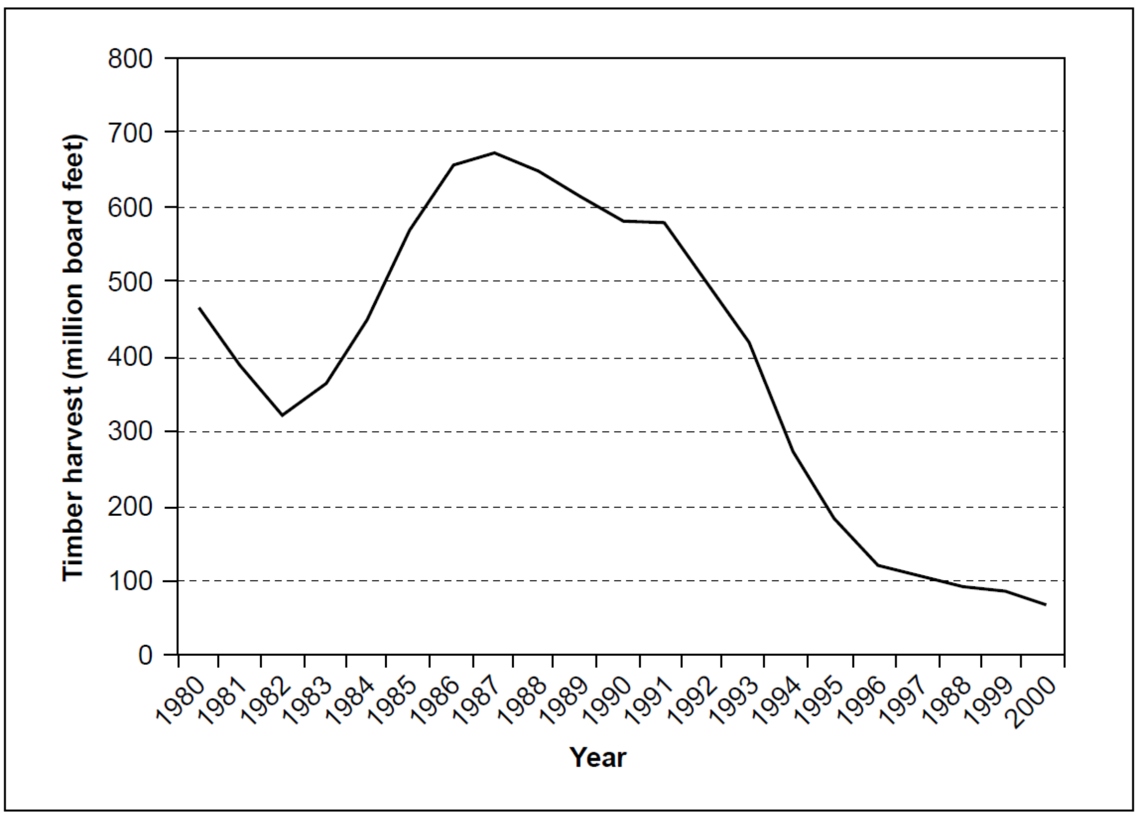

Figure 19. National forest harvests in Baker, Grant, Harney, Union, Wallowa, and Wheeler counties from 1980 to 2000 (3-year moving average) (Oregon Department of Forestry annual timber harvest reports)

Growth and Mortality

The analysis of tree volume, growth, and mortality was based on CVS inventory plot data and vegetation maps. The original establishment of CVS plots (occasion 1) occurred from 1994 to 1997. Re-measurement of plots (occasion 2) occurred from 1997 to 2005. The analysis file contains summaries of diameter class, species, annual growth and mortality for each forested potential vegetation group within the Malheur, Umatilla, and Wallowa-Whitman National Forests. A summary of the growth, mortality, volume, and number of trees for National Forest System lands within the Blue Mountains includes the following:

- The total live forest volume in the Blue Mountains on National Forest System lands is approximately 45 billion board feet.
- Live volume increased between sample periods for the dry upland forest potential vegetation group and increased or decreased for the moist and cold upland forest potential vegetation groups, depending on the national forest.
- The total number of live trees per acre increased in all diameter classes between sample periods.
- The greatest cause of death for trees that died between sample periods was insects and disease at 69 percent, followed by weather at 19 percent.
- Between sample periods, annual growth in the Blue Mountains was estimated at 800 million board feet and mortality was approximately 500 million.
- Between sample periods, annual mortality exceeded growth for subalpine fir and spruce, while growth exceeded mortality for the other species.
- Between sample periods, annual growth exceeded mortality for all diameter classes up to 27 inches. Mortality exceeded growth for diameter classes greater than 27 inches.
- Between sample periods, the percent of the landscape with more than 10 trees per acre greater than 21 inches d.b.h. increased from 24 to 31 percent.

Analysis Assumptions

The Blue Mountains forest plan revision analysis assumptions were guided by:

- Preliminary analysis of existing conditions in the Blue Mountains, as compared to the HRV or other historical/reference conditions and draft desired conditions.
- Draft wildlife viability/diversity modeling results.
- Recommendations and conclusions from the Interior Columbia Basin Ecosystem Management Project (current scientific information).
- Draft process and recommendations from the regional aquatic and riparian conservation strategy.
- Lessons learned from Eastside Screens.

Assumptions – Wildland Fire

Many different definitions exist for the wildland-urban interface (WUI), including those in the National Fire Plan (Grayzeck-Souter et al. 2009). In 2001, a list of wildland-urban interface communities was published in the Federal Register, identifying National Fire Plan communities of concern in each state (66 FR 43435, August 17, 2001). Local communities have also developed boundaries of those areas that are critical to community stability, based on the healthy forest restoration act (HFRA) starting point definition of at-risk communities. These boundaries are displayed in county wildfire protection plans (CWPPs). CWPPs will define the wildland-urban interface for site-specific analysis and project implementation.

There are two types of wildland fire that will be discussed in this document: prescribed fires (planned fires) and wildfires (unplanned fires). Prescribed fires are ignited by a management action and are designed to meet specific land management objectives. These objectives include modifying stand structure (size and arrangement of trees), species composition, and stand density to better match desired conditions. Wildfires are those not ignited by management actions. Some wildfires may be managed to meet specific land management objectives. The use of wildland fire as a tool to meet land management objectives may occur on all acres in all alternatives, as long as those fires are moving the landscape towards or helping maintain the desired conditions.

Assumptions – Harvest Analysis Minimum Management Requirements

Resource Protection/Species Viability and Diversity

Because of a deficit of old forest structure in the Blue Mountains and viability concerns for species that depend on that resource, even-aged regeneration harvests would not occur within current old forest stands, and only minimal harvest of trees 21 inches d.b.h. and greater was assumed. Under alternatives B, E, and F, all old forest stands would be considered unsuitable for timber production, but still available for harvest to meet objectives other than timber production. With these alternatives, old forest stands could receive treatments to improve ecological resiliency, forest structure, species composition, or other desired conditions. Under alternative D, old forest would be considered suitable for timber production. With alternative C, old forest stands would be considered unsuitable for timber production and timber harvest; silvicultural treatments in old forest would be limited, consisting mostly of thinning trees smaller than 8 inches d.b.h.

To protect those wildlife species needing solitude, all areas within the inventory meeting the criteria for potential wilderness area designation were identified as unsuitable for timber production and included in a VDDT model group with minimal management activities. Minimal harvest would occur within these areas and no new roads would be built. Harvest would be allowed if used to meet primary objectives other than timber production.

Resource Protection/Riparian Areas/Soil and Water

All riparian management areas, as defined by each alternative, were included in a VDDT model group with low levels of management activities and were modeled as unsuitable for timber production.

Resource Protection/Soil and Water/Vegetation Manipulation/Silvicultural Practices

To protect soil and water resources, no timber harvest would be scheduled within areas determined to be unsuitable for timber production due to concerns about sensitive soils or difficulty regenerating sites within five years.

Other treatment assumptions or highlights between alternatives include:

- Even-aged regeneration harvests (clearcut, shelterwood, and seed tree) would not occur in old forest (allocated or unallocated to a management area), regardless of the VDDT model group in which old forest occurs.

- Even-aged regeneration harvests would only occur in the active forest management VDDT model group.
- Burning and harvesting treatments would improve ecological resiliency by favoring early seral species, such as ponderosa pine and western larch, by decreasing stand densities where and as needed, by decreasing the abundance of multi-layered stands on the landscape, and by increasing the percent of the landscape in larger-diameter stands.
- Under alternative A, regeneration harvests would be less than 5 percent of the total acres harvested.
- Under alternatives B, C, D, E, and F, regeneration harvests would increase to approximately 20 to 30 percent of the total acres harvested.
- Under alternative C, all old forest and riparian areas would be placed in a VDDT model group with minimal management activities. However, some understory thinning of trees generally less than 8 inches in diameter would be expected to occur. Additionally, wildland fire could still occur in those areas.

Treatments were prioritized by the following areas:

- Priority/key watersheds (based on ARCS modeling)
- Wildland urban interface
- Dry upland forest potential vegetation group (or areas most departed from the HRV/desired conditions)
- Areas with established road systems (primarily within MA 4A General Forest)

Areas where multiple factors overlap are a higher priority than those with only a single factor. Depending on cost sharing or other factors, lower priority work may still occur before higher priority work. Prioritization also recognizes the need for maintenance activities to prevent areas from becoming departed from the desired conditions and then needing more extensive restoration treatments.

Objectives and Design of the Alternatives

All planned activities (timber harvest, reforestation, mechanical fuels treatments, wildfire management, and prescribed fire) would have the following general ecological objectives: to maintain or improve ecological resiliency, stand structures, species composition, stand densities, landscape patterns, fire regime condition classes, and potential fire behavior. These activities are designed to move the landscape towards the desired conditions for vegetation. The activities include social objectives to protect critical resources, such as municipal watersheds, wildland-urban interface areas, and adjacent private property. Economic objectives include contributing to the maintenance of community infrastructure, such as lumber mills and ranches.

Description of Timber Harvest by Alternative

Table 249, table 250, and table 251 contain the estimated annual acres harvested for the planning period under each alternative within the Malheur, Umatilla, and Wallowa-Whitman National Forests. Based on harvest levels for the period 2007 to 2009, combined annual harvest for all three national forest would be expected to occur on 16,800 acres under alternative A (no action). The majority of this acreage would consist of uneven-aged management. Alternative A would contain the lowest percentage of even-aged treatments, compared to the action alternatives. Under alternative A, even-aged management would total approximately 500 acres within all three national forests. Precommercial thinning would total approximately 5,600 acres. Planting would total approximately 300 acres. Alternative A would utilize the current forest plan standards and guidelines, including the Eastside Screens and PACFISH/INFISH. Alternative A would require a budget level similar to the current budget level.

Table 249. Annual acres of harvest for each alternative for the Malheur National Forest

Activity	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F
Even-aged regeneration harvest	150	1,500	800	3,300	2,900	1,800
Uneven-aged management harvest	6,950	5,600	2,600	17,200	9,600	6,500
Total timber harvest	7,100	7,100	3,400	20,500	12,500	8,300
Planting	100	700	400	1,600	1,400	900
Precommercial thinning	1,400	1,400	1,000	3,000	1,400	1,400

Table 250. Annual acres of harvest for each alternative for the Umatilla National Forest

Activity	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F
Even-aged regeneration harvest	260	1,200	500	2,600	2,400	1,500
Uneven-aged management harvest	4,940	4,000	1,800	13,000	8,200	4,900
Total timber harvest	5,200	5,200	2,300	15,600	10,600	6,400
Planting	150	600	200	1,300	1,200	700
Precommercial thinning	1,600	1,600	1,500	3,200	1,600	1,600

Table 251. Annual acres of harvest for each alternative for the Wallowa-Whitman National Forest

Activity	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F
Even-aged regeneration harvest	90	1,000	500	2,500	2,000	1,400
Uneven-aged management harvest	4,410	3,550	1,550	13,750	7,350	4,650
Total timber harvest	4,500	4,550	2,050	16,250	9,350	6,050
Planting	50	500	200	1,200	1,000	700
Precommercial thinning	2,600	2,600	1,700	5,200	2,600	2,600

Alternative B is the proposed action, as modified based on public scoping. The total number of acres of timber harvest would be similar to alternative A. Implementation of alternative B would require a budget level similar to the current budget level. In comparison to alternative A, alternative B would increase the number of acres of even-aged management, which would also increase the amount of young forest (stand initiation). The number of acres of planting would also increase. In comparison to alternative A, alternative B would decrease the number of acres of uneven-aged management. The number of acres of precommercial thinning would remain the same as alternative A. Old forest and riparian management areas would be classified as unsuitable for timber production. Old forest stands would not be designated as management areas; instead, guidance for these structural stages would come from the forest plan components for desired conditions, objectives, standards, and guidelines. Alternative B would also include a guideline similar to the Eastside Screens that would emphasize retaining trees 21 inches d.b.h. and greater both within and outside of old forest. However, harvesting of trees 21 inches d.b.h. and greater would be allowed under specific conditions: to favor hardwood species such as aspen and cottonwoods; to manage species composition; to remove hazard trees; and to improve the effectiveness of fuel reductions in wildland-urban interfaces.

Alternative C was designed to be the most restrictive alternative in terms of timber harvest. This alternative responds to those who wanted to emphasize more passive forest management. Alternative C proposes the utilization of more wildfire managed for resource benefits to move vegetation towards the desired conditions. Alternative C would contain the greatest number of acres of preliminary administratively recommended wilderness areas. Alternative C would also contain wider riparian management areas and additional areas in wildlife corridor management areas. Additionally, old forest would be designated as a management area. All of these additional management areas would reduce the number of acres suitable for timber production. Therefore, alternative C would have the fewest proposed acres of annual timber harvest. In comparison to alternative A, alternative C would still increase the number of acres of even-aged management and planting. However, the number of acres of uneven-aged management would decrease substantially. Additionally, the number of acres of precommercial thinning would decrease, compared to alternatives A and B. The total number of acres of annual timber harvest would be less than half of the acres under alternatives A and B. Alternative C would require a budget level of approximately 45 to 50 percent less than the current budget level for vegetation management and approximately 25 to 55 percent less for fuels reduction. This alternative would include a standard that would prohibit the harvesting of trees 21 inches d.b.h. and greater both within and outside of old forest. Salvage harvest would not be allowed under this alternative.

Alternative D responds to those that wanted to see a greater emphasis on product removal. Alternative D would reduce the widths of riparian management areas and would not include additional acres of recommended wilderness. Additionally, old forest would be classified as suitable for timber production. In comparison to the other alternatives, alternative D would contain the greatest number of acres suitable for timber production and would have the highest number of acres harvested annually within each national forest. Alternative D would also require the highest budget levels. Alternative D would require an increase in budget from current levels of approximately 170 to 195 percent for vegetation management and an increase of approximately 5 to 20 percent for fuels reduction. Under alternative D, the total number of acres harvested annually would be approximately three times greater than alternatives A and B. The level of harvest would attempt to utilize a substantial portion of the net growth per year. As a response to the request for removal of a greater amount of product, this alternative would rely more on utilization of woody material instead of burning as a fuel reduction activity. Alternative D would not include prescribed burning outside of harvest units and would include only limited amounts of prescribed burning within harvest units. The majority of the fuels treatments within harvest units would be accomplished by removal or crushing, instead of burning. Additionally, alternative D would increase the number of acres of precommercial thinning and planting. Alternative D would not contain a standard or guideline regarding the management of trees 21 inches d.b.h. and greater. It is not anticipated that the lack of a large tree standard or guideline would substantially increase the number of large trees removed. Instead, it is intended to give more site-specific flexibility in achieving other desired conditions and objectives, such as species composition. Alternative D would have an increased emphasis on salvage harvest.

Under alternative E, the total number of acres harvested annually would be approximately double, compared to alternatives A and B. Alternative E would require a budget increase from current levels of approximately 65 to 80 percent in vegetation management and approximately 20 to 35 percent in fuels reduction. The total number of acres of planting would also increase. The number of acres of precommercial thinning would remain the same as alternatives A and B. Under alternative E, old forest and riparian management areas would be classified as unsuitable for timber production but would be available for timber harvest to meet other resource objectives. Old forest would not be designated as management areas. Instead, management of old forest would be guided by the forest plan components for desired conditions, objectives, standards, and guidelines for structural stages, species composition, stand density, and fire regime condition class. This alternative would not contain a standard or guideline regarding the management of trees 21 inches d.b.h. and greater. Rather, alternative E would contain a guideline that emphasizes retaining live trees that exhibit certain old tree characteristics.

Under alternative F, the total number of acres harvested annually would increase by approximately 25 percent, compared to alternatives A and B. Alternative F would require a budget increase from current levels of approximately 15 to 20 percent in vegetation management and an increase of approximately 5 to 10 percent in fuels reduction. The total number of acres of planting would increase, in comparison to alternative A. The number of acres of precommercial thinning would remain the same as alternatives A and B. Under alternative F, old forest and riparian management areas would be classified as unsuitable for timber production but would be available for timber harvest to meet other resource objectives. Old forest would not be designated as management areas. Instead, management of old forest would be guided by the forest plan components for desired conditions, objectives, standards, and guidelines for structural stages, species composition, stand density, and fire regime condition class. Alternative F would contain a guideline that emphasizes retaining live trees greater than 150 years old, in most cases, rather than a size limit of 21 inches d.b.h.

Description of Fuels Management Activities by Alternative

For all alternatives, limitations to landscape-level fire management activities may include funding uncertainty, organizational capacity of the Forest Service, species at risk, wildland-urban interface issues, sensitive watershed concerns, and air quality issues related to smoke. Fuels treatments, including prescribed fire (planned ignitions) and management of wildfire (unplanned ignitions), would be utilized under all of the alternatives. However, the level and type of management activity would vary by alternative.

Table 252, table 253, and table 254 display the level of prescribed fire and mechanical fuel-reduction activity associated with each alternative by national forest. It was assumed in the design of each alternative that all activity-generated fuels would be reduced to levels meeting the desired conditions for down wood. The mix of fuels treatments would be a combination of thinning, removal of small diameter biomass, crushing, piling and burning, or just burning.

Table 252. Annual acres of fuels management for each alternative for the Malheur National Forest

Activity	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F
Prescribed burning outside harvest units (without ground-based mechanical pretreatment)	9,500	9,500	9,500	0	9,500	9,500
Prescribed burning within harvest units, without mechanical pretreatment by ground-based equipment	5,300	5,300	2,500	5,100	9,400	6,200
Prescribed burning or removal of fuels within harvest units (could include treatment of fuels with ground-based equipment)	1,800	1,800	900	15,400	3,100	2,100

Table 253. Annual acres of fuels management for each alternative for the Umatilla National Forest

Activity	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F
Prescribed burning outside harvest units (without ground-based mechanical pretreatment)	10,000	10,000	10,000	0	10,000	10,000
Prescribed burning within harvest units, without mechanical pretreatment by ground-based equipment	7,800	7,800	1,700	4,000	7,900	4,800
Prescribed burning or removal of fuels within harvest units (could include treatment of fuels with ground-based equipment)	1,300	1,300	600	12,000	2,700	1,600

Table 254. Annual acres of fuels management for each alternative for the Wallowa-Whitman National Forest

Activity	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F
Prescribed burning outside harvest units (without ground-based mechanical pretreatment)	10,500	10,500	10,500	0	10,500	10,500
Prescribed burning within harvest units, without mechanical pretreatment by ground-based equipment	3,400	3,450	1,550	4,300	7,050	4,550
Prescribed burning or removal of fuels within harvest units (could include treatment of fuels with ground-based equipment)	1,100	1,100	500	12,700	2,300	1,500

The level of prescribed burning outside of harvest units would not differ between the alternatives, except under alternative D. Under alternatives A, B, C, E, and F, prescribed burning outside of harvest units would continue at the current rate of approximately 30,000 acres per year within the three national forests, whereas the use of prescribed fire (planned ignitions) outside of harvest units would be eliminated under alternative D. Prescribed fire outside of timber harvest units may or may not utilize thinning or piling as a pretreatment, depending on anticipated fire effects in relation to the desired conditions (see desired fire regime; table 238). For example, a proposed prescribed fire in an area that has an abundance of multi-storied stands may have a high potential for high severity fire effects. However, if the desired condition for the area is low severity fire, it would be necessary to complete pretreatments to bring potential effects in alignment with the desired conditions.

Under alternatives A and B, prescribed burning and the treatment of fuels with ground-based equipment within harvest units would continue at the current rate of approximately 20,700 acres per year within the three national forests. Under alternative C, burning and the treatment of fuels with ground-based equipment within harvest units would decrease to approximately 7,750 acres within the three national forests due to the decrease in the level of timber harvest. With alternative D, the treatment of fuels within harvest units would increase substantially to approximately 53,500 acres per year due to the substantial increase in timber harvest proposed under this alternative. Under alternative D, the majority of the fuels treatments within the harvest units would be accomplished by removal or crushing, instead of burning. With alternative E, the treatment of fuels using fire and/or ground-based equipment within harvest units would increase to approximately 32,450 acres within the three national forests. Under alternative F, the treatment of fuels using fire and/or ground-based equipment within harvest units would increase to approximately 20,750 acres within the three national forests. With all of the alternatives except alternative D, the majority of the fuels treatments within the harvest units would be accomplished using fire, instead of removal or crushing fuels.

In addition to the activities listed in table 252, table 253, and table 254, unplanned ignitions (wildfires) may also be managed to achieve desired conditions under all of the alternatives. The use of unplanned ignitions as a tool to meet resource objectives could occur on all acres under all alternatives, as long as those fires are moving the landscape towards, or helping maintain, the desired conditions for the area. However, only alternatives C, E, and F would contain specific objective statements in terms of the number of acres of wildfire managed for resource benefits per decade to achieve desired conditions for species composition, stand densities, structural stages, fire frequency, fire severity, and fire regime condition class. Management of unplanned ignitions is guided by a national forest's fire management plan. A fire management plan is a decision support tool required by federal fire policy that aids decision makers and fire personnel in the determination of management response to an unplanned ignition. Alternative C contains the greatest acreage objective of unplanned ignitions managed for resource benefits due to an increased emphasis on more passive forest management to achieve desired conditions. Alternatives B and D would not contain a specific acreage objective for unplanned ignitions managed for resource benefits; however, the use of unplanned ignitions managed for resource benefits would not be precluded. A complete list of objectives for each national forest is available in appendix A.

Environmental Consequences – Forested Vegetation, Timber Resources, and Wildland Fire

Effects Common to All Alternatives

Harvest Prescriptions and Effects

The following discussion describes the harvest and stand management prescriptions common to all alternatives. Timber harvest is a tool used to modify stand structures, species composition, stand density, landscape patterns, and potential fire behavior.

Precommercial Thinning Effects

Precommercial thinning is designed to improve the health and vigor of timber stands. It increases resilience, enhances shrub/forb layer diversity, accelerates development of sapling to pole-sized material, and promotes stand differentiation (different growth rates that allow trees to occupy different amounts of growing space, which improves the health of the stand) in stands otherwise displaying poor differentiation. By reducing the risk of disease or insect infestation, precommercial thinning is a useful tool for protecting and enhancing ecosystem health and restoration. Differentiated stands maintain a higher level of growth and vigor and a greater resistance to damaging agents, such as insects, disease, snow, and wind. Site-specific prescriptions would adopt specifications that are compatible with wildlife, recreation, and scenery objectives.

In the absence of precommercial thinning, poorly differentiated stands can stagnate or experience height repression. Height repression refers to a stand condition where overcrowding reduces tree height and diameter growth and slows the process of stand differentiation.[3] Diameter growth is more sensitive to competition. A tree will maintain height growth after diameter has slowed, resulting in an unstable tree. Height repression occurs by degree across a range, from the nearly stagnated stand where height repression is severe, to the differentiating stand where height is reduced only slightly. With an increasing degree of height repression, a stand would experience reduced vigor, increased susceptibility to insect and disease problems, and would develop at a slower rate. Precommercial thinning extends the opportunity to increase the percentage of ponderosa pine and western larch (two species that have decreased across their historical range) where they occur in dense, mixed-species stands.

Precommercial thinning would result in decreased tree densities, decreased competition between trees for moisture, nutrients, and sunlight, increased nitrogen, carbon, and water uptake by individual trees, and improved tree health, growth, and vigor of residual trees. With less soil-moisture stress, a tree's natural defense mechanisms, such as the production of pitch, would be enhanced and trees would be better equipped to ward off attack by insects, such as bark beetles, and disease. In most cases, precommercial thinning would result in an increase in the average stand diameter by removing smaller diameter trees. Areas that are precommercially thinned would more rapidly move toward larger tree structure in the future. The stocking level control accomplished by precommercial thinning would more rapidly move the stands from sapling and small pole sizes toward large pole and small tree sizes. Because of this effect, thinning would be beneficial to the long-term development of old forest structure. Precommercial thinning would also result in increased sunlight to the forest floor, which would increase the productivity and diversity of herbaceous and/or shrub layers and stimulate forage production for increased wildlife habitat values. An ecological drawback of precommercial thinning would be that, if done too late after saplings and small poles have already self-pruned their lower branches, it can reduce wildlife cover. In the short-term, increased fuel levels from harvest activities would make the areas more prone to damage by fire and insects. Freshly created slash can increase the risk of bark beetle activity if the thinning is done at the wrong time of year. For example, thinning in ponderosa pine or lodgepole pine in the early spring can increase the risk of Ips beetle activity. In the long-term, lower stand densities would foster use of prescribed fire to manage fuel loadings where species that are more fire resistant occur.

Uneven-aged Management (Single-tree or Small Group Selection) Effects

Uneven-aged management is intended to perpetuate uneven-aged stands composed of intermingled trees of differing ages, species, and sizes. Individually selected trees would be removed to maintain a desired range of tree sizes for a prescribed diameter distribution. Cyclic entries would be designed to control the structure and species composition, and to provide the openings necessary for the establishment and growth of the continuously occurring regeneration that are a function of site quality and resource considerations.

Single-tree selection cutting would create favorable conditions for rapid growth on remaining trees. The treatments would decrease tree densities; decrease competition between trees for moisture, nutrients, and sunlight; increase nitrogen, carbon, and water uptake by individual trees; improve tree health, growth, and vigor; and increase resilience. With less soil-moisture stress, a tree's natural defense mechanisms, such as the production of pitch, would be enhanced and trees would be better equipped to ward off attack by insects and disease.

[3] Stand differentiation: Different growth rates that allow trees to occupy different amounts of growing space. This improves the health of the stand.

Single-tree selection cutting would reduce stand densities and canopy cover, thereby favoring the growth of shade intolerant species such as ponderosa pine and western larch where it occurs in the overstory. Group selection cutting would encourage regeneration of these more shade-intolerant species in the understory where seed sources are available, where canopy cover is more open, and/or where openings are larger in size. Regeneration of shade-intolerant tree species is necessary for the achievement of the desired conditions for species composition and structural stages, especially within the dry upland forest potential vegetation group. Decreased stand densities would also increase sunlight to the forest floor, thereby increasing understory productivity and enhancing the diversity of the grass/shrub/forb layer. Diversity is important in maintaining long-term site productivity (Perry et al. 1989).

In the short term, removing dead and dying trees and some of the small- and medium-sized trees that make up vegetative ladder fuels would decrease overall fuel loadings, making the areas slightly less prone to damage by wildfire. In the long term, lower stand densities would foster use of prescribed fires and wildfires to manage fuel loadings where species that are more fire-resistant occur. The reduction in stocking levels accomplished by single-tree selection would more rapidly move all existing structure classes toward the next larger class. Because of this effect, these treatments would be beneficial to the long-term development of old forest. Cumulative effects of continuing the uneven-aged management scenario would coincide with the vegetation management goals of sustaining ecosystem function on a landscape basis. Single-tree, uneven-aged selection systems maintain viable, multi-layered, and diverse structures well into the future.

Potential ecological impacts would include: soil compaction that reduces soil fertility and productivity; root disease, which infects untreated stumps and spreads to residual trees; residual tree wounding, which increases susceptibility to insects and diseases; introduction of exotic species that reduce biodiversity; removing biomass, which reduces nutrient cycling; and reduction of down woody material, which reduces soil-moisture retention.

Commercial and Intermediate Thinning Effects

The purpose of commercial thinning is to improve stand health, growth, and vigor, increase resilience, enhance shrub/forb-layer diversity, reduce the potential of major stand-replacing disturbance events, accelerate the development of late seral structures, thereby protecting and enhancing ecosystem health and restoration. By commercially thinning stands, the threat of insect and disease infestation would decrease from a high susceptibility rating to a low rating. Residual tree densities would be chosen to optimize stand vigor and health, allow for the future functioning of natural fire, and maintain marginal thermal cover. Thermal cover is cover used by animals to ameliorate effects of weather.

The resulting lower tree density from commercial thinning would create favorable conditions for rapid growth on remaining trees similar to the effects previously described for uneven-aged management. This activity could occur within all upland forest potential vegetation groups.

Salvage Harvest Effects

Salvage harvest could occur after an insect, disease, fire, or other event that causes substantial amounts of mortality. Salvage would reduce the density of snags and would potentially reduce the future amount of down wood.

Even-aged Regeneration (Shelterwood/Seed Tree, Clearcut) Harvest Effects

Even-aged regeneration harvest would only occur in those stands that have generally achieved the culmination of mean annual increment (CMAI), except for those circumstances allowed under the

National Forest System Land and Resource Management Planning 1982 Rule (Sec. 219.16). CMAI is the maximum level of the average growth of a stand up to the age in question. All alternatives assume a continued deficit of old forest during the planning horizon. Therefore, shelterwood or seed tree harvests would not occur in old forest. Even-aged regeneration harvests would generally occur in mid-aged stands that are in excess of what is needed to develop old forest to meet the desired conditions for structural stages. These harvests would alter the existing stand structure, resulting in a stand initiation stage and would require reforestation with either natural regeneration or planting. This type of harvest may reduce the number of snags and down wood, but only indirectly if snags and down wood are not specifically targeted for removal. Even-aged regeneration harvests may also change fire behavior on the landscape, increase shrubs, grasses, and forbs, and increase soil temperature. This type of harvest could occur within all of the upland forest potential vegetation groups except the xeric ponderosa pine type.

Planting Effects

Planting of conifers could occur in areas that have been reduced below the minimum desired tree density by timber harvest, insects, disease, or fire. Each site would be evaluated to determine if the desired tree species may seed in naturally within the required period of time. Sites that do not have the potential to reforest naturally would be planted.

Planting would result in an increase in the percent of the landscape in the stand initiation stage and an increase in the forested land base. Planting conifer seedlings could result in a more desirable species composition.

Wildland Fire Effects

For all of the alternatives, the reintroduction of fire is vital to the health, functioning, and sustainability of the ecosystem. Fire contributes to multiple ecological functions and processes, with effects varying depending on fire intensity, severity, and frequency. Intensity, severity, and frequency are the defining factors of a fire regime. The use of both planned ignitions (prescribed fire) and unplanned ignitions (wildfire managed for resource benefits) may result in the following effects on vegetation:

Moderate to High Severity Fire Effects

- Varying levels of mortality in both overstory and understory trees, which results in reduced tree densities, decreased competition between trees for moisture, nutrients, and sunlight, and increased tree health, growth, and vigor of the residual trees.
- Creation of snags and logs, which improves wildlife habitat values.
- Restoration and/or maintenance of meadow inclusions, grasslands, and shrublands where conifers have encroached due to fire suppression/exclusion.
- Stimulation of prolific vegetative regeneration and expansion of tree species such as aspen.

Low to Moderate Severity Fire Effects

- Modified species composition, favoring more fire tolerant tree species with thicker bark (ponderosa pine, older grand fir and Douglas-fir).
- Thinning of seedlings and smaller diameter trees.
- Maintenance of historical, low- and mixed-severity fire regimes by periodic reduction of accumulated biomass and downed woody debris.

- Scorched tree bark, which can attract bark beetles and increase the risk of attack and mortality in the short-term.
- Scorched lower branches of tree crowns, thereby increasing crown base height, decreasing the potential for ground fires to transition to crown fires, and reducing fire severity.
- Favoring the spread or deterring the establishment and proliferation of noxious weeds, depending on fire frequency, severity, and timing.
- Stimulated vegetative shoot/bud initiation (provided soil moisture remains favorable) that results in a more leafy and palatable forage regrowth.
- Sanitizing effect on trees infected with dwarf mistletoe by scorching brooms in the lower crowns or by completely killing heavily infected trees.

Litter and duff can have an insulating effect on soil, which acts to lower soil temperatures and delay spring growth and herbage. Increased litter and duff can also result in decreased growing space for plants and decreased understory productivity. Fire results in reduced litter and duff accumulations. Fire, especially in combination with reduced stand densities, results in changes in the microclimate on the forest floor, specifically increased sunlight penetration, increased soil temperatures, and increased understory productivity. Fire has been shown to result in substantial increases in understory productivity and diversity. Fire is essential to nutrient cycling in fire adapted ecosystems. Fire has a fertilizer effect on the soil by increasing ammonium and nitrogen levels, resulting in increased nutrient levels in both understory and overstory vegetation. Fire rejuvenates desirable grasses, depending on the species response to disturbance. Fire may also increase seedling establishment by aiding in seed bed and site preparation. By decreasing litter and duff accumulation, fire also decreases fuel loadings in general and aids in the maintenance of lower fire severity ratings.

Within the dry upland forest potential vegetation group, tree densities may be reduced by fire, although not always in a uniform way. Low-severity fire may result in a tree arrangement consisting of clumps of trees interspersed with openings. Low severity fire is necessary to the maintenance of open, park-like stands dominated by shade intolerant species, such as ponderosa pine. Low to mixed severity fire in mixed size and multi-storied stands could favor larger diameter trees and create stands with minimal amounts of understory, which perpetuates low severity fire.

Within the moist upland forest potential vegetation group, planned and unplanned ignitions may result in mixed-severity fire events. Mixed-severity fire alternates between stand-replacing crown fires that kill all trees and nonlethal, low-intensity surface fires that leave patches of living trees. Due to complex burning patterns, this type of fire tends to create a mosaic pattern across the landscape. Large openings created by stand-replacing crown fires result in regeneration of more shade-intolerant/fire tolerant and early seral tree species.

Within the cold upland forest potential vegetation group, planned and unplanned ignitions may result in stand-replacing fire events. Stand-replacing fire events are characterized by crown fire that kills most or all of both the overstory and understory trees across large areas. Stands are regenerated in this way, resulting in an increased percent of the landscape in the stand initiation stage.

The use of mechanical fuels treatments (thinning, crushing, piling, grinding) combined with removal of fuels would reduce the total amount of woody fuel on a site and reduce the potential fire severity effects on the soil. These activities would also be designed to reduce the average distance between ground fuels (reduced ladder fuels) and the lower crown of the trees, thereby reducing the potential for crown fire (Agee 2005). Thinning of small diameter trees in the understory could also reduce average stand density, favor early seral species, and increase the average tree diameter within a stand. These treatments could increase resiliency by increasing the probability of fire effects that are considered nonlethal, reducing moisture stress on remaining trees, and reducing the probability of certain types of insect activity.

The emphasis on treating National Forest System lands adjacent to wildland-urban interface areas would continue into the foreseeable future. The wildland-urban interface has been defined and identified through national efforts and additional wildland-urban interface would continue to be identified and refined through completion of community wildfire protection plans. Treatments in highly departed fire regime condition classes would occur in all alternatives. Effects on forest management related to unplanned ignitions do not vary widely among the alternatives. For all of the alternatives, the appropriate protection response would be taken where life or values are at risk, while meeting the desired conditions.

Effects from Each Alternative

In order to compare the effectiveness of each of the alternatives in achieving the desired conditions for forested structural stages, the amount of variation from the desired condition range was determined for each individual structural stage (stand initiation, stem exclusion, understory reinitiation, old forest single-story, and old forest multi-story). The amount of variation for each structural stage was then added together to obtain a summed total amount of variation for each alternative. This same method was used to compare the effectiveness of each of the alternatives in achieving the desired conditions for stand density and species composition.

Using the Malheur cold upland forest potential vegetation group as an example, alternative A would result in 33 percent of the potential vegetation group in the SI stage, 14 percent in the SE stage, 30 percent in the UR stage, 6 percent in the OFSS stage, and 17 percent in the OFMS stage at year 50 (see table 252). The desired conditions ranges for each structural stage are displayed in table 252. Under alternative A, the percent of the Malheur dry upland forest potential vegetation group in the SI stage (33 percent) would be within the desired condition range (20 to 45 percent) at year 50. The percent of the potential vegetation group in the SE stage (14 percent) would vary from the desired condition range (15 to 30 percent) by 1 percent at year 50. The percent of the potential vegetation group in the UR stage (30 percent) would vary from the desired condition range (10 to 25 percent) by 5 percent at year 50. The percent of the potential vegetation group in the OFSS stage (6 percent) would be within the desired condition range (5 to 20 percent) at year 50. The percent of the potential vegetation group in the OFMS stage (17 percent) would be within the desired condition range (10 to 25 percent) at year 50. All values were treated as positive, regardless of whether the structural stage fell above or below the desired condition range. If a value fell within the desired condition range, then there was no variation and a value of zero was assigned. For those stages that are outside of the desired condition ranges at year 50, the amount of variation for each structural stage was added together to obtain a summed total for each alternative. In the previous example, under alternative A, the projected percent of the cold upland forest potential vegetation group in each of the forested structural stages would vary from the desired condition ranges by a summed total of approximately 6 percent at year 50.

Forested Structural Stages Effects

Forested structural stages can be changed through a variety of mechanisms, such as insects, disease, fire, growth, wind storms, and timber harvest. The following section describes the changes in vegetation based on both natural and human actions for each of the alternatives. The landscape composition of forested structural stages can have an effect on ecological resiliency. A landscape that contains a diversity of structural stages would be more sustainable and able to perpetuate itself through time because, as older age classes succumb to mortality, younger age classes would be available to replace them. A landscape that consists of a diversity of diameter classes would also be at decreased risk of attack from bark beetles that favor certain diameter classes. The alternatives that result in the closest achievement of the desired conditions for forested structural stages would result in forest structures that are more ecologically resilient within the particular upland forest potential vegetation group because the desired conditions are based on the HRV. By maintaining and/or restoring a forest structure similar to that which occurred and evolved prior to interruption of the historical fire regime, ecosystems would be better able to absorb disturbances while retaining the same basic structure and ways of functioning and would have a greater capacity to adapt to stress and change.

Malheur National Forest

Table 255 through table 257 display the percent of each upland forest potential vegetation group in each of the forested structural stages by alternative projected over 50 years within the Malheur National Forest.

Cold Upland Forest Potential Vegetation Group – Within the Malheur cold upland forest potential vegetation group, very little timber harvest would occur. Much of the cold upland forest potential vegetation group is located within existing or proposed wilderness, roadless, or backcountry areas. Only approximately 5 to 10 percent of the harvest activities would occur within the cold upland forest potential vegetation group. The cold upland forest potential vegetation group in general exhibits the least amount of departure from the HRV for structural stages. The historical fire regime was characterized by infrequent fires and therefore this forest type has experienced the fewest number of missed fires.

Under alternatives D, E, and F, the projected percent of the cold upland forest potential vegetation group in each of the forested structural stages would vary from the desired condition ranges by a summed total of approximately 2 to 3 percent at year 50. Under alternatives A, B, and C, the projected percent of the cold upland forest potential vegetation group in each of the forested structural stages would vary from the desired condition ranges by a summed total of approximately 5 to 6 percent at year 50. The percent of the cold upland forest potential vegetation group in the SI stage would increase the most under alternatives D and E and would slightly exceed the desired conditions range at year 50. Under alternative F, the percent of the cold upland forest potential vegetation group in the SI stage would be within the desired conditions range at year 50. Under all of the alternatives, the percent of the cold upland forest potential vegetation group in the SE stage would increase and be within the desired conditions range at year 20. However, only alternative D would maintain the percent of the cold upland forest potential vegetation group in the SE stage within the desired conditions range at year 50. Under alternatives D, E, and F, the percent of the cold upland forest potential vegetation group in the UR stage would decrease and be within the desired conditions range at year 50. Under the other alternatives, the percent of cold upland forest potential vegetation group in the UR stage would remain above the desired conditions range.

Table 255. Forested structural stages, as a percent of the cold upland forest potential vegetation group (with amount of variation from desired condition range in parentheses) by alternative within the Malheur National Forest

Upland Forest PVG/ Structural Stage	DC	EC	Alt. A		Alt. B		Alt. C		Alt. D		Alt. E		Alt. F	
			Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50
Cold/SI	20-45	24	22 (0)	33 (0)	23 (0)	37 (0)	23 (0)	36 (0)	28 (0)	48 (3)	26 (0)	46 (1)	25 (0)	42 (0)
Cold/SE	15-30	12	19 (0)	14 (1)	18 (0)	13 (2)	19 (0)	13 (2)	19 (0)	15 (0)	19 (0)	14 (1)	18 (0)	13 (2)
Cold/UR	10-25	44	30 (5)	30 (5)	29 (4)	28 (3)	30 (5)	29 (4)	27 (2)	21 (0)	28 (3)	22 (0)	28 (3)	25 (0)
Cold/OFSS	5-20	1	3 (2)	6 (0)	4 (1)	6 (0)	4 (1)	7 (0)	3 (2)	5 (0)	4 (1)	5 (0)	4 (1)	5 (0)
Cold/OFMS	10-25	20	26 (1)	17 (0)	26 (1)	17 (0)	24 (0)	16 (0)	22 (0)	12 (0)	23 (0)	13 (0)	24 (0)	14 (0)
Summed Total Amount of Variation			(8)	(6)	(6)	(5)	(6)	(6)	(4)	(3)	(4)	(2)	(4)	(2)

PVG = potential vegetation group; DC = desired condition; EC = existing condition; SI = stand initiation; SE = stem exclusion; UR = understory reinitiation; OFSS = old forest single story; OFMS = old forest multi-story

While all of the alternatives would achieve the desired conditions for the percent of the cold upland forest potential vegetation group in the OFSS stage at year 50, alternative C would slightly exceed the other alternatives (by approximately 1 to 2 percent). All of the alternatives would also achieve the desired conditions for the percent of the cold upland forest potential vegetation group in the OFMS stage at year 50. However, alternatives A and B would result in the highest percent of the cold upland forest potential vegetation group in the OFMS stage at year 50, exceeding the other alternatives by approximately 1 to 5 percent. The percent of the cold upland forest potential vegetation group in the OFMS stage at year 50 would be lower than existing conditions under all of the alternatives due to mortality caused by wildfire and insects. This structural stage may be difficult to maintain within the desired condition range, especially with climate change potentially increasing the level of stand-replacing wildfire. For more information, see the cumulative effects section.

Dry Upland Forest Potential Vegetation Group – Within the Malheur dry upland forest potential vegetation group, the different alternatives would result in a substantial difference in the percent of the landscape in each of the forested structural stages because approximately 60 to 90 percent of the forest's timber harvest would occur in the dry upland forest potential vegetation group. The dry upland forest potential vegetation group, in general, exhibits the greatest amount of departure from the HRV for forested structural stages. The historical fire regime was characterized by more frequent fire; therefore this potential vegetation group has experienced the greatest number of missed fires.

Table 256. Forested structural stages, as a percent of the dry upland forest potential vegetation group (with amount of variation from desired condition range in parentheses) by alternative within the Malheur National Forest

Upland Forest PVG/ Structural Stage	DC	EC	Alt. A		Alt. B		Alt. C		Alt. D		Alt. E		Alt. F	
			Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50
Dry/SI	15-30	6	7 (8)	11 (4)	10 (5)	14 (1)	9 (6)	13 (2)	12 (3)	19 (0)	12 (3)	18 (0)	10 (5)	16 (0)
Dry/SE	10-20	18	29 (9)	30 (10)	28 (8)	29 (9)	27 (7)	28 (8)	25 (5)	29 (9)	33 (13)	35 (15)	29 (9)	31 (11)
Dry/UR	0-5	54	35 (30)	26 (21)	35 (30)	35 (30)	36 (31)	28 (23)	36 (31)	20 (15)	28 (23)	16 (11)	33 (28)	23 (18)
Dry/OFSS	40-65	3	7 (33)	13 (27)	6 (34)	11 (29)	6 (34)	10 (30)	10 (30)	16 (24)	8 (32)	16 (24)	7 (33)	12 (28)
Dry/OFMS	1-15	20	22 (7)	20 (5)	22 (7)	20 (5)	22 (7)	22 (7)	18 (3)	16 (1)	19 (4)	15 (0)	21 (6)	19 (4)
Summed Total Amount of Variation			(87)	(67)	(84)	(74)	(85)	(70)	(72)	(49)	(75)	(50)	(81)	(61)

PVG = potential vegetation group; DC = desired condition; EC = existing condition; SI = stand initiation; SE = stem exclusion; UR = understory reinitiation; OFSS = old forest single story; OFMS = old forest multi-story

Alternatives D and E would result in the closest achievement of the desired conditions for forested structural stages at year 50 because of the increased levels of timber harvest activities associated with these alternatives. Under alternative D, the projected percent of the dry upland forest potential vegetation group in each of the structural stages would vary from the desired condition ranges by a summed total of approximately 49 percent. Under alternative E, the projected percent of the dry upland forest potential vegetation group in each of the structural stages would vary from the desired condition ranges by a summed total of approximately 50 percent.

Alternatives B and C would be the least effective alternatives in achieving the desired conditions for structural stages in the Malheur dry upland forest potential vegetation group. Under alternatives B and C, the percent of the dry upland forest potential vegetation group in each of the structural stages would vary from the desired condition ranges by a summed total of approximately 74 percent and 70 percent, respectively, at year 50.

The percent of the dry upland forest potential vegetation group in the SI stage would increase the most under alternatives D and E and would be within the desired conditions range at year 50 due to the increased levels of timber harvest activities associated with these alternatives. Under alternative F, the percent of the dry upland forest potential vegetation group in the SI stage would also be within the desired conditions range at year 50. Under all of the alternatives, the percent of the dry upland forest potential vegetation group in the SE stage would increase and exceed the desired conditions range at year 50. This would be a combined result of timber harvest activities and/or fire removing and killing smaller diameter trees within multi-storied stands. Under all of the alternatives, the percent of the dry upland forest potential vegetation group in the UR stage would decrease but would continue to exceed the desired conditions range at year 50. Alternatives D and E would result in the greatest reductions in the UR stage because of the increased levels of timber harvest activities associated with these alternatives.

None of the alternatives would achieve the desired conditions for the percent of the dry upland forest potential vegetation group in the OFSS stage by year 50 due to the large amount of variation between existing and desired conditions and the amount of time required to develop old forest. However, alternatives D and E would result in the greatest increase in the OFSS stage at year 50, exceeding other alternatives by approximately 3 to 6 percent. This would be the result of increased timber harvest activities associated with these alternatives and the conversion of OFMS to OFSS within the dry upland forest potential vegetation group. Most of the decrease in OFMS would be a shift into the OFSS stage due to timber harvest activities or fire. Only alternative E would achieve the desired conditions for the percent of the dry upland forest potential vegetation group in the OFMS stage at year 50. However, alternative D would only vary from the desired condition range by approximately 1 percent at year 50. Alternative C would result in the highest percent of the dry upland forest potential vegetation group in the OFMS stage.

Moist Upland Forest Potential Vegetation Group – Within the Malheur moist upland forest potential vegetation group, alternative D would result in the closest achievement of the desired conditions for forested structural stages at year 50. Under alternative D, the projected percent of the moist upland forest potential vegetation group in each of the forested structural stages would vary from the desired condition ranges by a summed total of approximately 28 percent at year 50. Alternative E would be the second most effective alternative in achieving the desired condition ranges for forested structural stages at year 50. Under alternative E, the projected percent of the moist upland forest potential vegetation group in each of the structural stages would vary from the desired condition ranges by a summed total of approximately 39 percent at year 50.

Table 257. Forested structural stages, as a percent of the moist upland forest potential vegetation group (with amount of variation from desired condition range in parentheses) by alternative within the Malheur National Forest

Upland Forest PVG/ Structural Stage	DC	EC	Alt. A		Alt. B		Alt. C		Alt. D		Alt. E		Alt. F	
			Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50
Moist/SI	20-30	1	3 (17)	7 (13)	4 (16)	9 (11)	4 (16)	9 (11)	8 (12)	20 (0)	6 (14)	16 (4)	4 (16)	12 (8)
Moist/SE	20-30	5	0 (20)	11 (9)	8 (12)	9 (11)	7 (13)	9 (11)	9 (11)	13 (7)	8 (12)	11 (9)	8 (12)	9 (11)
Moist/UR	15-25	41	36 (11)	41 (16)	35 (10)	41 (16)	36 (11)	43 (18)	33 (8)	32 (7)	34 (9)	36 (11)	36 (11)	40 (15)
Moist/OFSS	10-20	5	6 (14)	7 (13)	6 (4)	5 (5)	6 (4)	6 (4)	6 (4)	6 (4)	6 (4)	6 (4)	6 (4)	6 (4)
Moist/OFMS	15-20	47	47 (27)	34 (14)	47 (27)	35 (15)	47 (27)	35 (15)	44 (24)	30 (10)	46 (26)	31 (11)	47 (27)	33 (13)
Summed Total Amount of Variation			(89)	(65)	(69)	(58)	(71)	(59)	(59)	(28)	(65)	(39)	(70)	(51)

PVG = potential vegetation group; DC = desired condition; EC = existing condition; SI = stand initiation; SE = stem exclusion; UR = understory reinitiation; OFSS = old forest single story; OFMS = old forest multi-story

Alternatives C and B would be the least effective alternatives in achieving the desired conditions for structural stages in the moist upland forest potential vegetation group. Under alternatives C and B, the percent of the moist upland forest potential vegetation group in each of the structural stages would vary from the desired condition ranges by a summed total of approximately 59 percent and 58 percent, respectively, at year 50.

The percent of the moist upland forest potential vegetation group in the SI stage would increase the most under alternative D and would be within the desired conditions range at year 50 due to the increased levels of timber harvest activities associated with this alternative. Under alternative E, the percent of the moist upland forest potential vegetation group in the SI stage would also increase substantially but would remain slightly below the desired conditions range at year 50. Under all of the alternatives, the percent of the moist upland forest potential vegetation group in the SE stage would increase due to a combined result of timber harvest activities and/or fire removing and killing smaller diameter trees within multi-storied stands. However, the percent of the moist upland forest potential vegetation group in the SE stage would remain below the desired conditions range at year 50. Alternatives D and E would result in the greatest increases in the percent of the moist upland forest potential vegetation group in the SE stage. Alternatives D and E would result in the greatest reductions in the UR stage in the moist upland forest potential vegetation group because of the increased levels of timber harvest associated with these alternatives but would continue to exceed the desired conditions range at year 50.

None of the alternatives would achieve the desired conditions for the percent of the moist upland forest potential vegetation group in the OFSS or OFMS stages by year 50. Under all of the alternatives, the percent of the potential vegetation group in the OFMS stage would decrease from existing conditions to year 50 due to mortality caused by insects, disease, and fire. Alternatives D and E would come closest to achieving the desired conditions for the percent of the moist upland forest potential vegetation group in the OFMS stage at year 50.

Umatilla National Forest

Table 258 through table 260 display the percent of each upland forest potential vegetation group in each of the forested structural stages by alternative projected over 50 years within the Umatilla National Forest.

Cold Upland Forest Potential Vegetation Group – Within the Umatilla cold upland forest potential vegetation group, very little timber harvest would occur. Much of the cold upland forest potential vegetation group is located within existing or proposed wilderness, roadless, or backcountry areas. Only approximately 5 to 10 percent of the harvest activities would occur within this potential vegetation group. The cold upland forest potential vegetation group in general exhibits the least amount of departure from the HRV for structural stages. The historical fire regime was characterized by infrequent fires and therefore this forest type has experienced the fewest number of missed fires.

Under alternatives A, B, and C, the projected percent of the cold upland forest potential vegetation group in each of the forested structural stages would be within the desired condition ranges at year 50, and alternatives D, E, and F would only vary from the desired condition ranges by a summed total of approximately 1 to 5 percent at year 50.

The percent of the cold upland forest potential vegetation group in the SI stage would increase the most under alternatives D, E, and F and would slightly exceed the desired condition range at year 50. Under alternatives A, B, and C, the percent of the cold upland forest potential vegetation group in the SI stage would be within the desired condition range at year 50. Under all of the alternatives, the percent of the cold upland forest potential vegetation group in the SE stage would increase at year 20 and be slightly above the desired condition range, but would then decrease and be within the desired condition range at year 50. Under all of the alternatives, the percent of the cold upland forest potential vegetation group in the UR stage would remain within the desired condition range at year 50.

Table 258. Forested structural stages, as a percent of the cold upland forest potential vegetation group (with amount of variation from desired condition range in parentheses) by alternative within the Umatilla National Forest

Upland Forest PVG/ Structural Stage	DC	EC	Alt. A		Alt. B		Alt. C		Alt. D		Alt. E		Alt. F	
			Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50
Cold/SI	20-45	30	28 (0)	43 (0)	28 (0)	45 (0)	28 (0)	45 (0)	31 (0)	49 (4)	29 (0)	46 (1)	29 (0)	46 (1)
Cold/SE	15-30	21	31 (1)	19 (0)	31 (1)	19 (0)	31 (1)	18 (0)	31 (1)	21 (0)	31 (1)	22 (0)	31 (1)	19 (0)
Cold/UR	10-25	18	20 (0)	20 (0)	20 (0)	19 (0)	20 (0)	19 (0)	18 (0)	13 (0)	19 (0)	16 (0)	20 (0)	18 (0)
Cold/OFSS	5-20	0	2 (3)	7 (0)	2 (3)	7 (0)	2 (3)	8 (0)	2 (3)	7 (0)	2 (3)	7 (0)	2 (3)	7 (0)
Cold/OFMS	10-25	30	20 (0)	11 (0)	19 (0)	11 (0)	19 (0)	10 (0)	18 (0)	9 (1)	18 (0)	9 (1)	19 (0)	10 (0)
Summed Total Amount of Variation			(4)	(0)	(4)	(0)	(4)	(0)	(4)	(5)	(4)	(2)	(4)	(1)

PVG = potential vegetation group; DC = desired condition; EC = existing condition; SI = stand initiation; SE = stem exclusion; UR = understory reinitiation; OFSS = old forest single story; OFMS = old forest multi-story

While all of the alternatives would achieve the desired condition for the percent of the cold upland forest potential vegetation group in the OFSS stage at year 50, alternative C would exceed the other alternatives by approximately 1 percent. All of the alternatives would also achieve the desired conditions for the percent of the cold upland forest potential vegetation group in the OFMS stage at year 20. However, the percent of the cold upland forest potential vegetation group in the OFMS stage would decrease from existing conditions to year 50 under all of the alternatives due to mortality caused by wildfire and insects. This structural stage may be difficult to maintain within the desired condition range, especially with climate change potentially increasing the level of stand-replacing wildfire. For more information, see the cumulative effects section.

Dry Upland Forest Potential Vegetation Group – Within the Umatilla dry upland forest potential vegetation group, the alternatives would result in a substantial difference in the percent of the dry upland forest potential vegetation group in each of the forested structural stages because more timber harvest would occur this potential vegetation group. Approximately 60 to 90 percent of the harvest activities would occur within the dry upland forest potential vegetation group. Additionally, the dry upland forest potential vegetation group in general exhibits the greatest amount of departure from the HRV for structural stages. The historical fire regime was characterized by more frequent fire; therefore; this potential vegetation group has experienced the greatest number of missed fires.

Table 259. Forested structural stages, as a percent of the dry upland forest potential vegetation group (with amount of variation from desired condition range in parentheses) by alternative within the Umatilla National Forest

Upland Forest PVG/ Structural Stage	DC	EC	Alt. A		Alt. B		Alt. C		Alt. D		Alt. E		Alt. F	
			Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50
Dry/SI	15-30	12	11 (4)	12 (3)	13 (2)	17 (0)	11 (4)	14 (1)	16 (0)	21 (0)	17 (0)	21 (0)	14 (1)	18 (0)
Dry/SE	10-20	26	39 (19)	41 (21)	37 (17)	40 (20)	36 (16)	38 (18)	40 (20)	41 (21)	40 (20)	43 (23)	38 (18)	40 (20)
Dry/UR	0-5	50	31 (26)	21 (16)	32 (27)	21 (16)	35 (30)	25 (20)	26 (21)	16 (11)	26 (21)	14 (9)	30 (25)	19 (14)
Dry/OFSS	40-65	4	7 (33)	15 (25)	7 (33)	12 (28)	6 (34)	11 (29)	9 (31)	14 (26)	8 (32)	15 (25)	7 (33)	13 (27)
Dry/OFMS	1-15	8	11 (0)	10 (0)	11 (0)	10 (0)	12 (0)	12 (0)	9 (0)	8 (0)	10 (0)	7 (0)	10 (0)	9 (0)
Summed Total Amount of Variation			(82)	(65)	(79)	(64)	(84)	(68)	(72)	(58)	(73)	(57)	(77)	(61)

PVG = potential vegetation group; DC = desired condition; EC = existing condition; SI = stand initiation; SE = stem exclusion; UR = understory reinitiation; OFSS = old forest single story; OFMS = old forest multi-story

Alternatives E and D would result in the closest achievement of the desired conditions for forested structural stages at year 50 due to the increased levels of timber harvest activities associated with these alternatives. Under alternative E, the projected percent of the dry upland forest potential vegetation group in each of the forested structural stages would vary from the desired condition ranges by a summed total of approximately 57 percent at year 50. Under alternative D, the projected percent of the dry upland forest potential vegetation group in each of the forest structural stages would vary from the desired condition ranges by a summed total of approximately 58 percent at year 50.

Alternative C would be the least effective alternative in achieving the desired conditions for forested structural stages in the dry upland forest potential vegetation group due to the decreased levels of timber harvest activities associated with this alternative. Under alternative C, the percent of the dry upland forest potential vegetation group in each of the forested structural stages would vary from the desired condition ranges by a summed total of approximately 68 percent at year 50.

The percent of the dry upland forest potential vegetation group in the SI stage would increase the most under alternatives D and E and would be within the desired condition range at year 50 due to the increased levels of timber harvest associated with these alternatives. Under alternatives B and F, the percent of the dry upland forest potential vegetation group in the SI stage would also be within the desired condition range at year 50. Under all of the alternatives, the percent of the dry upland forest potential vegetation group in the SE stage would increase and exceed the desired conditions range at year 50 due to a combined result of timber harvest activities and/or fire removing and killing smaller diameter trees within multi-storied stands. Under all of the alternatives, the percent of the dry upland forest potential vegetation group in the UR stage would decrease but would continue to exceed the desired conditions range at year 50. Alternatives D and E would result in the greatest reductions in the dry upland forest potential vegetation group UR stage because of the increased levels of timber harvest activities associated with these alternatives.

None of the alternatives would achieve the desired conditions for the percent of the dry upland forest potential vegetation group in the OFSS stage by year 50 due to the large variation between existing and desired conditions and the amount of time required to develop old forest. However, alternatives A, D, and E would result in the greatest increase in the OFSS stage in the dry upland forest potential vegetation group at year 50, exceeding other alternatives by approximately 1 to 4 percent. Alternatives D and E would result in increased timber harvest activities and the conversion of OFMS to OFSS within the dry upland forest potential vegetation group. Most of the decrease in the OFMS stage would be a shift into the OFSS stage by timber harvest or fire. All of the alternatives would achieve the desired conditions for the percent of the dry upland forest potential vegetation group in the OFMS stage at years 20 and 50.

Moist Upland Forest Potential Vegetation Group – Within the Umatilla moist upland forest potential vegetation group, alternative E would result in the closest achievement of the desired conditions for forested structural stages at year 50. Under alternative E, the projected percent of the moist upland forest potential vegetation group in each of the forested structural stages would vary from the desired condition ranges by a summed total of approximately 21 percent at year 50. Alternative D would be the second most effective alternative in achieving the desired conditions for forested structural stages, within the moist upland forest potential vegetation group at year 50. Under alternative D, the projected percent of the moist upland forest potential vegetation group in each of the forested structural stages would vary from the desired condition ranges by a summed total of approximately 26 percent at year 50.

Table 260. Forested structural stages, as a percent of the moist upland forest potential vegetation group (with amount of variation from desired condition range in parentheses) by alternative within the Umatilla National Forest

Upland Forest PVG/ Structural Stage	DC	EC	Alt. A		Alt. B		Alt. C		Alt. D		Alt. E		Alt. F	
			Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50
Moist/SI	20-30	9	7 (13)	8 (12)	8 (12)	11 (9)	8 (12)	9 (11)	11 (9)	17 (3)	10 (20)	16 (4)	9 (11)	12 (8)
Moist/SE	20-30	10	14 (6)	18 (2)	13 (7)	16 (4)	14 (6)	16 (4)	14 (6)	20 (0)	14 (6)	17 (3)	14 (6)	16 (4)
Moist/UR	15-25	26	27 (2)	36 (11)	27 (2)	36 (11)	27 (2)	37 (12)	25 (0)	8 (7)	25 (0)	30 (5)	26 (1)	34 (9)
Moist/OFSS	10-20	23	15 (0)	9 (1)	14 (0)	8 (2)	16 (0)	10 (0)	15 (0)	28 (8)	16 (0)	9 (1)	15 (0)	9 (1)
Moist/OFMS	15-20	32	37 (17)	29 (9)	37 (17)	29 (9)	37 (17)	29 (9)	36 (16)	28 (8)	35 (15)	28 (8)	36 (16)	28 (8)
Summed Total Amount of Variation			(38)	(35)	(38)	(35)	(37)	(36)	(31)	(26)	(41)	(21)	(34)	(30)

PVG = potential vegetation group; DC = desired condition; EC = existing condition; SI = stand initiation; SE = stem exclusion; UR = understory reinitiation; OFSS = old forest single story; OFMS = old forest multi-story

Alternatives A, B, and C would be the least effective alternatives in achieving the desired conditions for forested structural stages within the moist upland forest potential vegetation group. Under alternatives A, B, and C, the percent of the moist upland forest potential vegetation group in each of the forested structural stages would vary from the desired condition ranges by a summed total of approximately 35 to 36 percent at year 50.

Alternatives D and E would result in the greatest increase in the percent of the moist upland forest potential vegetation group in the SI stage due to increased levels of timber harvest activities associated with these alternatives. However, the percent of the moist upland forest potential vegetation group in the SI stage would continue to be below the desired condition range at year 50. Alternative D would result in the greatest increase in the percent of the moist upland forest potential vegetation group in the SE stage and would achieve the desired conditions at year 50. This would be the result of timber harvest activities removing smaller diameter trees within multi-storied stands. Alternative D would result in the greatest reduction in the moist upland forest potential vegetation group UR stage and would achieve the desired conditions at year 50 because of the increased levels of timber harvest activities associated with this alternative.

All of the alternatives would achieve the desired conditions for the percent of the moist upland forest potential vegetation group in the OFSS stage at year 20. However, with all the alternatives except alternative D, the percent of the moist upland forest potential vegetation group in the OFSS stage would continue to decrease between years 20 and 50 due to mortality caused by insects and fire. Under alternative D, the percent of the moist upland forest potential vegetation group in the OFSS stage would increase to approximately 28 percent at year 50 and exceed the desired condition range. This would be the result of increased timber harvest activities associated with this alternative, which would result in more open stand densities, improved forest health, and decreased fire severity. The alternatives would not result in a substantial difference in the percent of the moist upland forest potential vegetation group in the OFMS stage. Under all of the alternatives, the percent of the potential vegetation group in the OFMS stage would be slightly lower than existing conditions at year 50 due to mortality from fire, insects, and disease. However, all of the alternatives would exceed the desired condition range for the percent of the moist upland forest potential vegetation group in the OFMS stage at year 50.

Wallowa-Whitman National Forest

Table 261 through table 263 display the percent of each upland forest potential vegetation group in each of the forested structural stages by alternative projected over 50 years within the Wallowa-Whitman National Forest.

Cold Upland Forest Potential Vegetation Group – Within the Wallowa-Whitman, very little timber harvest would occur. Much of the cold upland forest potential vegetation group is located within existing or proposed wilderness, roadless, or backcountry areas. Only approximately 5 to 10 percent of the harvest activities would occur within this potential vegetation group. The cold upland forest potential vegetation group in general exhibits the least amount of departure from the HRV for structural stages. The historical fire regime was characterized by infrequent fire; therefore this forest type has experienced the fewest number of missed fires.

Table 261. Forested structural stages, as a percent of the cold upland forest potential vegetation group (with amount of variation from desired condition range in parentheses) by alternative within the Wallowa-Whitman National Forest

Upland Forest PVG/ Structural Stage	DC	EC	Alt. A		Alt. B		Alt. C		Alt. D		Alt. E		Alt. F	
			Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50
Cold/SI	20-45	14	20 (0)	33 (0)	21 (0)	34 (0)	20 (0)	33 (0)	22 (0)	36 (0)	21 (0)	35 (0)	21 (0)	34 (0)
Cold/SE	15-30	10	14 (1)	10 (5)	14 (1)	10 (5)	14 (1)	10 (5)	14 (1)	11 (4)	14 (1)	11 (4)	14 (1)	10 (5)
Cold/UR	10-25	41	35 (10)	32 (7)	35 (10)	34 (9)	36 (11)	32 (7)	34 (9)	28 (3)	34 (9)	29 (4)	35 (10)	31 (6)
Cold/OFSS	5-20	1	3 (2)	5 (0)	3 (2)	5 (0)	3 (2)	5 (0)	3 (2)	5 (0)	3 (2)	5 (0)	3 (2)	5 (0)
Cold/OFMS	10-25	34	27 (2)	20 (0)	28 (3)	20 (0)	27 (2)	20 (0)	27 (2)	20 (0)	27 (2)	20 (0)	27 (2)	20 (0)
Summed Total Amount of Variation			(15)	(12)	(16)	(14)	(16)	(12)	(14)	(7)	(14)	(8)	(15)	(11)

PVG = potential vegetation group; DC = desired condition; EC = existing condition; SI = stand initiation; SE = stem exclusion; UR = understory reinitiation; OFSS = old forest single story; OFMS = old forest multi-story

Under alternatives D and E, the projected percent of the cold upland forest potential vegetation group in each of the forested structural stages would vary from the desired condition ranges by a summed total of approximately 7 percent and 8 percent, respectively, at year 50.

Alternative B would be the least effective in achieving the desired conditions for forested structural stages in the cold upland forest potential vegetation group. Under alternative B, the percent of the cold upland forest potential vegetation group in each of the forested structural stages would vary from the desired condition ranges by a summed total of approximately 14 percent at year 50.

The percent of the cold upland forest potential vegetation group in the SI stage would increase the most under alternatives D and E. However, all of the alternatives would achieve the desired conditions for the percent of the cold upland forest potential vegetation group in the SI stage at year 50. Under all of the alternatives, the percent of the cold upland forest potential vegetation group in the SE stage would increase at year 20, but would then decrease and be below the desired conditions range at year 50. Alternatives D and E would come closest to achieving the desired conditions for the percent of the cold upland forest potential vegetation group in the UR stage at year 50, but would remain slightly above the desired condition range.

All of the alternatives would achieve the desired conditions for the percent of the cold upland forest potential vegetation group in the OFSS and OFMS stages at year 50. The percent of the cold upland forest potential vegetation group in the OFMS stage would decrease from existing conditions to year 50 under all of the alternatives due to mortality caused by wildfire, insects, and disease. This structural stage may be difficult to maintain within the desired condition range, especially with climate change potentially increasing the level of stand-replacing wildfire. For more information, see the cumulative effects section.

Dry Upland Forest Potential Vegetation Group – Within the Wallowa-Whitman dry upland forest potential vegetation group, the alternatives would result in a substantial difference in the percent of dry upland forest potential vegetation group in each of the forested structural stages because approximately 60 to 90 percent of the timber harvest activities would occur in this potential vegetation group. The dry upland forest potential vegetation group in general exhibits the greatest amount of departure from the HRV for forested structural stages. The historical fire regime was characterized by more frequent fire; therefore this potential vegetation group has experienced the greatest number of missed fires.

Table 262. Forested structural stages, as a percent of the dry upland forest potential vegetation group (with amount of variation from desired condition range in parentheses) by alternative within the Wallowa-Whitman National Forest

Upland Forest PVG/ Structural Stage	DC	EC	Alt. A		Alt. B		Alt. C		Alt. D		Alt. E		Alt. F	
			Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50
Dry/SI	15-30	14	11 (4)	12 (3)	13 (2)	15 (0)	12 (3)	14 (1)	16 (0)	18 (0)	16 (0)	19 (0)	14 (1)	17 (0)
Dry/SE	10-20	16	37 (17)	44 (24)	35 (15)	42 (22)	34 (14)	39 (19)	36 (16)	43 (23)	39 (19)	46 (26)	36 (16)	43 (23)
Dry/UR	0-5	54	34 (29)	25 (20)	34 (29)	25 (20)	37 (32)	29 (24)	31 (26)	19 (14)	28 (23)	16 (11)	33 (28)	22 (17)
Dry/OFSS	40-65	1	4 (36)	9 (31)	4 (36)	8 (32)	4 (36)	7 (33)	6 (34)	11 (29)	5 (35)	11 (29)	4 (36)	9 (31)
Dry/OFMS	1-15	14	13 (0)	11 (0)	13 (0)	11 (0)	14 (0)	12 (0)	11 (0)	8 (0)	11 (0)	8 (0)	13 (0)	9 (0)
Summed Total Amount of Variation			(86)	(78)	(82)	(74)	(85)	(77)	(76)	(66)	(77)	(66)	(81)	(71)

PVG = potential vegetation group; DC = desired condition; EC = existing condition; SI = stand initiation; SE = stem exclusion; UR = understory reinitiation; OFSS = old forest single story; OFMS = old forest multi-story

Alternatives D and E most closely achieve the desired conditions for forested structural stages at year 50. Under alternatives D and E, the projected percent of the dry upland forest potential vegetation group in each of the forested structural stages would vary from the desired condition ranges by a summed total of approximately 66 percent at year 50.

Alternatives A and C would be the least effective alternatives in achieving the desired conditions for forested structural stages in the Wallowa-Whitman dry upland forest potential vegetation group. Under alternatives A and C, the percent of the dry upland forest potential vegetation group in each of the forested structural stages would vary from the desired condition ranges by a summed total of approximately 78 percent and 77 percent, respectively, at year 50.

The percent of the dry upland forest potential vegetation group in the SI stage would increase the most under alternatives D and E and would be within the desired condition range at year 50 due to the increased levels of timber harvest activities associated with these alternatives. Under alternatives B and F, the percent of the dry upland forest potential vegetation group in the SI stage would also be within the desired condition range at year 50. Under all of the alternatives, the percent of the dry upland forest potential vegetation group in the SE stage would increase and exceed the desired condition range at year 50 due to a combined result of timber harvest activities and/or fire removing and killing smaller diameter trees within multi-storied stands. Alternative C would most closely achieve the desired conditions for the percent of the dry upland forest potential vegetation group in the SE stage because this alternative would result in the fewest number of acres of timber harvest and the smallest percent increase in the SE stage. Under all of the alternatives, the percent of the dry upland forest potential vegetation group in the UR stage would decrease, but would continue to exceed the desired condition range at year 50. This would be due to the large amount of variation between the existing and desired conditions. Alternatives D and E would result in the greatest reductions in the UR stage because of the increased levels of timber harvest activities associated with these alternatives.

None of the alternatives would achieve the desired conditions for the percent of the dry upland forest potential vegetation group in the OFSS stage by year 50 due to the large amount of variation between existing and desired conditions and the amount of time required to develop old forest. However, alternatives D and E would result in the greatest increase in the OFSS stage within the dry upland forest potential vegetation group at year 50, exceeding other alternatives by approximately 2 to 4 percent. Alternatives D and E would result in increased timber harvest activities, which would convert more of the OFMS to OFSS stage. All of the alternatives would achieve the desired conditions for the percent of the dry upland forest potential vegetation group in OFMS stage at years 20 and 50. Most of the decrease in the OFMS stage would be a shift into the OFSS stage as the result of timber harvest activities or fire.

Moist Upland Forest Potential Vegetation Group – Within the Wallowa-Whitman moist upland forest potential vegetation group, alternatives D and E would most closely achieve the desired conditions for forested structural stages at year 50. Under alternatives D and E, the projected percent of the moist upland forest potential vegetation group in each of the forested structural stages would vary from the desired condition ranges by a summed total of approximately 12 percent and 14 percent, respectively, at year 50.

Alternatives A and C would be the least effective alternatives in achieving the desired conditions for forested structural stages within the moist upland forest potential vegetation group. Under alternatives A and C, the percent of the moist upland forest potential vegetation group in each of the forested structural stages would vary from the desired condition ranges by a summed total of approximately 32 percent at year 50.

Alternatives D and E would result in the greatest increase in the percent of the moist upland forest potential vegetation group in the SI stage due to the increased levels of timber harvest activities associated with these alternatives. Under alternative D, the percent of the moist upland forest potential vegetation group in the SI stage would be within the desired condition range at year 50. Alternative E would be slightly below the desired condition range at year 50. Because of timber harvest activities removing smaller diameter trees within multi-storied stands, alternative D would result in the greatest increase in the percent of the moist upland forest potential vegetation group in the SE stage and would achieve the desired conditions at year 50. However, all of the alternatives would achieve the desired condition for the percent of the moist upland forest potential vegetation group in the SE stage at year 50. Alternative D would result in the greatest reduction in the UR stage because of the increased levels of timber harvest activities associated with this alternative, but would continue to exceed the desired condition range at year 50 due to the large amount of variation between existing and desired conditions. Alternative C would result in the highest amount of variation from desired conditions for the percent of the moist upland forest potential vegetation group in the UR stage at year 50 due to decreased levels of timber harvest activities associated with this alternative.

Table 263. Forested structural stages, as a percent of the moist upland forest potential vegetation group (with amount of variation from desired condition range in parentheses) by alternative within the Wallowa-Whitman National Forest

Upland Forest PVG/ Structural Stage	DC	EC	Alt. A		Alt. B		Alt. C		Alt. D		Alt. E		Alt. F	
			Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50
Moist/SI	20-30	12	9 (11)	10 (10)	10 (10)	13 (7)	10 (10)	12 (8)	14 (6)	22 (0)	13 (7)	19 (1)	11 (9)	16 (4)
Moist/SE	20-30	11	20 (0)	23 (0)	19 (1)	21 (0)	18 (2)	20 (0)	21 (0)	26 (0)	21 (0)	23 (0)	19 (1)	21 (0)
Moist/UR	15-25	50	44 (19)	43 (18)	44 (19)	43 (18)	45 (20)	45 (20)	40 (15)	32 (7)	40 (15)	35 (10)	43 (18)	40 (15)
Moist/OFSS	10-20	1	4 (6)	6 (4)	3 (7)	5 (5)	4 (6)	6 (4)	3 (7)	5 (5)	5 (5)	7 (3)	4 (6)	6 (4)
Moist/OFMS	15-20	25	23 (3)	17 (0)	23 (3)	17 (0)	23 (3)	17 (0)	22 (2)	15 (0)	21 (1)	16 (0)	22 (2)	17 (2)
Summed Total Amount of Variation			(39)	(32)	(40)	(30)	(41)	(32)	(30)	(12)	(28)	(14)	(36)	(25)

PVG = potential vegetation group; DC = desired condition; EC = existing condition; SI = stand initiation; SE = stem exclusion; UR = understory reinitiation; OFSS = old forest single story; OFMS = old forest multi-story

Alternative E would result in the greatest percent of the moist upland forest potential vegetation group in the OFSS stage at year 50, but would be slightly below the desired condition range. Under all of the alternatives, the percent of the potential vegetation group in the OFMS stage would be lower than existing conditions at year 50 due to mortality caused by fire, insects, and disease. However, all of the alternatives would achieve the desired condition for the percent of the moist upland forest potential vegetation group in the OFMS stage at year 50.

Species Composition Effects

The alternatives that result in the closest achievement of the desired conditions for species composition would result in vegetation that is more ecologically resilient within the particular upland forest potential vegetation group because the desired conditions are based on the HRV. By maintaining and/or restoring the balance of shade tolerant/intolerant/mixed tolerance species that occurred and evolved on a site prior to interruption of the historical fire regime, species would be better adapted to temperature, moisture, and disturbance regimes.

Malheur National Forest

Table 264, table 265, and table 266 display species composition as a percent of each upland forest potential vegetation group by alternative projected over 50 years within the Malheur National Forest.

Cold Upland Forest Potential Vegetation Group – Within the Malheur cold upland forest potential vegetation group, none of the alternatives would achieve the desired conditions for species composition. This is because very little timber harvest would occur in the cold upland forest potential vegetation group. Much of the cold upland forest potential vegetation group is located within existing or proposed wilderness, roadless, or backcountry areas. Only approximately 5 to 10 percent of the harvest activities would occur within this potential vegetation group.

Under alternatives B, C, E, and F, the projected percent of the cold upland forest potential vegetation group in each of the species composition tolerance classes would vary from the desired condition ranges by a summed total of approximately 23 percent. Under alternatives A and D, the projected percent of the cold upland forest potential vegetation group in each of the species composition tolerance classes would vary from the desired condition ranges by a summed total of approximately 24 percent and 25 percent, respectively, at year 50.

Table 264. Forested species composition, as a percent of the cold upland forest potential vegetation group (with amount of variation from desired condition range in parentheses) by alternative within the Malheur National Forest

Upland Forest PVG/ Species Composition	DC	EC	Alt. A		Alt. B		Alt. C		Alt. D		Alt. E		Alt. F	
			Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50
Cold/ shade intolerant	40-60	63	61 (1)	61 (1)	62 (2)	62 (2)	61 (1)	61 (1)	63 (3)	67 (7)	63 (3)	65 (5)	62 (2)	63 (3)
Cold/ mixed tolerance	5-20	31	30 (10)	29 (9)	30 (10)	27 (7)	30 (10)	28 (8)	28 (8)	23 (3)	28 (8)	24 (4)	28 (8)	26 (6)
Cold/ shade tolerant	25-50	7	9 (16)	11 (14)	9 (16)	11 (14)	9 (16)	11 (14)	9 (16)	10 (15)	9 (16)	11 (14)	9 (16)	11 (14)
Summed Total Amount of Variation			(27)	(24)	(28)	(23)	(27)	(23)	(27)	(25)	(27)	(23)	(26)	(23)

PVG = potential vegetation group; DC= desired condition; EC = existing condition

Under all of the alternatives:

- the projected percent of the cold upland forest potential vegetation group in shade intolerant species would range from approximately 61 to 67 percent at year 50, exceeding the desired conditions range of 40 to 60 percent.
- the percent of the cold upland forest potential vegetation group in mixed tolerance species would range from approximately 23 to 29 percent at year 50, exceeding the desired condition range of 5 to 20 percent.
- the percent of the cold upland forest potential vegetation group in shade tolerant species would range from approximately 10 to11 percent at year 50, falling below the desired condition range of 25 to 50 percent.
- species composition tolerance classes would remain slightly outside the HRV/desired conditions ranges at year 50, which may result in decreased ecological resiliency within the cold upland forest potential vegetation group.

Species composition tolerance classes would remain slightly outside the desired conditions ranges at year 50, which may result in decreased ecological resiliency within the cold upland forest potential vegetation group. Species may be less suited to temperature, moisture, and fire regimes and insects and diseases within the cold upland forest potential vegetation group and therefore experience increased levels of mortality related to insects, disease, fire, and moisture stress.

Dry Upland Forest Potential Vegetation Group – Within the Malheur National Forest dry upland forest potential vegetation group, alternative D would achieve the desired conditions for species composition at year 50. Alternative E would be the second most effective alternative in achieving the desired conditions for species composition, with the projected percent of the dry upland forest potential vegetation group in each of the species composition tolerance classes varying from the desired condition ranges by a summed total of approximately 2 percent at year 50. Alternatives D and E would most closely achieve desired conditions for species composition in the dry upland forest potential vegetation group due to the increased level of timber harvest associated with these alternatives. Under alternatives D and E, the percent of the dry upland forest potential vegetation group in shade intolerant species classes would be approximately 80 percent and 78 percent, respectively, at year 50. The higher percent of the dry upland forest potential vegetation group in shade intolerant species would result in improved ecological resilience. Shade intolerant tree species such as ponderosa pine tend to have thicker bark and are better adapted to frequent fire regimes. Ponderosa pine also self-prune their lower branches, which increases their crown base height, increases the wind speed required to initiate a crown fire, and results in decreased fire severity. Ponderosa pine is also more drought tolerant, making it better adapted to moisture stress and drier conditions. Species that better withstand moisture stress are also less susceptible to attack by bark beetles because of natural defense mechanisms, such as the production of pitch.

Table 265. Forested species composition, as a percent of the dry upland forest potential vegetation group (with amount of variation from desired condition range in parentheses) by alternative within the Malheur National Forest

Upland Forest PVG/ Species Composition	DC	EC	Alt. A		Alt. B		Alt. C		Alt. D		Alt. E		Alt. F	
			Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50
Dry/ shade intolerant	75-90	76	75 (0)	74 (1)	75 (0)	75 (0)	75 (0)	73 (2)	77 (0)	80 (0)	77 (0)	78 (0)	76 (0)	76 (0)
Dry/ shade tolerant	5-20	24	25 (5)	26 (6)	25 (5)	25 (5)	26 (6)	28 (8)	23 (3)	20 (0)	23 (3)	22 (2)	24 (4)	24 (4)
Summed Total Amount of Variation			(5)	(7)	(5)	(5)	(6)	(10)	(3)	(0)	(3)	(2)	(4)	(4)

PVG = potential vegetation group; DC= desired condition; EC = existing condition

Alternative C would be the least effective alternative in achieving the desired conditions for species composition, with the projected percent of the dry upland forest potential vegetation group in each of the species composition tolerance classes varying from the desired condition ranges by a summed total of approximately 10 percent at year 50. Alternative C would exhibit a lower percent of shade intolerant species and a higher percent of shade tolerant species classes in the dry upland forest potential vegetation group at year 50. Under alternative C, the projected percent of the dry upland forest potential vegetation group in shade intolerant species would be approximately 73 percent at year 50, while the shade tolerant species would be approximately 28 percent at year 50. The decreased levels of timber harvest activities associated with alternative C would result in more closed canopy stand conditions and increased regeneration of shade tolerant tree species.

Under alternatives A, B, C, E, and F, the projected percent of the dry upland forest potential vegetation group in shade tolerant species would range from approximately 22 to 28 percent at year 50, exceeding the desired conditions range of 5 to 20 percent. The higher percent of the dry upland forest potential vegetation group in shade tolerant species would result in decreased ecological resilience. Shade tolerant tree species such as grand fir tend to have thinner bark, are less able to withstand fire, and are less adapted to frequent fire regimes. Shade tolerant tree species also tend to retain their lower branches, which decreases their crown base height, decreases the wind speed required to initiate a crown fire, and results in increased fire severity. Shade tolerant tree species such as grand fir also tend to be less drought-tolerant, making them more prone to moisture stress and less adapted to drier site conditions. Species that are more prone to moisture stress are also more susceptible to attack by insects such as bark beetles because of a lack of natural defense mechanisms, such as the production of pitch.

Moist Upland Forest Potential Vegetation Group – Within the Malheur National Forest moist upland forest potential vegetation group, alternative D would result in the closest achievement of desired conditions for species composition. Under alternative D, the projected percent of the moist upland forest potential vegetation group in each of the species composition tolerance classes would vary from the desired condition ranges by a summed total of approximately 48 percent at year 50. Alternative E would be the second most effective alternative in achieving the desired conditions for species composition, with the projected percent of the moist upland forest potential vegetation group in each of the species composition tolerance classes varying from desired condition ranges by a summed total of approximately 51 percent at year 50. Alternatives D and E would result in the closest achievement of desired conditions for species composition in the moist upland forest potential vegetation group because the increased levels of timber harvest associated with these alternatives would result in more open stand densities and regeneration of more shade intolerant tree species. With alternatives D and E, the percent of the moist upland forest potential vegetation group in shade intolerant species would increase by approximately 5 percent and 3 percent, respectively, over 50 years as the result of regeneration harvests and other timber harvest activities. Under alternatives D and E, the projected percent of the moist upland forest potential vegetation group in shade intolerant species would be approximately 26 percent and 24 percent, respectively, at year 50, falling below the desired condition range of 30 to 60 percent.

Table 266. Forested species composition, as a percent of the moist upland forest potential vegetation group (with amount of variation from desired condition range in parentheses) by alternative within the Malheur National Forest

Upland Forest PVG/ Species Composition	DC	EC	Alt. A		Alt. B		Alt. C		Alt. D		Alt. E		Alt. F	
			Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50
Moist/ shade intolerant	30-60	21	20 (10)	20 (10)	20 (10)	21 (9)	20 (10)	21 (9)	21 (9)	26 (4)	21 (9)	24 (6)	21 (9)	22 (8)
Moist/ mixed tolerance	20-40	6	8 (12)	11 (9)	8 (12)	10 (10)	8 (12)	10 (10)	8 (12)	10 (10)	9 (11)	11 (9)	8 (12)	10 (10)
Moist/ shade tolerant	10-30	73	71 (41)	69 (39)	71 (41)	69 (39)	72 (42)	69 (39)	70 (40)	64 (34)	71 (41)	66 (36)	71 (41)	68 (38)
Summed Total Amount of Variation			(63)	(58)	(63)	(58)	(64)	(58)	(61)	(48)	(61)	(51)	(62)	(56)

PVG = potential vegetation group; DC= desired condition; EC = existing condition

Alternatives A, B, and C would be the least effective alternatives in achieving the desired conditions for species composition, with the projected percent of the moist upland forest potential vegetation group in each of the species composition tolerance classes varying from desired condition ranges by a summed total of approximately 58 percent at year 50. Under alternatives A, B, and C, the projected percent of the moist upland forest potential vegetation group in shade intolerant species would range from approximately 20 percent to 21 percent at year 50, falling below the desired condition range of 30 to 60 percent.

Under all of the alternatives, the percent of the moist upland forest potential vegetation group in shade tolerant species would range from approximately 64 to 69 percent at year 50, exceeding the desired condition range of 10 to 30 percent. The high percent of the moist upland forest potential vegetation group in shade tolerant species would result in decreased ecological resiliency. Shade tolerant tree species tend to be less able to withstand fire due to thinner bark. These species also tend to retain their lower branches, which decreases their crown base height, decreases the wind speed required to initiate a crown fire, and results in increased fire severity. Shade tolerant tree species also tend to be less drought tolerant, making them less able to withstand moisture stress and more susceptible to attack by insects such as bark beetles because of a lack of natural defense mechanisms, such as the production of pitch.

Umatilla National Forest

Table 267, table 268, and table 269 display species composition as a percent of each upland forest potential vegetation group by alternative projected over 50 years within the Umatilla National Forest.

Cold Upland Forest Potential Vegetation Group – Within the Umatilla cold upland forest potential vegetation group, none of the alternatives would completely achieve the desired conditions for species composition because very little timber harvest would occur in this potential vegetation group. Much of the cold upland forest potential vegetation group is located within existing or proposed wilderness, roadless, or backcountry areas. Only approximately 5 to 10 percent of the harvest activities for this forest would occur within the cold upland forest potential vegetation group.

Table 267. Forested species composition, as a percent of the cold upland forest potential vegetation group (with amount of variation from desired condition range in parentheses) by alternative within the Umatilla National Forest

Upland Forest PVG/ Species Composition	DC	EC	Alt. A		Alt. B		Alt. C		Alt. D		Alt. E		Alt. F	
			Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50
Cold/ shade intolerant	40-60	70	66 (6)	66 (6)	66 (6)	66 (6)	67 (7)	66 (6)	67 (7)	68 (8)	67 (7)	67 (7)	67 (7)	67 (7)
Cold/ mixed tolerance	5-20	10	13 (0)	15 (0)	13 (0)	15 (0)	13 (0)	15 (0)	12 (0)	13 (0)	13 (0)	14 (0)	13 (0)	14 (0)
Cold/ shade tolerant	25-50	20	21 (4)	19 (6)	21 (4)	19 (6)	20 (5)	19 (6)	20 (5)	19 (6)	20 (5)	19 (6)	20 (5)	19 (6)
Summed Total Amount of Variation			(10)	(12)	(10)	(12)	(12)	(12)	(12)	(14)	(12)	(13)	(12)	(13)

PVG = potential vegetation group; DC= desired condition; EC = existing condition

Under alternatives A, B, and C, the projected percent of the cold upland forest potential vegetation group in each of the species composition tolerance classes would vary from the desired condition ranges by a summed total of approximately 12 percent. Under alternatives D, E, and F, the percent in each of the species composition tolerance classes would vary from the desired condition ranges by a summed total of approximately 14 percent, 13 percent, and 13 percent, respectively, at year 50. Under all of the alternatives:

- the projected percent of the cold upland forest potential vegetation group in shade intolerant species would range from approximately 66 to 68 percent at year 50, exceeding the desired conditions range of 40 to 60 percent.
- the projected percent of the cold upland forest potential vegetation group in mixed tolerance species would range from approximately 13 to 15 percent at year 50, which would be within the desired conditions range of 5 to 20 percent.
- the projected percent of the cold upland forest potential vegetation group in shade tolerant species would be approximately 19 percent, falling below the desired conditions range of 25 percent to 50 percent.
- species composition tolerance classes would remain slightly outside the HRV/desired conditions ranges at year 50, which may result in decreased ecological resiliency within the cold upland forest potential vegetation group.

Species composition tolerance classes would remain slightly outside the desired conditions ranges at year 50, which may result in decreased ecological resiliency within the cold upland forest potential vegetation group. Species may be less suited to temperature, moisture, and fire regimes and insects and diseases within the cold upland forest potential vegetation group and therefore experience increased levels of mortality related to insects, disease, fire, and moisture stress.

Dry Upland Forest Potential Vegetation Group – Within the Umatilla dry upland forest potential vegetation group, alternatives D and E would result in the closest achievement of the desired conditions for species composition at year 50, with the projected percent of the dry upland forest potential vegetation group varying from the desired conditions ranges by a summed total of approximately 19 percent and 31 percent, respectively, at year 50. Alternatives D and E would most closely achieve the desired conditions for species composition in the dry upland forest potential vegetation group due to the increased level of timber harvest associated with these alternatives. Under Alternatives D and E, the projected percent of the dry upland forest potential vegetation group in shade intolerant species would be approximately 68 percent and 62 percent, respectively, at year 50, falling below the desired conditions range of 75 to 90 percent. The higher percent of the dry upland forest potential vegetation group in shade intolerant species would result in improved ecological resilience, compared to the other alternatives. Shade intolerant tree species such as ponderosa pine tend to have thicker bark and are better adapted to frequent fire regimes. Ponderosa pine also self-prune their lower branches, which increases their crown base height, increases the wind speed required to initiate a crown fire, and results in decreased fire severity. Ponderosa pine is also more drought tolerant, making them better adapted to moisture stress and drier conditions. Species that better withstand moisture stress are also less susceptible to attack by bark beetles because of natural defense mechanisms, such as the production of pitch.

Table 268. Forested species composition, as a percent of the dry upland forest potential vegetation group (with amount of variation from desired condition range in parentheses) by alternative within the Umatilla National Forest

Upland Forest PVG/ Species Composition	DC	EC	Alt. A		Alt. B		Alt. C		Alt. D		Alt. E		Alt. F	
			Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50
Dry/ shade intolerant	75-90	45	50 (25)	55 (20)	50 (25)	56 (19)	47 (28)	48 (27)	56 (19)	68 (7)	53 (22)	62 (13)	50 (25)	58 (17)
Dry/ shade tolerant	5-20	55	50 (30)	45 (25)	50 (30)	44 (24)	54 (34)	52 (32)	44 (24)	32 (12)	47 (27)	38 (18)	50 (30)	42 (22)
Summed Total Amount of Variation			(55)	(45)	(55)	(43)	(62)	(59)	(43)	(19)	(49)	(31)	(55)	(39)

PVG = potential vegetation group; DC= desired condition; EC = existing condition

Under the other alternatives, the projected percent of the dry upland forest potential vegetation group in shade tolerant species would range from approximately 42 to 52 percent at year 50, exceeding the desired conditions range of 5 to 20 percent. Alternative C would be the least effective alternative in achieving the desired conditions for species composition, with the projected percent of the dry upland forest potential vegetation group in each of the species composition tolerance classes varying from the desired condition ranges by a summed total of approximately 59 percent at year 50. Alternative C would exhibit a lower percent of shade intolerant species classes and a higher percent of shade tolerant species classes at year 50. The projected percent of the dry upland forest potential vegetation group in shade intolerant species would be approximately 48 percent at year 50, while the shade tolerant species would be approximately 52 percent at year 50. This would be due to the decreased levels of timber harvest activities associated with alternative C resulting in more closed canopy stand conditions and regeneration of more shade tolerant tree species. A higher percent of the dry upland forest potential vegetation group in shade tolerant species would result in decreased ecological resilience. Shade tolerant tree species such as grand fir tend to have thinner bark, are less able to withstand fire, and are less adapted to frequent fire regimes. Shade tolerant tree species also tend to retain their lower branches, which decreases their crown base height, decreases the wind speed required to initiate a crown fire, and results in increased fire severity. Shade-tolerant tree species such as grand fir also tend to be less drought-tolerant, making them more prone to moisture stress and less adapted to drier conditions. Species that are more prone to moisture stress are also more susceptible to attack by insects such as bark beetles because of a lack of natural defense mechanisms, such as the production of pitch.

Moist Upland Forest Potential Vegetation Group – Within the Umatilla National Forest moist upland forest potential vegetation group, alternatives D and E would most closely achieve the desired conditions for species composition, with the projected percent of species composition tolerance classes varying from the desired condition ranges by a summed total of approximately 40 percent at year 50. This would be due to more open stand densities resulting from the increased levels of timber harvest activities associated with these alternatives. Under alternatives D and E, the percent of the moist upland forest potential vegetation group in shade intolerant species would increase by approximately 5 percent over 50 years as the result of regeneration harvests and other timber harvest activities to approximately 20 percent at year 50, falling below the desired condition range of 30 to 60 percent. Under Alternatives D and E, the projected percent of the moist upland forest potential vegetation group in mixed tolerance species would be approximately 20 percent at year 50, which would be within the desired condition range of 20 to 40 percent. The projected percent of the moist upland forest potential vegetation group in shade tolerant species would be approximately 60 percent at year 50, which would exceed the desired condition range of 10 to 30 percent.

Table 269. Forested species composition, as a percent of the moist upland forest potential vegetation group (with amount of variation from desired condition range in parentheses) by alternative within the Umatilla National Forest

Upland Forest PVG/ Species Composition	DC	EC	Alt. A		Alt. B		Alt. C		Alt. D		Alt. E		Alt. F	
			Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50
Moist/ shade intolerant	30-60	15	14 (16)	15 (15)	14 (16)	16 (14)	15 (15)	16 (14)	16 (14)	20 (10)	15 (15)	20 (10)	15 (15)	17 (13)
Moist/ mixed tolerance	20-40	21	21 (0)	21 (0)	21 (0)	20 (0)	21 (0)	21 (0)	20 (0)	20 (0)	21 (0)	20 (0)	21 (0)	20 (0)
Moist/ shade tolerant	10-30	65	65 (35)	64 (34)	65 (35)	63 (33)	66 (36)	65 (35)	64 (34)	60 (30)	64 (34)	60 (30)	65 (35)	63 (33)
Summed Total Amount of Variation			(51)	(49)	(51)	(47)	(51)	(49)	(48)	(40)	(49)	(40)	(50)	(46)

PVG = potential vegetation group; DC= desired condition; EC = existing condition

Alternatives A and C would be the least effective alternatives in achieving the desired conditions for species composition within the moist upland forest potential vegetation group, with the projected percent of species composition tolerance classes varying from desired condition ranges by a summed total of approximately 49 percent at year 50. Under alternatives A and C, the projected percent of the moist upland forest potential vegetation group in shade intolerant species would be approximately 16 percent at year 50, which would be below the desired condition range of 30 to 60 percent.

Under all of the alternatives, the percent of the moist upland forest potential vegetation group in shade tolerant species would range from approximately 60 to 65 percent at year 50, exceeding the desired condition range of 10 to 30 percent. The high percent of the moist upland forest potential vegetation group in shade tolerant species would result in decreased ecological resilience. Shade tolerant tree species tend to be less able to withstand fire due to thinner bark. These species also tend to retain their lower branches, which decreases their crown base height, decreases torching indices, and results in increased fire severity. Shade tolerant tree species also tend to be less drought tolerant, making them less able to withstand moisture stress and more susceptible to attack by insects such as bark beetles because of a lack of natural defense mechanisms, such as the production of pitch.

Wallowa-Whitman National Forest

Table 270, table 271, and table 272 display species composition as a percent of each upland forest potential vegetation group by alternative projected over 50 years within the Wallowa-Whitman National Forest.

Cold Upland Forest Potential Vegetation Group – Within the Wallowa-Whitman cold upland forest potential vegetation group, none of the alternatives would completely achieve the desired conditions for species composition because very little timber harvest would occur in the cold upland forest potential vegetation group. Much of the cold upland forest potential vegetation group is located within existing or proposed wilderness, roadless, or backcountry areas. Only approximately 5 to 10 percent of the harvest activities would occur within the cold upland forest potential vegetation group.

Table 270. Forested species composition, as a percent of the cold upland forest potential vegetation group (with amount of variation from desired condition range in parentheses) by alternative within the Wallowa-Whitman National Forest

Upland Forest PVG/ Species Composition	DC	EC	Alt. A		Alt. B		Alt. C		Alt. D		Alt. E		Alt. F	
			Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50
Cold/ shade intolerant	40-60	38	39 (1)	45 (0)	39 (0)	45 (0)	39 (1)	45 (0)	40 (0)	47 (0)	40 (0)	46 (0)	39 (1)	45 (0)
Cold/ mixed tolerance	5-20	24	24 (4)	23 (3)	24 (4)	23 (3)	24 (4)	23 (3)	23 (3)	21 (1)	24 (4)	22 (2)	24 (4)	22 (2)
Cold/ shade tolerant	25-50	38	37 (0)	32 (0)	37 (0)	32 (0)	37 (0)	32 (0)	36 (0)	32 (0)	37 (0)	32 (0)	37 (0)	32 (0)
Summed Total Amount of Variation			(5)	(3)	(4)	(3)	(5)	(3)	(3)	(1)	(4)	(2)	(5)	(2)

PVG = potential vegetation group; DC= desired condition; EC = existing condition

Under alternative D, the projected percent of the cold upland forest potential vegetation group in each of the species composition tolerance classes would vary from the desired condition ranges by a summed total of approximately 1 percent at year 50. Under the other alternatives, the projected percent of the cold upland forest potential vegetation group in each of the species composition tolerance classes would vary from the desired condition ranges by a summed total of approximately 2 to3 percent at year 50. Under all of the alternatives:

- the projected percent of the cold upland forest potential vegetation group in shade intolerant species would range from approximately 45 to 47 percent at year 50, which falls within the desired conditions range of 40 to 60 percent.
- the projected percent of the cold upland forest potential vegetation group in mixed tolerance species would range from approximately 21 to 23 percent at year 50, slightly exceeding the desired condition range of 5 to 20 percent.
- the percent of the cold upland forest potential vegetation group in shade tolerant species would be approximately 32 percent at year 50, falling within the desired condition range of 25 to 50 percent.
- species compositions would be very similar to the HRV/desired conditions, resulting in increased ecological resiliency within the cold upland forest potential vegetation group.
- Species compositions would be very similar to the desired conditions, resulting in increased ecological resiliency within the cold upland forest potential vegetation group. Species would be more suited to temperature, moisture, and fire regimes and insects and diseases within the Wallowa-Whitman cold upland forest potential vegetation group.
- **Dry Upland Forest Potential Vegetation Group** – Within the Wallowa-Whitman National Forest dry upland forest potential vegetation group, alternative D would result in the closest achievement of the desired conditions for species composition. Under alternative D, the

projected percent of the dry upland forest potential vegetation group in each of the species composition tolerance classes would vary from the desired condition ranges by approximately 21 percent at year 50. Alternative E would be the second most effective alternative in achieving the desired conditions for species composition, with the projected percent of the dry upland forest potential vegetation group in each of the species composition tolerance classes varying from the desired condition ranges by approximately 35 percent at year 50. Alternatives D and E would result in the closest achievement of desired conditions for species composition in the Wallowa-Whitman dry upland forest potential vegetation group because the increased levels of timber harvest activities associated with these alternatives would result in more open stand densities and regeneration of more shade intolerant tree species. Under alternatives D and E, the percent of the dry upland forest potential vegetation group in shade intolerant species classes would be approximately 67 percent and 60 percent, respectively, at year 50. The higher percent of the dry upland forest potential vegetation group in shade intolerant species would result in improved ecological resilience. Shade intolerant tree species such as ponderosa pine tend to have thicker bark and are better adapted to frequent fire regimes. Ponderosa pine also self-prune their lower branches, which increases their crown base height, increases the wind speed required to initiate a crown fire, and results in decreased fire severity. Ponderosa pine is also more drought tolerant, making them better adapted to moisture stress and drier conditions. Species that better withstand moisture stress are also less susceptible to attack by bark beetles because of natural defense mechanisms, such as the production of pitch.

Table 271. Forested species composition, as a percent of the dry upland forest potential vegetation group (with amount of variation from desired condition range in parentheses) by alternative within the Wallowa-Whitman National Forest

Upland Forest PVG/ Species Composition	DC	EC	Alt. A		Alt. B		Alt. C		Alt. D		Alt. E		Alt. F	
			Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50
Dry/ shade intolerant	75-90	45	49 (26)	53 (22)	49 (26)	54 (21)	47 (28)	48 (27)	55 (20)	67 (8)	52 (23)	60 (15)	50 (25)	56 (19)
Dry/ shade tolerant	5-20	55	51 (31)	47 (27)	50 (30)	45 (25)	53 (33)	52 (32)	45 (20)	33 (13)	48 (28)	40 (20)	50 (30)	44 (24)
Summed Total Amount of Variation			(57)	(49)	(56)	(46)	(61)	(59)	(45)	(21)	(51)	(35)	(55)	(43)

PVG = potential vegetation group; DC= desired condition; EC = existing condition

Under alternatives D and E, the projected percent of the dry upland forest potential vegetation group in shade tolerant species would be approximately 33 percent and 40 percent, respectively, at year 50, exceeding the desired conditions range of 5 to 20 percent. Under the other alternatives, the projected percent of the dry upland forest potential vegetation group in shade tolerant species would range from approximately 44 to 52 percent at year 50, exceeding the desired conditions range of 5 to 20 percent.

Alternative C would be the least effective alternative in achieving the desired conditions for species composition, with the projected percent of the dry upland forest potential vegetation group in each of the species composition tolerance classes varying from the desired condition ranges by approximately 59 percent at year 50. Alternative C would exhibit a lower percent of shade intolerant species classes and a higher percent of shade tolerant species classes at year 50.

Under alternative C, the projected percent of the dry upland forest potential vegetation group in shade intolerant species would be approximately 48 percent at year 50, while the shade tolerant species would be approximately 52 percent at year 50. This would be due to the decreased levels of timber harvest activities associated with alternative C resulting in more closed canopy stand conditions in the dry upland forest potential vegetation group.

A higher percent of the dry upland forest potential vegetation group in shade tolerant species would result in decreased ecological resilience. Shade tolerant tree species such as grand fir tend to have thinner bark, are less able to withstand fire, and are less adapted to frequent fire regimes. Shade tolerant tree species also tend to retain their lower branches, which decreases their crown base height, decreases the wind speed required to initiate a crown fire, and results in increased fire severity. Shade tolerant tree species such as grand fir also tend to be less drought-tolerant, making them more prone to moisture stress and less adapted to drier conditions. Species that are more prone to moisture stress are also more susceptible to attack by insects such as bark beetles because of a lack of natural defense mechanisms, such as the production of pitch.

Moist Upland Forest Potential Vegetation Group – Within the Wallowa-Whitman National Forest moist upland forest potential vegetation group, alternative D would most closely achieve desired conditions for species composition. Under alternative D, the projected percent of the moist upland forest potential vegetation group in each of the species composition tolerance classes would vary from the desired condition ranges by a summed total of approximately 12 percent at year 50. Alternative E would be the second most effective alternative in achieving the desired conditions for species composition, with the projected percent of species composition tolerance classes varying from the desired condition ranges by a summed total of approximately 13 percent at year 50. Alternatives D and E would result in the closest achievement of desired conditions for species composition in the Wallowa-Whitman moist upland forest potential vegetation group due to more open stand densities resulting from the increased levels of timber harvest activities associated with these alternatives. Under alternatives D and E, the percent of the moist upland forest potential vegetation group in shade intolerant species would increase by approximately 6 percent and 5 percent, respectively, over 50 years as the result of regeneration harvests and other timber harvest activities to approximately 33 percent and 32 percent, respectively, and within the desired condition range of 30 to 60 percent.

Table 272. Forested species composition, as a percent of the moist upland forest potential vegetation group (with amount of variation from desired condition range in parentheses) by alternative within the Wallowa-Whitman National Forest

Upland Forest PVG/ Species Composition	DC	EC	Alt. A		Alt. B		Alt. C		Alt. D		Alt. E		Alt. F	
			Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50
Moist/ shade intolerant	30-60	27	26 (4)	26 (4)	26 (4)	27 (3)	26 (4)	26 (4)	28 (2)	33 (0)	28 (2)	32 (0)	27 (3)	29 (1)
Moist/ mixed tolerance	20-40	27	27 (0)	27 (0)	27 (0)	26 (0)	27 (0)	27 (0)	27 (0)	25 (0)	26 (0)	25 (0)	27 (0)	25 (0)
Moist/ shade tolerant	10-30	46	47 (17)	47 (17)	46 (16)	46 (16)	47 (17)	47 (17)	45 (15)	42 (12)	46 (16)	43 (13)	46 (16)	45 (15)
Summed Total Amount of Variation			(21)	(21)	(20)	(19)	(21)	(21)	(17)	(12)	(18)	(13)	(19)	(16)

PVG = potential vegetation group; DC= desired condition; EC = existing condition

Alternatives A, B, and C would be the least effective alternatives in achieving the desired conditions for species composition, with the projected percent of the moist upland forest potential vegetation group in each of the species composition tolerance classes varying from the desired condition ranges by a summed total of approximately 19 to 21 percent at year 50. This would be due to the decreased levels of timber harvest activities associated with these alternatives. Under alternatives A, B, and C, the projected percent of the moist upland forest potential vegetation group in shade intolerant species would range from approximately 26 to 27 percent at year 50, falling below the desired condition range of 30 to 60 percent. Under all of the alternatives, the percent of the moist upland forest potential vegetation group in shade tolerant species would range from approximately 42 to 47 percent at year 50, exceeding the desired condition range of 10 to 30 percent. The high percent of the moist upland forest potential vegetation group in shade tolerant species would result in decreased ecological resiliency. Shade tolerant tree species tend to be less able to withstand fire due to thinner bark. These species also tend to retain their lower branches, which decreases their crown base height, decreases the wind speed required to initiate a crown fire, and results in increased fire severity. Shade tolerant tree species also tend to be less drought tolerant, making them less able to withstand moisture stress and more susceptible to attack by insects such as bark beetles because of a lack of natural defense mechanisms, such as the production of pitch.

Aspen

According to Shirley and Erickson (2001), a landscape approach to restoring aspen requires a variety of techniques, including the construction of large herbivore exclosures, prescribed fire, establishment of new aspen stands using containerized planting stock, simulation of natural refugia (jackstrawing), and the use of genetic variation data to guide management decisions. Shepperd (2004) states that vegetative regeneration of declining aspen can be initiated through manipulations that provide three critical elements defined as the aspen regeneration triangle: 1) hormonal stimulation, 2) proper growth environment, and 3) sucker protection. Soils and site productivity, competition from other vegetation, and the potential impact of browsing animals upon new regeneration should all be considered. Treatments may include doing nothing, removal of existing aspen trees, removal of competing conifers or other vegetation, prescribed burning, mechanical root stimulation (ripping), and browse protection (Shepperd 2004). The best available science should be used to guide the restoration and management of aspen.

Within all three national forests, alternative E would result in the greatest overall improvement in the health, vigor, and sustainability of aspen populations, followed by alternative F. Alternatives E and F would result in decreased conifer encroachment within aspen clones due to the increased number of acres of timber harvest activities associated with these alternatives. Alternative E would combine the greatest number of acres of conifer removal through timber harvest activities with the greatest number of acres of prescribed burning. While alternatives E and F would place restrictions on the harvesting of older trees, this restriction would not be anticipated to restrict aspen restoration activities substantially because conifers that are generally targeted for removal would be those which have encroached due to fire suppression (< 150 years old). Aspen are relatively shade-intolerant. Removal of conifer encroachment combined with prescribed burning would result in increased aspen regeneration, increased aspen densities, improved aspen health, growth, and vigor, and improved successional dynamics. However, under all of the alternatives, aspen regeneration would require protection from ungulate browsing for a minimum of approximately 10 to 20 years. Protection may include fencing, logs/downed woody debris (jackstrawing), or the use of chemical repellents to deter browsing by large ungulates.

Under alternative B, there would be no restrictions on the harvesting of trees 21 inches d.b.h. and greater to favor aspen. However, alternative B would contain fewer acres of timber harvest activities, in comparison with alternatives E and F, resulting in less acres of conifers removed and more closed stand densities. However, alternative B would contain approximately the same number of acres of prescribed burning as alternative F, which would result in some stimulation of aspen sprouting in areas with open stand densities.

Under alternative D, there would be no restrictions on the harvesting of trees 21 inches d.b.h. Alternative D would result in the greatest number of acres of timber harvest activities and the greatest increase in the percent of the landscape in open stand densities. The removal of conifer encroachment from aspen clones would result in improved aspen health, growth, and vigor and likely some improvement in aspen regeneration. Although alternative D emphasizes the utilization of woody material instead of burning as a fuel reduction activity within harvest units, the use of prescribed burning to stimulate aspen regeneration would not be prohibited. However, because aspen clones tend to occur as smaller, scattered patches across the landscape, prescribed burning solely for the purpose of increasing regeneration within aspen clones may be difficult to implement due to logistical considerations and costs. The amount of prescribed burning that is likely to occur in aspen clones under alternative D would be substantially less than under alternative E. Therefore, alternative D would be expected to result in substantially less aspen regeneration, in comparison to alternatives E and F.

Under alternative C, there would be an absolute restriction on the harvesting of trees 21 inches d.b.h. and greater. This alternative would limit the ability to remove larger diameter conifer encroachment in aspen clones. Alternative C would result in the greatest percent of the landscape in closed stand densities, resulting in decreased aspen health, growth, and vigor. Aspen are relatively shade-intolerant and require full sunlight for maximum sprouting. Although alternative C emphasizes the use of fire, aspen regeneration would be decreased due to the increased percent of the landscape in closed stand densities.

Whitebark Pine

Under all of the alternatives, the desired conditions for whitebark pine would be no net loss in whitebark pine habitat on National Forest System lands. Degraded habitat and connectivity would be restored wherever necessary, including in designated wilderness. Genetic diversity would be conserved across the landscape. Populations would exhibit an increase in age class diversity. The risk of mortality from mountain pine beetle and stand-replacing fire would be reduced. Resistance to white pine blister rust would be increased. Fire would be used as one tool to achieve these desired conditions. However, it would be important to minimize the negative impacts to whitebark pine resulting from fire suppression activities.

Under alternatives C, E, and F, additional areas would be allocated to MA 1B (PARWA) within the Wallowa-Whitman National Forest. Under alternative C, an additional 57,640 acres would be preliminarily recommended for designation and inclusion in the National Wilderness Preservation System. Under alternatives E and F, approximately 9,530 acres of PARWA in the Twin Mountain area would be designated. Until a decision is made by Congress, this area would be managed to protect wilderness characteristics. The designation of PARWA may have a negative impact on the ability to restore whitebark pine in this area by limiting the ability to conduct more active management, such as tree harvesting. Restoration would have to rely heavily on burning, which could result in increased mortality of whitebark pine. The use of fire alone would not allow managers to select for rust resistance in whitebark pine populations and could actually result in the mortality of some rust-resistant trees. Large, high-severity fires have the potential to severely reduce or even eliminate cone-bearing whitebark pine across an extensive landscape (Aubry et al. 2008). If a fire becomes intense and widespread enough that most or all cone-bearing whitebark pines within the fire perimeter are killed, seed from unburned stands within nutcracker caching range may be available to regenerate in the burned area. If there is no such seed source, natural regeneration would be extremely slow or whitebark pine may become locally extirpated (Aubry et al. 2008).

Restrictions on the harvesting of larger diameter conifers could potentially affect the ability to conduct restoration treatments within whitebark pine populations by limiting the removal of some competing vegetation. Under alternatives B and C, there would be restrictions on the harvesting of trees 21 inches d.b.h. and greater. These alternatives would limit the ability to remove larger diameter trees competing with whitebark pine. While alternatives E and F would place restrictions on the harvesting of older trees, this restriction would not be anticipated to restrict whitebark pine restoration activities substantially because conifers that are generally targeted for removal would be those which have encroached due to fire suppression (less than approximately 150 years old). Under alternative D, there would be no restrictions on the harvesting of trees 21 inches d.b.h.

Stand Density Effects

Malheur National Forest

Table 273, table 274, and table 275 display forested stand density classes as a percent of each upland forest potential vegetation group by alternative projected over 50 years within the Malheur National Forest.

Cold Upland Forest Potential Vegetation Group – Within the Malheur National Forest cold upland forest potential vegetation group, none of the alternatives would achieve the desired conditions for the percent of the cold upland forest potential vegetation group in open and closed forest at year 50 due to the large amount of variation between existing and desired conditions. Currently, approximately 88 percent of the cold upland forest potential vegetation group is in open stand densities. The desired condition would be to reduce the percent of the cold upland forest potential vegetation group in open stand densities to 20 to 30 percent and increase the percent of the cold upland forest potential vegetation group in closed stand densities to 65 to 80 percent. Under all of the alternatives, the percent of the cold upland forest potential vegetation group in open forest would remain above the desired condition range at year 50. Much of this would be due to mortality from fire, insects, and disease exceeding growth rates. Much of the cold upland forest potential vegetation group is located within existing or proposed wilderness, roadless, or backcountry areas. Only approximately 5 to 10 percent of the harvest activities would occur within the cold upland forest potential vegetation group.

Alternatives A and C would result in the closest achievement of the desired conditions for stand densities at year 50 because of the lower levels of timber harvest activities associated with these alternatives. The projected percent of the cold upland forest potential vegetation group in open and closed forest under these alternatives would vary from the desired condition ranges by a summed total of approximately 31 percent. Alternative D would be the least effective alternative in achieving the desired conditions for stand densities within the cold upland forest potential vegetation group. Under alternative D, the projected percent of the cold upland forest potential vegetation group in open and closed forest would vary from the desired condition ranges by a summed total of approximately 43 percent at year 50.

Table 273. Forested stand density class, as a percent of the cold upland forest potential vegetation group (with amount of variation from desired condition range in parentheses) by alternative within the Malheur National Forest

Upland Forest PVG/ Stand Density	DC	EC	Alt. A		Alt. B		Alt. C		Alt. D		Alt. E		Alt. F	
			Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50
Cold/ open	20-30	88	46 (16)	48 (18)	53 (23)	49 (19)	46 (16)	48 (18)	53 (23)	54 (24)	51 (21)	53 (23)	49 (19)	50 (20)
Cold/ closed	65-80	12	54 (11)	52 (13)	47 (18)	51 (14)	54 (11)	52 (13)	47 (18)	46 (19)	49 (16)	47 (18)	51 (14)	50 (15)
Summed Total Amount of Variation			(27)	(31)	(41)	(33)	(27)	(31)	(41)	(43)	(37)	(41)	(33)	(35)

PVG = potential vegetation group; DC= desired condition; EC = existing condition

Dry Upland Forest Potential Vegetation Group – Within the Malheur National Forest dry upland forest potential vegetation group, alternative D would result in the closest achievement of the desired conditions for stand densities. Under alternative D, the projected percent of the dry upland forest potential vegetation group in open and closed forest would vary from the desired condition ranges by a summed total of approximately 16 percent at year 50. Alternative E would be the second most effective alternative in achieving the desired conditions for stand densities, with the projected percent of the dry upland forest potential vegetation group in open and closed forest varying from the desired condition ranges by a summed total of approximately 22 percent at year 50. Alternatives D and E would result in the greatest increase in ecological resiliency within the Malheur dry upland forest potential vegetation group by decreasing stand densities and creating a more open forest structure that more closely resembles the historical forest structure that existed prior to interruption of the historical frequent fire regime. A more open forest structure would result in decreased competition between trees for moisture, nutrients, and sunlight, increased tree health, growth, and vigor, decreased risk of insect attack and mortality, improved forest health, increased heterogeneity, decreased crown continuity, and decreased fire severity. Decreased stand densities would also result in increased regeneration of more shade intolerant tree species and closer achievement of the desired conditions for species composition within the Malheur National Forest dry upland forest potential vegetation group. The increased percent of the dry upland forest potential vegetation group in open stand densities would also aid in the reintroduction of low severity surface fire into the ecosystem.

Because alternatives D and E would result in an increased percent of the dry upland forest potential vegetation group in open stand densities as the result of an increased number of acres of timber harvest activities, there would be an increase in opportunities to manage wildfires for resource benefits, compared to alternative C. More open stand densities would result in decreased fire-related mortality and an increased likelihood of achieving other desired conditions. As more fire is reintroduced into the ecosystem, ecosystem processes would be restored and the dry upland forest potential vegetation group would become more ecologically resilient.

Table 274. Forested stand density classes, as a percent of the dry upland forest potential vegetation group (with amount of variation from desired condition range in parentheses) by alternative within the Malheur National Forest

Upland Forest PVG/ Stand Density	DC	EC	Alt. A		Alt. B		Alt. C		Alt. D		Alt. E		Alt. F	
			Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50
Dry/open	80-90	60	55 (25)	57 (23)	56 (24)	56 (24)	52 (28)	51 (29)	64 (16)	72 (8)	61 (19)	69 (11)	56 (24)	59 (21)
Dry/closed	5-20	40	45 (25)	43 (23)	44 (24)	44 (24)	49 (29)	50 (30)	36 (16)	28 (8)	39 (19)	31 (11)	44 (24)	41 (21)
Summed Total Amount of Variation			(50)	(46)	(48)	(48)	(57)	(59)	(32)	(16)	(38)	(22)	(48)	(42)

PVG = potential vegetation group; DC= desired condition; EC = existing condition

Alternative C would be the least effective alternative in achieving the desired conditions for stand densities, with the projected percent of the dry upland forest potential vegetation group in open and closed forest varying from the desired condition ranges by a summed total of approximately 59 percent at year 50. Under alternative C, approximately half of the Malheur National Forest dry upland forest potential vegetation group would be in closed stand density conditions at year 50. Increased stand densities would result in increased crown continuity, increased fuel loading, decreased wind speeds required to initiate and sustain a crown fire, and increased fire severity. Increased stand densities would also result in regeneration of more shade tolerant/fire intolerant tree species. Additionally, increased stand densities would result in increased competition between trees for moisture, nutrients, and sunlight, decreased tree health, growth, and vigor, and grow larger trees at a slower rate. Smaller diameter trees tend to have thinner bark that is less resistant to fire mortality.

Alternative C would rely mainly on the use of fire (planned and unplanned ignitions) to reduce stand densities. Rather than harvesting trees to reduce tree densities, trees would be thinned by fire under alternative C. Due to the high percent of the landscape in closed stand densities and the potential for very high levels of mortality, the window or time frame under which fire could and would be managed to achieve the desired conditions for stand densities, structural stages, and species composition would be limited and unrealistic based on current conditions and the inability to reintroduce low severity fire effects. Additionally, the levels of smoke emissions generated under alternative C would be substantially increased, further limiting burn windows and the amount of acres that could be burned due to the increased levels of particulate matter generated. Impacts to public health from the likelihood of exceeding air quality standards would also substantially limit the amount of acres that could be burned under alternative C. Alternative C would likely result in increased fire severity, decreased ecological resiliency, and loss of key ecosystem components and functions due to scope and scale of fire severity outside that which historically occurred within the dry upland forest potential vegetation group. The result would be substantially fewer acres treated and restored by fire under alternative C.

Moist Upland Forest Potential Vegetation Group – Within the Malheur National Forest moist upland forest potential vegetation group, alternatives A, B, C, and F would all achieve the desired conditions for stand densities. The projected percent of the moist upland forest potential vegetation group in open and closed forest would be within the desired condition ranges at year

50. Under alternative E, the projected percent of the moist upland forest potential vegetation group of open and closed forest would vary from the desired condition ranges by approximately 1 percent at year 50. Alternative D would be the least effective alternative in achieving the desired conditions for stand densities within the moist upland forest potential vegetation group. Under alternative D, the projected percent of the moist upland forest potential vegetation group in open and closed forest would vary from the desired condition ranges by a summed total of approximately 10 percent at year 50.

Table 275. Forested stand density classes, as a percent of the moist upland forest potential vegetation group (with amount of variation from desired condition range in parentheses) by alternative within the Malheur National Forest

Upland Forest PVG/ Stand Density	DC	EC	Alt. A		Alt. B		Alt. C		Alt. D		Alt. E		Alt. F	
			Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50
Moist/open	30-40	58	33 (0)	35 (0)	38 (0)	33 (0)	31 (0)	33 (0)	41 (1)	45 (5)	36 (0)	41 (1)	34 (0)	37 (0)
Moist/closed	60-80	42	67 (0)	65 (0)	62 (0)	67 (0)	69 (0)	68 (0)	58 (2)	55 (5)	64 (0)	60 (0)	66 (0)	63 (3)
Summed Total Amount of Variation			(0)	(0)	(0)	(0)	(0)	(0)	(3)	(10)	(0)	(1)	(0)	(3)

PVG = potential vegetation group; DC= desired condition; EC = existing condition

Umatilla National Forest

Table 276, table 277, and table 278 display forested stand density classes as a percent of each upland forest potential vegetation group by alternative projected over 50 years within the Umatilla National Forest.

Cold Upland Forest Potential Vegetation Group – Within the Umatilla National Forest cold upland forest potential vegetation group, none of the alternatives would achieve the desired conditions for the percent of the cold upland forest potential vegetation group in open and closed forest at year 50. Under all of the alternatives, the percent of the cold upland forest potential vegetation group in open forest would remain above the desired condition range at year 50. Much of this would be due to mortality from fire, insects, and disease exceeding growth rates. Much of the cold upland forest potential vegetation group is located within existing or proposed wilderness, roadless, or backcountry areas. Only approximately 5 to 10 percent of the harvest activities would occur within the cold upland forest potential vegetation group.

Alternatives C and A would result in the closest achievement of desired conditions for stand densities at year 50 due to lower levels of timber harvest activities associated with these alternatives. The projected percent of the cold upland forest potential vegetation group in open and closed forest under each of these alternatives would vary from the desired condition ranges by a summed total of approximately 34 percent and 35 percent, respectively, at year 50. However, Alternatives B and F would vary from the desired condition ranges by a summed total of approximately 37 percent at year 50.

Table 276. Forested stand density classes, as a percent of the cold upland forest potential vegetation group (with amount of variation from desired condition range in parentheses) by alternative within the Umatilla National Forest

Upland Forest PVG/ Stand Density	DC	EC	Alt. A		Alt. B		Alt. C		Alt. D		Alt. E		Alt. F	
			Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50
Cold/ open	20-30	44	34 (4)	50 (20)	35 (5)	51 (21)	35 (5)	50 (20)	39 (9)	59 (29)	38 (8)	57 (27)	36 (6)	51 (21)
Cold/ closed	65-80	56	65 (0)	50 (15)	65 (0)	49 (16)	65 (0)	51 (14)	60 (5)	41 (24)	62 (3)	43 (22)	64 (1)	49 (16)
Summed Total Amount of Variation			(4)	(35)	(5)	(37)	(5)	(34)	(14)	(53)	(11)	(49)	(7)	(37)

PVG = potential vegetation group; DC= desired condition; EC = existing condition

Alternative D would be the least effective alternative in achieving the desired conditions for stand densities within the cold upland forest potential vegetation group. Under alternative D, the projected percent of the cold upland forest potential vegetation group in open and closed forest would vary from the desired condition ranges by a summed total of approximately 53 percent at year 50.

Dry Upland Forest Potential Vegetation Group – Within the Umatilla National Forest dry upland forest potential vegetation group, none of the alternatives would achieve the desired conditions for stand densities due to the substantial amount of variation between the existing and desired conditions. Historically, this fire regime was characterized by more frequent fire; therefore this potential vegetation group has experienced a greater number of missed fires.

Table 277. Forested stand density classes, as a percent of the dry upland forest potential vegetation group (with amount of variation from desired condition range in parentheses) by alternative within the Umatilla National Forest

Upland Forest PVG/ Stand Density	DC	EC	Alt. A		Alt. B		Alt. C		Alt. D		Alt. E		Alt. F	
			Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50
Dry/open	80-90	30	46 (34)	60 (20)	45 (35)	59 (21)	39 (41)	49 (31)	60 (20)	77 (3)	55 (25)	70 (10)	47 (33)	63 (17)
Dry/closed	5-20	70	54 (34)	40 (20)	55 (35)	41 (21)	61 (41)	52 (32)	40 (20)	23 (3)	45 (25)	30 (10)	53 (33)	38 (18)
Summed Total Amount of Variation			(68)	(40)	(70)	(42)	(82)	(63)	(40)	(6)	(50)	(20)	(66)	(35)

PVG = potential vegetation group; DC= desired condition; EC = existing condition

Alternative D would result in the closest achievement of the desired conditions for stand densities due to the increased levels of timber harvest activities associated with this alternative. Under alternative D, the projected percent of the dry upland forest potential vegetation group in open and closed forest would vary from the desired condition ranges by a summed total of approximately 6 percent at year 50. Alternative E would be the second most effective alternative in achieving the desired conditions for stand densities, with the projected percent of the dry upland forest potential vegetation group varying from the desired condition ranges by a summed total of approximately 20 percent at year 50. Alternatives D and E would result in the greatest increase in ecological resiliency within the Umatilla dry upland forest potential vegetation group by decreasing stand densities and creating a more open forest structure that more closely resembles the historical forest structure that existed prior to interruption of the historical frequent fire regime. A more open forest structure would result in decreased competition between trees for moisture, nutrients, and sunlight, increased tree health, growth, and vigor, decreased risk of insect attack and mortality, improved forest health, increased heterogeneity, decreased crown continuity, and decreased fire severity. Decreased stand densities would also result in increased regeneration of more shade intolerant tree species and closer achievement of the desired conditions for species composition within the dry upland forest potential vegetation group.

The increased percent of the dry upland forest potential vegetation group in open stand densities would also aid in the reintroduction of low severity surface fire into the ecosystem. Because alternatives D and E would result in an increased percent of the dry upland forest potential vegetation group in open stand densities as the result of an increased number of acres of timber harvest activities, there would be an increase in opportunities to manage wildfires for resource benefits, compared to alternative C. More open stand densities would result in decreased fire-related mortality and an increased likelihood of achieving other desired conditions. As more fire is reintroduced into the ecosystem, ecosystem processes would be restored and the dry upland forest potential vegetation group would become more ecologically resilient.

Alternative C would be the least effective alternative in achieving the desired conditions for stand densities, with the projected percent of the dry upland forest potential vegetation group in open and closed forest varying from the desired condition ranges by a summed total of approximately 63 percent at year 50. Under alternative C, over half of the Umatilla National Forest dry upland forest potential vegetation group would be in closed stand density conditions at year 50. Increased stand densities would result in increased crown continuity, increased fuel loading, decreased wind speeds required to initiate and sustain a crown fire, and increased fire severity. Increased stand densities would also result in regeneration of more shade tolerant/fire intolerant tree species. Additionally, increased stand densities would result in increased competition between trees for moisture, nutrients, and sunlight, decreased tree health, growth, and vigor, and grow larger trees at a slower rate. Smaller diameter trees tend to have thinner bark that is less resistant to fire mortality.

Alternative C would rely mainly on the use of fire (planned and unplanned ignitions) to reduce stand densities. Rather than harvesting trees, trees would be thinned by fire under alternative C. Due to the high percent of the landscape in closed stand densities and the potential for very high levels of mortality, the window or time frame under which fire could and would be managed to achieve the desired conditions for stand densities, structural stages, and species composition would be limited and unrealistic based on current conditions and the inability to reintroduce low severity fire effects. Additionally, the levels of smoke emissions and particulate matter generated under alternative C would be substantially increased, further limiting burn windows and the amount of acres that could be burned due to impacts to public health from the likelihood of exceeding air quality standards. Alternative C would likely result in increased fire severity, decreased ecological resiliency, and loss of key ecosystem components and functions due to scope and scale of fire severity outside that which historically occurred within the dry upland forest potential vegetation group. The result would be substantially fewer acres treated and restored by fire under alternative C.

Moist Upland Forest Potential Vegetation Group – Within the Umatilla moist upland forest potential vegetation group, alternatives A, B, C, and F would achieve the desired conditions for stand densities due to the lower levels of timber harvest activities associated with these alternatives. The projected percent of the moist upland forest potential vegetation group in open and closed forest would be within the desired condition ranges at year 50.

Table 278. Forested stand density classes, as a percent of the moist upland forest potential vegetation group (with amount of variation from desired condition range in parentheses) by alternative within the Umatilla National Forest

Upland Forest PVG/ Stand Density	DC	EC	Alt. A		Alt. B		Alt. C		Alt. D		Alt. E		Alt. F	
			Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50
Moist/open	30-40	55	35 (0)	39 (0)	35 (0)	37 (0)	35 (0)	36 (0)	41 (1)	49 (9)	39 (0)	45 (5)	36 (0)	38 (0)
Moist/closed	60-80	45	65 (0)	61 (0)	65 (0)	63 (0)	66 (0)	65 (0)	59 (1)	51 (9)	61 (0)	54 (6)	64 (0)	62 (0)
Summed Total Amount of Variation			(0)	(0)	(0)	(0)	(0)	(0)	(2)	(18)	(0)	(11)	(0)	(0)

PVG = potential vegetation group; DC= desired condition; EC = existing condition

Under alternative E, the projected percent of the moist upland forest potential vegetation group in open and closed forest would vary from the desired condition ranges by a summed total of approximately 11 percent at year 50.

Alternative D would be the least effective alternative in achieving the desired conditions for stand densities within the moist upland forest potential vegetation group due to the increased levels of timber harvest activities associated with this alternative. Under alternative D, the projected percent of the moist upland forest potential vegetation group in open and closed forest would vary from the desired condition ranges by a summed total of approximately 18 percent at year 50.

Wallowa-Whitman National Forest

Table 279, table 280, and table 281 display forested stand density classes as a percent of each upland forest potential vegetation group by alternative projected over 50 years within the Wallowa-Whitman National Forest.

Cold Upland Forest Potential Vegetation Group – Under all of the alternatives, the projected percent of the cold upland forest potential vegetation group in open forest would remain above the desired condition range at year 50. Much of this would be due to mortality from fire, insects, and disease exceeding growth rates. Much of the cold upland forest potential vegetation group is located within existing or proposed wilderness, roadless, or backcountry areas. Only approximately 5 to 10 percent of the harvest activities would occur within the cold upland forest potential vegetation group.

Table 279. Forested stand density classes, as a percent of the cold upland forest potential vegetation group (with amount of variation from desired condition range in parentheses) by alternative within the Wallowa-Whitman National Forest

Upland Forest PVG/ Stand Density	DC	EC	Alt. A		Alt. B		Alt. C		Alt. D		Alt. E		Alt. F	
			Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50
Cold/ open	20-30	62	48 (18)	47 (17)	48 (18)	46 (16)	48 (18)	46 (16)	52 (22)	51 (21)	50 (20)	50 (20)	48 (18)	47 (17)
Cold/ closed	65-80	38	52 (13)	53 (12)	52 (13)	53 (12)	52 (13)	54 (11)	48 (17)	49 (16)	50 (15)	50 (15)	51 (14)	53 (12)
Summed Total Amount of Variation			(31)	(29)	(31)	(28)	(31)	(27)	(39)	(37)	(35)	(35)	(32)	(29)

PVG = potential vegetation group; DC= desired condition; EC = existing condition

Alternatives A, B, C and F would result in the closest achievement of desired conditions for stand densities at year 50. The projected percent of the cold upland forest potential vegetation group in open and closed forest under these alternatives would vary from the desired condition ranges by a summed total of approximately 27 to 29 percent at year 50.

Alternatives D and E would be the least effective alternatives in achieving the desired conditions for stand densities within the cold upland forest potential vegetation group. Under alternatives D and E, the projected percent of the cold upland forest potential vegetation group in open and closed forest would vary from the desired condition ranges by a summed total of approximately 37 percent and 35 percent, respectively, at year 50.

Dry Upland Forest Potential Vegetation Group – Within the Wallowa-Whitman dry upland forest potential vegetation group, the alternatives would result in a substantial difference in the percent of dry upland forest potential vegetation group in open and closed forest because more timber harvest would occur in the dry upland forest potential vegetation group. Approximately 60 to 90 percent of the harvest activities would occur within the dry upland forest potential vegetation group. Additionally, stand densities within the dry upland forest potential vegetation group tend to exhibit a greater amount of departure from the HRV. Historically, this fire regime was characterized by more frequent fire and therefore this forest type has experienced a greater number of missed fires.

Alternative D would result in the closest achievement of the desired conditions for stand densities. Under alternative D, the projected percent of the dry upland forest potential vegetation group in open and closed forest would vary from the desired condition ranges by a summed total of approximately 6 percent at year 50. Alternative E would be the second most effective alternative in achieving the desired conditions for stand densities, with the projected percent of the dry upland forest potential vegetation group varying from the desired condition ranges by a summed total of approximately 22 percent at year 50. Alternatives D and E would most closely achieve the desired conditions for stand densities at year 50 because of the increased levels of timber harvest activities associated with these alternatives and would result in the greatest increase in ecological resiliency by decreasing stand densities and creating a more open forest structure. This more open forest structure more closely resembles the forest structure that existed prior to interruption of the historical frequent fire regime. A more open forest structure would result in decreased competition between trees for moisture, nutrients, and sunlight, increased tree health, growth, and vigor, decreased risk of insect attack and mortality, improved forest health, increased heterogeneity, decreased crown continuity, and decreased fire severity. Decreased stand densities would also result in increased regeneration of more shade intolerant tree species and closer achievement of the desired conditions for species composition within the dry upland forest potential vegetation group.

Table 280. Forested stand density classes, as a percent of the dry upland forest potential vegetation group (with amount of variation from desired condition range in parentheses) by alternative within the Wallowa-Whitman National Forest

Upland Forest PVG/ Stand Density	DC	EC	Alt. A		Alt. B		Alt. C		Alt. D		Alt. E		Alt. F	
			Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50
Dry/open	80-90	32	44 (36)	56 (24)	44 (36)	56 (24)	39 (41)	46 (34)	57 (23)	77 (3)	52 (28)	69 (11)	46 (34)	59 (21)
Dry/closed	5-20	67	56 (36)	44 (24)	56 (36)	44 (24)	61 (41)	54 (34)	43 (23)	23 (3)	48 (28)	31 (11)	54 (34)	41 (21)
Summed Total Amount of Variation			(72)	(48)	(72)	(48)	(82)	(68)	(46)	(6)	(56)	(22)	(68)	(42)

PVG = potential vegetation group; DC= desired condition; EC = existing condition

The increased percent of the dry upland forest potential vegetation group in open stand densities would also aid in the reintroduction of low severity surface fire into the ecosystem. Because alternatives D and E would result in an increased percent of the dry upland forest potential vegetation group in open stand densities as the result of an increased number of acres of timber harvest activities, there would be an increase in opportunities to manage wildfires for resource benefits, compared to alternative C. More open stand densities would result in decreased fire-related mortality and an increased likelihood of achieving other desired conditions. As more fire is reintroduced into the ecosystem, ecosystem processes would be restored and the dry upland forest potential vegetation group would become more ecologically resilient.

Alternative C would be the least effective alternative in achieving the desired conditions for stand densities, with the projected percent of the dry upland forest potential vegetation group in open and closed forest varying from the desired condition ranges by a summed total of approximately 68 percent at year 50. Under alternative C, over half of the Wallowa-Whitman dry upland forest potential vegetation group would be in closed stand density conditions at year 50. Increased stand densities would result in increased crown continuity, increased fuel loading, decreased wind speeds required to initiate and sustain a crown fire, and increased fire severity. Increased stand densities would also result in regeneration of more shade tolerant/fire intolerant tree species. Additionally, increased stand densities would result in increased competition between trees for moisture, nutrients, and sunlight, decreased tree health, growth, and vigor, and grow larger trees at a slower rate Rather than harvesting trees, alternative C would rely mainly on the use of fire (planned and unplanned ignitions) to thin trees and reduce stand densities. Due to the high percent of the landscape in closed stand densities and the potential for very high levels of mortality, the window or time frame under which fire could and would be managed to achieve the desired conditions for stand densities, structural stages, and species composition would be limited and unrealistic based on current conditions and the inability to reintroduce low severity fire effects.

Additionally, the levels of smoke emissions generated under alternative C would be substantially increased, further limiting burn windows and the amount of acres that could be burned due to the increased levels of particulate matter generated. Impacts to public health from the likelihood of exceeding air quality standards would also substantially limit the amount of acres that could be burned under alternative C. Alternative C would likely result in increased fire severity, decreased ecological resiliency, and loss of key ecosystem components and functions due to scope and scale of fire severity outside that which historically occurred within the dry upland forest potential vegetation group. The result would be substantially fewer acres treated and restored by fire under alternative C.

Moist Upland Forest Potential Vegetation Group – Within the Wallowa-Whitman moist upland forest potential vegetation group, alternative C would result in closest achievement of the desired conditions for stand densities. Under alternative C, the projected percent of the moist upland forest potential vegetation group in open and closed forest would be within the desired condition ranges at year 50. Alternatives B and A would be the second and third most effective alternatives in achieving the desired conditions for stand densities. Under alternatives B and A, the projected percent of the moist upland forest potential vegetation group in open and closed forest would vary from the desired condition ranges by a summed total of approximately 2 percent and 4 percent, respectively, at year 50.

Table 281. Forested stand density classes, as a percent of the moist upland forest potential vegetation group (with amount of variation from desired condition range in parentheses) by alternative within the Wallowa-Whitman National Forest

Upland Forest PVG/ Stand Density	DC	EC	Alt. A		Alt. B		Alt. C		Alt. D		Alt. E		Alt. F	
			Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50	Yr. 20	Yr. 50
Moist/open	30-40	41	28 (2)	42 (2)	28 (2)	41 (1)	26 (4)	39 (0)	36 (0)	53 (13)	33 (0)	49 (9)	29 (1)	43 (3)
Moist/closed	60-80	59	72 (0)	58 (2)	72 (0)	59 (1)	74 (0)	61 (0)	64 (0)	47 (13)	66 (0)	51 (9)	70 (0)	57 (3)
Summed Total Amount of Variation			(2)	(4)	(2)	(2)	(4)	(0)	(0)	(26)	(0)	(18)	(1)	(6)

PVG = potential vegetation group; DC= desired condition; EC = existing condition

Alternative D would be the least effective alternative in achieving the desired conditions for stand densities within the moist upland forest potential vegetation group, with the projected percent of the moist upland forest potential vegetation group in open and closed forest varying from the desired condition ranges by a summed total of approximately 26 percent at year 50.

Fire Regime Condition Class Effects

The changes in fire regime condition class under each of the alternatives would vary depending on the combined amount of management activities, including prescribed fire, timber harvest, mechanical fuels treatments, and natural changes such as tree growth and succession, insect and disease-related mortality, and mortality due to wildfire.

The departure values for fire regime condition class are based on a score of zero to 100, with a departure score of zero indicating the least amount of departure between the existing conditions and the HRV and a departure score of one hundred indicating the maximum amount of departure between the existing conditions and the HRV. A score of less than 33 would be considered low departure from the HRV (condition class 1). A departure score of 33 to 66 would be considered moderate departure from the HRV (condition class 2). A departure score of greater than 66 would be considered high departure from the HRV (condition class 3).

Malheur National Forest

Table 282, table 283, and table 284 display the fire regime condition class departure scores by potential vegetation group under each of the alternatives projected over 50 years within the Malheur National Forest.

Cold Upland Forest Potential Vegetation Group – Within the Malheur cold upland forest potential vegetation group, all of the alternatives would result in achievement of the desired conditions for fire regime condition class (class 1) at year 50. Under all of the alternatives, the fire regime condition class departure scores would range from approximately 14 to 26 at year 50. Under all of the alternatives, fire regime condition class departure scores would be reduced because vegetation structure and fuels composition would be altered as the result of mortality caused by wildfire, insects, and/or disease. Much of the cold upland forest potential vegetation group is located within existing or proposed wilderness, roadless, or backcountry areas. Only approximately 5 to 10 percent of the harvest activities would occur within the cold upland forest potential vegetation group.

Table 282. Malheur National Forest fire regime condition class departure score (0 to 100) for the cold upland forest potential vegetation group

Timeframe	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F
Existing Condition	54	54	54	54	54	54
Year 20	21	25	20	21	21	20
Year 50	14	17	15	26	24	23

Dry Upland Forest Potential Vegetation Group – Within the Malheur dry upland forest potential vegetation group, all of the alternatives would result in moderate departure of fire regime condition class (class 2) at year 50 due to the relatively large amount of departure between existing conditions and the HRV. However, alternatives D and E would result in the greatest improvement in fire regime condition class departure scores at year 50. Under alternatives D and E, the fire regime condition class departure scores would be approximately 33 and 36, respectively, at year 50. Under Alternative D, vegetation within the dry upland forest potential vegetation group would be very close to low departure (fire regime condition class 1) at year 50 at the scale of the Malheur National Forest. However, condition class 1 may be achieved sooner in some individual watersheds that currently have significant amounts of large mid-aged forests that are more than 100 years old. For many areas that currently have 80 to 100 year old forests, it would take more than 50 years for those forests to grow into the larger and older age and size classes commonly associated with the definition of old forest.

Under alternatives D and E, departure scores would be lower due to the increased levels of timber harvest activities, mechanical fuels treatments, and/or prescribed burning associated with these alternatives. Alternatives D and E would also show improvement at a faster rate because of the increased harvesting of smaller trees within the old forest, which may decrease mortality in older age classes due to decreased moisture stress and fire severity and modification of closed canopy to open canopy. However, alternative D would not include prescribed burning outside of harvest units and would include decreased amounts of prescribed burning within harvest units. Under alternative D, the majority of fuels treatments within harvest units would be accomplished by removal or crushing instead of burning.

Table 283. Malheur National Forest fire regime condition class departure score (zero to 100) for the dry upland forest potential vegetation group

Timeframe	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F
Existing Condition	62	62	62	62	62	62
Year 20	55	53	56	47	50	53
Year 50	47	45	48	33	36	43

Because alternative E includes the reintroduction of fire to the ecosystem in addition to reducing the amount of departure in the dry upland forest vegetation, this alternative would be expected to result in increased ecological resiliency in the Malheur dry upland forest potential vegetation group because fuel composition, fire frequency, severity, pattern, and other associated disturbances would more closely resemble the HRV. Under alternative E, the risk of fire behavior, effects and associated disturbances would be similar to those that occurred prior to interruption of the historical low severity frequent fire regime. Although the risk of loss of key ecosystem components, such as native species, large trees, and soil, would be lower under both alternatives D and E, the lack of fire under alternative D would inhibit other ecological processes. Fire is essential to nutrient cycling in fire-adapted ecosystems. Fire has a fertilizer effect on the soil by increasing ammonium levels and microbial nitrogen mineralization, resulting in increased nutrient levels in both understory and overstory vegetation. Fire rejuvenates desirable grasses, depending on the species response to disturbance (i.e., sprouters, prolific seeders, and species with strong rhizome extension respond favorably to fire). Especially in combination with reduced stand densities, fire results in changes in the microclimate on the forest floor, specifically increased sunlight penetration, increased soil temperatures, and increased understory productivity. Fire has been shown to result in significant increases in herbaceous biomass, species richness, and understory productivity and diversity. Depending on timing, fire may also increase seedling establishment by aiding in seedbed and site preparation. Fire would also aid in the creation of openings for regeneration.

Under alternative C, the fire regime condition class departure score would be approximately 48 at year 50, the highest fire regime condition class departure score among alternatives. Conditions would be more highly departed from the HRV under alternative C due to increased stand densities and altered species compositions resulting from the lower levels of timber harvest and prescribed burning associated with this alternative. Vegetation characteristics and other conditions would least resemble the HRV under alternative C, resulting in decreased ecological resiliency in the Malheur dry upland forest potential vegetation group. The risk of loss of key ecosystem components, such as native species, large trees, and soil, would be greatest under alternative C due to an increased risk of uncharacteristically severe fire behavior.

Moist Upland Forest Potential Vegetation Group – Within the Malheur moist upland forest potential vegetation group, all of the alternatives would result in achievement of the desired conditions for fire regime condition class (class 1) at year 50.This is because the degree of departure between the existing conditions and the HRV is relatively small. Under all of the alternatives, the fire regime condition class departure scores would range from approximately 13 to 19 at year 50.

Table 284. Malheur National Forest fire regime condition class departure score (zero to 100) for the moist upland forest potential vegetation group

Timeframe	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F
Existing Condition	36	36	36	36	36	36
Year 20	23	22	24	17	20	23
Year 50	19	17	18	13	13	13

Umatilla National Forest

Table 285, table 286, and table 287 display the fire regime condition class departure scores by potential vegetation group under each of the alternatives projected over 50 years within the Umatilla National Forest.

Cold Upland Forest Potential Vegetation Group – Within the Umatilla cold upland forest potential vegetation group, all of the alternatives would result in moderate departure of fire regime condition class (condition class 2) at year 50 . Under all of the alternatives, the fire regime condition class departure scores would range from approximately 39 to 50 at year 50. Under all of the alternatives, fire regime condition class departure scores would be reduced from existing conditions because vegetation structure and fuels composition would be altered as the result of mortality caused by wildfire, insects, and/or disease. Much of the cold upland forest potential vegetation group is located within existing or proposed wilderness, roadless, or backcountry areas. Only approximately 5 to 10 percent of the harvest activities would occur within the cold upland forest potential vegetation group.

Table 285. Umatilla National Forest fire regime condition class departure score (zero-100) for the cold upland forest potential vegetation group

Timeframe	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F
Existing Condition	60	60	60	60	60	60
Year 20	56	55	57	49	50	53
Year 50	48	46	50	39	39	43

Dry Upland Forest Potential Vegetation Group – Within the Umatilla dry upland forest potential vegetation group, all of the alternatives would result in moderate departure of fire regime condition class (class 2) at year 50 due to the relatively large amount of departure between the existing conditions and the HRV. However, alternatives D and E would result in the greatest improvement in fire regime condition class departure scores at year 50. Under alternatives D and E, the fire regime condition class departure scores would be approximately 39 at year 50. Under alternatives D and E, vegetation within the dry upland forest potential vegetation group would be close to achieving low departure from the HRV (condition class 1) at the scale of the Umatilla National Forest. However, condition class 1 may be achieved sooner in some individual watersheds that currently have significant amounts of large mid-aged forests that are more than 100 years old. For many areas that currently have 80 to 100 year old forests, it would take more than 50 years for those forests to grow into the larger and older age and size classes commonly associated with the definition of old forest.

Table 286. Umatilla National Forest fire regime condition class departure score (zero-100) for the dry upland forest potential vegetation group

Timeframe	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F
Existing Condition	60	60	60	60	60	60
Year 20	56	55	57	49	50	53
Year 50	48	46	50	39	39	43

Under alternatives D and E, departure scores would be lower due to the increased levels of timber harvest activities, mechanical fuels treatments, and/or prescribed burning associated with these alternatives. Alternatives D and E would also show improvement at a faster rate because of the increased harvesting of smaller trees within old forest, which may decrease mortality in older age classes (due to decreased moisture stress and fire severity) and modification of closed canopy to open canopy. However, Alternative D would not include prescribed burning outside of harvest units and would include decreased amounts of prescribed burning within harvest units. Under alternative D, the majority of fuels treatments within harvest units would be accomplished by removal or crushing instead of burning.

Because alternative E includes the reintroduction of fire to the ecosystem in addition to reducing the amount of departure in the dry upland forest vegetation, alternative E would be expected to result in increased ecological resiliency in the Umatilla dry upland forest potential vegetation group. Fuel composition, fire frequency, severity, pattern, and other associated disturbances would more closely resemble the HRV. Under alternative E, the risk of fire behavior, effects and associated disturbances would be similar to those that occurred prior to interruption of the historical low severity frequent fire regime. Although the risk of loss of key ecosystem components, such as native species, large trees, and soil, would be lower under both alternatives D and E, the lack of fire under alternative D would inhibit other ecological processes. Fire is essential to nutrient cycling in fire adapted ecosystems. Fire has a fertilizer effect on the soil by increasing ammonium levels and microbial nitrogen mineralization, resulting in increased nutrient levels in both understory and overstory vegetation. Fire rejuvenates desirable grasses, depending on the species response to disturbance (i.e., sprouters, prolific seeders, and species with strong rhizome extension respond favorably to fire). Especially in combination with reduced stand densities, fire results in changes in the microclimate on the forest floor, specifically increased sunlight penetration, increased soil temperatures, and increased understory productivity. Fire has been shown to result in significant increases in herbaceous biomass, species richness, and understory productivity and diversity. Depending on timing, fire may also increase seedling establishment by aiding in seed bed and site preparation. Fire would also aid in the creation of openings for regeneration.

Under alternative C, the fire regime condition class departure score would be approximately 50 at year 50, the highest among the alternatives. Conditions would be more highly departed from the desired conditions/HRV under alternative C due to increased stand densities and altered species compositions resulting from the lower levels of timber harvest and prescribed burning associated with this alternative. Alternative C would result in decreased ecological resiliency in the Umatilla dry upland forest potential vegetation group because vegetation characteristics and other conditions would least resemble the HRV. The risk of loss of key ecosystem components, such as native species, large trees, and soil, would be greatest under alternative C due to an increased risk of uncharacteristically severe fire behavior.

Moist Upland Forest Potential Vegetation Group – Within the Umatilla moist upland forest potential vegetation group, all of the alternatives would result in achievement of the desired conditions for fire regime condition class (class 1) at year 50. This is because the amount of departure between the existing conditions and the HRV is low. Under all of the alternatives, the fire regime condition class departure scores would range from approximately 13 to 17 at year 50.

Table 287. Umatilla National Forest fire regime condition class departure score (zero-100) for the moist upland forest potential vegetation group

Timeframe	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F
Existing Condition	26	26	26	26	26	26
Year 20	19	19	20	16	17	18
Year 50	17	15	16	17	14	13

Wallowa-Whitman National Forest

Table 288, table 289, and table 290 display the fire regime condition class departure scores by potential vegetation group under each of the alternatives projected over 50 years within the Wallowa-Whitman National Forest.

Cold Upland Forest P Potential Vegetation Group – Within the Wallowa-Whitman cold upland forest potential vegetation group, all of the alternatives would result in achievement of the desired conditions for fire regime condition class (class 1) at year 50.Under all of the alternatives, the fire regime condition class departure scores would range from approximately 14 to 19 at year 50.Under all of the alternatives, fire regime condition class departure scores would be reduced because vegetation structure and fuels composition would be altered as the result of mortality caused by wildfire, insects, and/or disease. Much of the cold upland forest potential vegetation group is located within existing or proposed wilderness, roadless, or backcountry areas. Only approximately 5 to 10 percent of the harvest activities would occur within the cold upland forest potential vegetation group.

Table 288. Wallowa-Whitman National Forest fire regime condition class departure score (zero-100) for the cold upland forest potential vegetation group

Timeframe	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F
Existing Condition	37	37	37	37	37	37
Year 20	22	23	24	26	25	24
Year 50	15	15	14	19	18	16

Dry Upland Forest Potential Vegetation Group – Within the Wallowa-Whitman dry upland forest potential vegetation group, all of the alternatives would result in moderate departure of fire regime condition class (class 2) at year 50 due to the relatively large amount of departure between existing conditions and the HRV. However, alternatives D and E would result in the greatest improvement in fire regime condition class departure scores at year 50. Under alternatives D and E, the fire regime condition class departure scores would be approximately 47 at year 50.

Table 289. Wallowa-Whitman National Forest fire regime condition class departure score (zero-100) for the dry upland forest potential vegetation group

Timeframe	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F
Existing Condition	56	56	56	56	56	56
Year 20	57	57	58	52	54	56
Year 50	53	52	54	47	47	50

Under alternatives D and E, departure scores would be lower due to the increased levels of timber harvest activities, mechanical fuels treatments, and/or prescribed burning associated with these alternatives. Alternatives D and E would also show improvement at a faster rate because of the increased harvesting of smaller trees within the old forest, which may decrease mortality in older age classes (due to decreased moisture stress and fire severity) and modify closed canopy to open canopy. However, alternative D would not include prescribed burning outside of harvest units and would include decreased amounts of prescribed burning within harvest units. Under this alternative, the majority of fuels treatments within harvest units would be accomplished by removal or crushing instead of burning. Because alternative E includes the reintroduction of fire to the ecosystem in addition to reducing the amount of departure in the dry upland forest vegetation, alternative E would be expected to result in increased ecological resiliency in the Wallowa-Whitman dry upland forest potential vegetation group. With this alternative, fuel composition, fire frequency, severity, pattern, and other associated disturbances would more closely resemble the HRV. Under alternative E, the risk of fire behavior, effects and associated disturbances would be similar to those that occurred prior to interruption of the historical low severity fire regime. Although the risk of loss of key ecosystem components, such as native species, large trees, and soil, would be lower under both alternatives D and E, the lack of fire under alternative D would inhibit other ecological processes. Fire is essential to nutrient cycling in fire adapted ecosystems. Fire has a fertilizer effect on the soil by increasing ammonium levels and microbial nitrogen mineralization, resulting in increased nutrient levels in both understory and overstory vegetation. Fire rejuvenates desirable grasses, depending on the species response to disturbance (i.e., sprouters, prolific seeders, and species with strong rhizome extension respond favorably to fire). Especially in combination with reduced stand densities, fire results in changes in the microclimate on the forest floor, specifically increased sunlight penetration, increased soil temperatures, and increased understory productivity. Fire has been shown to result in significant increases in herbaceous biomass, species richness, and understory productivity and diversity. Depending on timing, fire may also increase seedling establishment by aiding in seed bed and site preparation. Fire would also aid in the creation of openings for regeneration.

Under alternative C, the fire regime condition class departure score would be 54 at year 50, the highest departure score among the alternatives. Conditions would be more highly departed from the HRV under alternative C due to increased stand densities and altered species compositions resulting from the lower levels of timber harvest and prescribed burning associated with this alternative. Alternative C would result in decreased ecological resiliency in the Wallowa-Whitman dry upland forest potential vegetation group because vegetation characteristics and other conditions would least resemble the HRV. The risk of loss of key ecosystem components, such as native species, large trees, and soil, would be greatest under alternative C due to an increased risk of uncharacteristically severe fire behavior.

Moist Upland Forest Potential Vegetation Group – Within the Wallowa-Whitman moist upland forest potential vegetation group, all of the alternatives would result in achievement of the desired conditions for fire regime condition class (class 1) at year 50. This is because the amount of departure between the existing conditions and the HRV is low. Under all of the alternatives, the fire regime condition class departure scores would range from approximately 18 to 26 at year 50.

Table 290. Wallowa-Whitman National Forest fire regime condition class departure score (zero-100) for the moist upland forest potential vegetation group

Timeframe	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F
Existing Condition	23	23	23	23	23	23
Year 20	24	22	23	21	21	22
Year 50	26	23	20	18	18	21

Fire Severity Effects

All of the alternatives would have the potential to influence the number of acres of wildfire and the associated distribution of severity classes. The VDDT model as used is nonspatial, so no analysis of the effects of treatments on fire size was completed. In reality, the spatial location of treatment acres relative to landscape and vegetation patterns can influence the size of fires (Finney 2001, Reinhardt 2008). It is assumed that the actual treatments implemented would be strategically located to leverage the benefit that they would provide in managing towards the desired conditions for fire severities and frequencies. Vegetation types that consist of smaller diameter, dense, multi-storied, and thinner bark species (alpine fir, spruce) would have a higher probability of a mixed or high severity fire.

Fire return intervals are now much longer than those estimated to have occurred historically. These changes are most apparent in the dry upland forest potential vegetation group. Data indicates that the amount of fire has increased in the last 25 year period. Much of the fire that has occurred in the warm-dry systems has been high severity fire, as opposed to the low severity fires that historically dominated these areas.

Fire severity data indicates that, under severe fire weather conditions, much of the area has the potential for high severity fire (based on CVS data and the forest vegetation simulator-fire/fuel extension modeling). The current potential for high severity fire within the cold and moist upland forest potential vegetation groups exhibits the least amount of departure from historical/reference values. Even though the cold and moist upland forest potential vegetation groups show the potential for a moderate to high amount of high severity fire (32 to 55 percent of each potential vegetation group), this amount of fire is consistent with the mixed to infrequent high severity fires that historically dominated these systems. Within the dry upland forest potential vegetation group, the potential for high severity fire ranges from approximately 50 to 55 percent, which indicates a moderate to high increase in high severity fires, compared to historical/reference conditions. This current increase in potential fire severity reduces landscape resiliency, especially with the potential for longer fire seasons with increased fire severity effects due to climate change.

Under all of the alternatives, the VDDT predicted acres burned in the fifth decade decreased slightly when comparing the acres burned in the second decade. The average acres burned (since 1980, based on actual wildland fire history data) on National Forest System lands in the Blue Mountains was about 22,000 acres. With the model, the predicted acres burned increased to 25,000 acres per year in the second decade, and then decreased slightly to 16,000 acres per year.

Cold Upland Forest Potential Vegetation Group

Within the cold upland forest potential vegetation group, all of the alternatives would result in a high proportion of high severity fire through time within all three national forests. This would be within the HRV/desired condition range for the percent of high severity fire within the cold upland forest potential vegetation group. High severity fire is the historical fire regime within the cold upland forest potential vegetation group. Because only 5 to 10 percent of the harvest activities would occur within the cold upland forest potential vegetation group, fire severity would not be substantially altered as a result of the alternatives. All of the alternatives would utilize wildfire for resource benefits (unplanned ignitions) within the cold upland forest potential vegetation group.

Moist Upland Forest Potential Vegetation Group

Within the moist upland forest potential vegetation group, alternatives D and E would result in the closest achievement of the desired conditions for fire severity within all three national forests. The potential for high severity fire would be reduced the most under alternatives D and E due to the increased levels of timber harvest activities, mechanical fuels treatments, and/or use of fire associated with these alternatives. The increased levels of harvesting activities under alternatives D and E would result in an increased percent of the landscape in open stand densities. Decreased stand densities result in decreased crown continuity, decreased fuel loadings, increased wind speeds required to initiate and sustain a crown fire, and decreased fire severity. Decreased stand densities would also result in regeneration of more shade intolerant/fire tolerant tree species. Although there would be substantial reductions in the potential for high severity fire under alternatives D and E, mixed severity fire would maintain a role in the moist upland forest potential vegetation group. Mixed severity fire is the historical fire regime within the moist upland forest potential vegetation group.

Dry Upland Forest Potential Vegetation Group

Within the dry upland forest potential vegetation group within all three national forests, alternatives D and E would most closely achieve the desired conditions for fire severity within each of the three national forests. The potential for high severity fire would be reduced the most under alternatives D and E due to the increased levels of timber harvest activities, mechanical fuels treatments, and/or fire associated with these alternatives. The increased levels of harvesting activities under alternatives D and E would result in an increased percent of the landscape in open stand densities and would create a more open forest structure that more closely resembles the forest structure that existed prior to interruption of the historical frequent fire regime. A more open forest structure would result in decreased competition between trees for moisture, nutrients, and sunlight, increased tree health, growth, and vigor, decreased risk of insect attack and mortality, increased spatial heterogeneity, decreased crown continuity, decreased fuel loadings, increased wind speeds required to initiate and sustain a crown fire, and decreased fire severity. Decreased stand densities would also result in increased regeneration of more shade intolerant tree species and closer achievement of the desired conditions for species composition. Shade intolerant tree species such as ponderosa pine are better adapted to a frequent fire regime, better able to withstand low severity fire, and result in a lower fire hazard. Alternatives D and E would result in increased ecological resiliency in the dry upland forest potential vegetation group by decreasing fire severity across the landscape. The increased percent of the landscape in open stand densities would also aid in the reintroduction of low severity surface fire into the ecosystem. Because alternatives D and E would result in an increased number of acres of timber harvest activities and an increased percent of the landscape in open stand densities, there would be more opportunities to use wildfire for resource benefits, in comparison to alternative C.

Within the dry upland forest potential vegetation group within all three national forests, the potential for high severity fire would be highest under alternative C due to the decreased levels of timber harvest activities associated with this alternative. Alternative C would result in an increased percent of the landscape in closed stand densities. Increased stand densities would result in increased crown continuity, increased fuel loading, decreased wind speeds required to initiate and sustain a crown fire, and increased fire severity. Increased stand densities would also result in regeneration of more shade tolerant/fire intolerant tree species. In theory, alternative C would rely mainly on the use of fire (planned and unplanned ignitions) to reduce stand densities. Rather than harvesting trees to reduce tree densities, trees would be thinned by fire under alternative C. However, due to the high percent of the landscape in closed stand densities and the potential for very high levels of mortality and high severity fire effects to other resources such as soils, the window or time frame under which fire could and would be managed to achieve the desired conditions for stand densities, structural stages, and species composition would be limited and unrealistic based on current conditions and the inability to reintroduce low severity fire effects. Additionally, the levels of smoke emissions generated under alternative C would be substantially increased, further limiting burn windows and the amount of acres that could be burned due to the increased levels of particulate matter generated. Impacts to public health from the likelihood of exceeding air quality standards would also substantially limit the amount of acres that could be burned under alternative C. Alternative C would likely result in increased fire severity, decreased ecological resiliency, and loss of key ecosystem components and functions due to scope and scale of fire severity outside that which historically occurred within the dry upland forest potential vegetation group.

Insect and Disease Effects

The alternatives that would result in the closest achievement of the HRV/desired conditions for structural stages, species composition, and stand densities would result in the greatest reduction in insect and disease risk hazard. Insects such as bark beetles tend to favor a particular age or size class. A landscape that contains a diversity of structural stages consistent with that which evolved within the historic disturbance regime would be more resilient to perturbation by disturbance agents, such as insects, disease, and fire. Additionally, as older age classes succumb to insects and disease, younger age classes would be available to take their place, thus ensuring a sustainable forest structure over time.

Lower stand densities and a more open forest structure would result in decreased competition between trees for moisture, nutrients, and sunlight, which would increase tree health, growth, and vigor, decrease susceptibility to insects and diseases, decrease the risk of insect attack and mortality, decrease continuity of preferred tree species and age and size classes, and improve overall forest health. A tree’s natural defense mechanisms, such as the production of pitch, would also be intact and trees would be better able to withstand or ward off attack from insects such as bark beetles. A more open forest structure would also aid in the dispersal of pheromones released by bark beetles that signal other bark beetles to aggregate and attack trees in an area. Openings within a stand also inhibit the spread of diseases such as dwarf mistletoe.

Species composition also affects insect and disease risk. Different insects and diseases tend to favor a particular tree species. A landscape that contains a diversity of species consistent with the HRV would be more resilient to perturbation from insects and disease. Species that evolved over time and occurred on a site historically would be better adapted to site conditions in terms of moisture, drought, soil characteristics, fire, insect, and disease tolerance. Off-site species that have encroached into other forest types over the past century due to fire suppression would be less drought- and fire-tolerant and more susceptible to moisture stress and damage by fire, insect attack, and disease. As temperatures increase with anticipated climate changes, off-site species would be more prone to moisture stress, at increased risk of insect attack and mortality, and less adapted to warmer temperatures and lower precipitation.

Malheur National Forest

Cold Upland Forest Potential Vegetation Group – Within the Malheur cold upland forest potential vegetation group, very little active management would occur in this potential vegetation group. Only approximately 5 to 10 percent of the harvest activities would occur within the cold upland forest potential vegetation group. Much of the potential vegetation group would be wilderness, roadless, or backcountry areas. Additionally, the cold upland forest potential vegetation group, in general, tends to exhibit the least amount of departure from the HRV. The historical fire regime was characterized by infrequent fire; therefore this forest type has experienced the fewest number of missed fires.

Under alternatives D, E, and F, the projected percent of the landscape in each of the forested structural stages would vary from the desired condition ranges by a summed total of approximately 2 to 3 percent at year 50 (table 255). Under alternatives A, B, and C, the projected percent of the landscape in each of the forested structural stages would vary from the desired condition ranges by a summed total of approximately 5 to 6 percent at year 50 (table 255). Under alternatives B, C, E, and F, the projected percent of the landscape in each of the species composition tolerance classes would vary from the desired condition ranges by a summed total of approximately 23 percent (table 264). Under alternatives A and D, the projected percent of the landscape in each of the species composition tolerance classes would vary from the desired condition ranges by a summed total of approximately 24 percent and 25 percent, respectively, at year 50 (table 264).

None of the alternatives would achieve the desired conditions for stand densities at year 50 due to the large variation between existing and desired conditions. Currently, approximately 88 percent of the cold upland forest potential vegetation group is in open stand densities (table 273). The desired condition would be to reduce the percent of the cold upland forest potential vegetation group in open stand densities to 20 to 30 percent and increase the percent of the cold upland forest potential vegetation group in closed stand densities to 65 to 80 percent. Under all of the alternatives, the percent of the landscape in open forest would remain above the desired condition range at year 50 due to mortality from wildfire, insects, and disease exceeding growth rates. Under alternatives A and C, the projected percent of the landscape in open and closed forest would vary from the desired condition ranges by a summed total of approximately 31 percent at year 50 (table 273). Under alternatives B, D, E, and F, the projected percent of the landscape in open and closed forest would vary from the desired condition ranges by a summed total of approximately 33 to 43 percent at year 50 (table 273).

With little active management occurring in the cold upland forest potential vegetation group under any of the alternatives to substantially alter structural stages, species composition, and stand densities, mortality from insects, disease, and wildfire would be expected to continue to result in stand-replacing events consistent with the historic disturbance regimes.

Dry Upland Forest Potential Vegetation Group – Within the Malheur dry upland forest potential vegetation group, the alternatives would result in a substantial difference in the reduction of insect and disease risk hazard because more active management would occur in the dry upland forest potential vegetation group. Approximately 60 to 90 percent of the harvest activities would occur within the dry upland forest potential vegetation group. Additionally, the dry upland forest potential vegetation group in general tends to exhibit the greatest amount of departure from the HRV. The historical fire regime was characterized by more frequent fire; therefore these forest types have experienced the greatest number of missed fires.

At year 50, alternatives D and E would result in the greatest reduction in insect and disease risk hazard and greatest improvement in overall forest health because these alternatives would result in the closest achievement of the desired conditions for forested structural stages, species composition, and stand densities within the Malheur dry upland forest potential vegetation group. Alternatives D and E would result in increased ecological resiliency within the Malheur dry upland forest potential vegetation group by decreasing stand densities and creating a more open forest structure that more closely resembles the historical forest structure and species composition that existed prior to interruption of the historical frequent fire regime. This is because of the increased levels of timber harvest activities associated with these alternatives. Under alternatives D and E, the projected percent of the landscape in each of the structural stages would vary from the desired condition ranges by a summed total of approximately 49 percent and 50 percent, respectively, at year 50 (table 256). Alternative D would result in achievement of the desired conditions for species composition at year 50 (table 265). Under alternative E, the projected percent of the landscape in each of the species composition tolerance classes would vary from the desired condition ranges by a summed total of approximately 2 percent at year 50 (table 265). Under alternatives D and E, the projected percent of the landscape in open and closed forest would vary from the desired condition ranges by a summed total of approximately 16 percent and 22 percent, respectively, at year 50 (table 274).

Within the Malheur dry upland forest potential vegetation group, alternative C would be the least effective alternative in reducing the insect and disease risk hazard because this alternative would result in the greatest amount of variation from the desired conditions for structural stages (table 256), species composition (table 265), and stand densities (table 274) at year 50. Under alternative C, the percent of the landscape in each of the structural stages would vary from the desired condition ranges by a summed total of approximately 70 percent at year 50. Under alternative C, the projected percent of the landscape in each of the species composition tolerance classes would vary from the desired condition ranges by a summed total of approximately 10 percent at year 50. Under alternative C, the projected percent of the landscape in open and closed forest would vary from the desired condition ranges by a summed total of approximately 59 percent at year 50. Alternative C would result in the least amount of improvement in overall forest health and ecological resiliency within the Malheur dry upland forest potential vegetation group by maintaining higher stand densities and a more departed forest structure that less resembles the historical forest structure and species composition that existed prior to interruption of the historical frequent fire regime.

Moist Upland Forest Potential Vegetation Group – Within the Malheur moist upland forest potential vegetation group, the alternatives would result in a difference in the reduction of insect and disease risk hazard. However, the difference between the alternatives would not be as substantial as in the dry upland forest potential vegetation group. The moist upland forest potential vegetation group would be less actively managed than the dry upland forest potential vegetation group. Only approximately 10 to 30 percent of the harvest activities would occur within the moist upland forest potential vegetation group. Additionally, in comparison to the dry upland forest potential vegetation group, the moist upland forest potential vegetation group in general exhibits a lesser amount of departure from the HRV because the historical fire regime was characterized by fires of mixed frequency and severity. Therefore, these forest types have experienced a fewer number of missed fires.

All of the alternatives would result in a general reduction in insect and disease risk hazard due to decreased stand densities (table 275). Alternatives A, B, C, and F would all result in the achievement of the desired conditions for stand densities. The projected percent of the landscape in open and closed forest would be within the desired condition ranges at year 50. However, under alternative E, the projected percent of the landscape of open and closed forest would only vary from the desired condition ranges by a summed total of approximately 1 percent at year 50. Under alternative D, the projected percent of the landscape in open and closed forest would vary from the desired condition ranges by a summed total of approximately 10 percent at year 50. Alternative D would result in slightly more open stand conditions at year 50 than the HRV/desired condition range. When taken in the context of climate change, slightly more open stand conditions may be desirable to reduce insect and disease risk hazards that are anticipated to increase with increasing temperatures.

Within the Malheur moist upland forest potential vegetation group, alternatives D and E, would result in a further reduction in insect and disease risk hazard by year 50 because these alternatives result in the closest achievement of the desired conditions for forested structural stages (table 257) and species composition (table 266). This is because of the increased levels of timber harvest activities associated with these alternatives. Under alternatives D and E, the projected percent of the landscape in each of the structural stages would vary from the desired condition ranges by a summed total of approximately 28 percent and 39 percent, respectively, at year 50. Under alternatives D and E, the projected percent of the landscape in each of the species composition tolerance classes would vary from the desired condition ranges by a summed total of approximately 48 percent and 51 percent, respectively, at year 50.

Within the Malheur moist upland forest potential vegetation group, alternatives A, B, and C would be less effective at reducing the insect and disease risk hazard because these alternatives would result in a greater amount of variation from the desired conditions for structural stages (table 257) and species composition (table 266) at year 50. Under alternatives A, B, and C, the percent of the landscape in each of the structural stages would vary from the desired condition ranges by a summed total of approximately 55 to 59 percent at year 50. Under alternatives A, B, and C, the projected percent of the landscape in each of the species composition tolerance classes would vary from desired condition ranges by a summed total of approximately 58 percent at year 50.

Umatilla National Forest

Cold Upland Forest Potential Vegetation Group – Within the Umatilla cold upland forest potential vegetation group, very little active management would occur in this potential vegetation group. Only approximately 5 to 10 percent of the harvest activities would occur within the cold upland forest potential vegetation group. Much of the cold upland forest potential vegetation group is located within existing or proposed wilderness, roadless, or backcountry areas. Additionally, the cold upland forest potential vegetation group in general tends to exhibit the least amount of departure from the HRV because the historical fire regime was characterized by infrequent fire; therefore this forest type has experienced the fewest number of missed fires.

Under alternatives A, B, and C, the projected percent of the landscape in each of the forested structural stages would be within the desired condition ranges at year 50 (table 258). However, under alternatives D, E, and F, the projected percent of the landscape in each of the forested structural stages would only vary from the desired condition ranges by a summed total of approximately 1 to 5 percent of the landscape at year 50. Under alternatives A, B, and C, the projected percent of the landscape in each of the species composition tolerance classes would vary from the desired condition ranges by a summed total of approximately 12 percent (table 267). Under alternatives D, E, and F, the projected percent of the landscape in each of the species composition tolerance classes would vary from the desired condition ranges by a summed total of approximately 14 percent, 13 percent, and 13 percent, respectively, at year 50.

None of the alternatives would achieve the desired conditions for stand densities at year 50. Under all of the alternatives, the percent of the landscape in open forest would remain above the desired condition range at year 50 due to mortality from wildfire, insects, and disease exceeding growth rates. With little active management occurring in the cold upland forest potential vegetation group under all of the alternatives which would alter structural stages, species composition, and stand densities, mortality from insects, disease, and wildfire would be expected to continue to result in stand-replacing events consistent with the historic disturbance regimes.

Dry Upland Forest Potential Vegetation Group – Within the Umatilla dry upland forest potential vegetation group, the alternatives would result in a substantial difference in the reduction of insect and disease risk hazard because more active management would occur in the dry upland forest potential vegetation group. Approximately 60 to 90 percent of the harvest activities would occur within the dry upland forest potential vegetation group. Additionally, the dry upland forest potential vegetation group in general tends to exhibit the greatest amount of departure from the HRV. The historical fire regime was characterized by more frequent fire; therefore these forest types have experienced the greatest number of missed fires.

At year 50, alternatives D and E would result in the greatest reduction in insect and disease risk hazard and greatest improvement in overall forest health because these alternatives would result in the closest achievement of the desired conditions for forested structural stages (table 259), species composition (table 268), and stand densities (table 277) within the Umatilla dry upland forest potential vegetation group. Alternatives D and E would result in increased ecological resiliency within the Umatilla dry upland forest potential vegetation group by decreasing stand densities and creating a more open forest structure that more closely resembles the historical forest structure and species composition that existed prior to interruption of the historical frequent fire regime. This is because of the increased levels of timber harvest activities associated with these alternatives. Under alternatives E and D, the projected percent of the landscape in each of the structural stages would vary from the desired condition ranges by a summed total of approximately 57 percent and 58 percent, respectively, at year 50. Under alternatives D and E, the projected percent of species composition tolerance classes would vary from the desired condition ranges by a summed total of approximately 19 percent and 31 percent, respectively, at year 50. Under alternatives D and E, the projected percent of the landscape in open and closed forest would vary from the desired condition ranges by a summed total of approximately 6 percent and 20 percent, respectively, at year 50.

Within the Umatilla dry upland forest potential vegetation group, alternative C would be the least effective alternative in reducing the insect and disease risk hazard because this alternative would result in the greatest amount of variation from the desired conditions for structural stages (table 259), species composition (table 268), and stand densities (table 277) at year 50. Under alternative C, at year 50, the percent of the landscape in each of the structural stages would vary from the desired condition ranges by a summed total of approximately 68 percent; the projected percent of the landscape in each of the species composition tolerance classes would vary from the desired condition ranges by a summed total of approximately 59 percent; and, the projected percent of the landscape in open and closed forest would vary from the desired condition ranges by a summed total of approximately 63 percent . Alternative C would result in the least amount of improvement in overall forest health and ecological resiliency within the Umatilla dry upland forest potential vegetation group by maintaining higher stand densities and a more departed forest structure that less resembles the historical forest structure and species composition that existed prior to interruption of the historical frequent fire regime.

Moist Upland Forest Potential Vegetation Group – Within the Umatilla moist upland forest potential vegetation group, the alternatives would result in a difference in the reduction of insect and disease risk hazard. However, the difference between the alternatives would not be as substantial as in the dry upland forest potential vegetation group. The moist upland forest potential vegetation group would be less actively managed than the dry upland forest potential vegetation group. Only approximately 10 to 30 percent of the harvest activities would occur within the moist upland forest potential vegetation group. Additionally, in comparison to the dry upland forest potential vegetation group, the moist upland forest potential vegetation group in general exhibits a lesser amount of departure from the HRV because the historical fire regime was characterized by fires that burned with mixed frequency and severity. Therefore, these forest types have experienced a fewer number of missed fires.

All of the alternatives would result in a general reduction in insect and disease risk hazard due to decreased stand densities (table 278). Alternatives A, B, C, and F would result in the achievement of the desired conditions for stand densities. The projected percent of the landscape in open and closed forest would be within the desired condition ranges at year 50. Under alternatives D and E, the projected percent of the landscape in open and closed forest would vary from the desired condition ranges by a summed total of approximately 18 percent and 11 percent, respectively, at year 50. Alternatives D and E would result in slightly more open stand conditions at year 50 than the HRV/desired condition range. When taken in the context of climate change, slightly more open stand conditions may be desirable to reduce insect and disease risk hazards that are anticipated to increase with increasing temperatures.

Within the Umatilla moist upland forest potential vegetation group, alternatives D and E would result in further reduction in insect and disease risk hazard by year 50 because these alternatives result in the closest achievement of the desired conditions for forested structural stages (table 260) and species composition (table 269). This is because of the increased levels of timber harvest activities associated with these alternatives. Under alternatives D and E, the projected percent of the landscape in each of the structural stages would vary from the desired condition ranges by a summed total of approximately 26 percent and 21 percent, respectively, at year 50. Under alternatives D and E, the projected percent of the landscape in each of the species composition tolerance classes would vary from the desired condition ranges by a summed total of approximately 40 percent at year 50.

Within the Umatilla moist upland forest potential vegetation group, alternatives A and C would be less effective at reducing the insect and disease risk hazard because these alternatives would result in a greater amount of variation from the desired conditions for structural stages (table 260) and species composition (table 269) at year 50. Under alternatives A and C, the percent of the landscape in each of the structural stages would vary from the desired condition ranges by a summed total of approximately 35 to 36 percent at year 50. Under alternatives A and C, the projected percent of the landscape in each of the species composition tolerance classes would vary from desired condition ranges by a summed total of approximately 49 percent at year 50.

Wallowa-Whitman National Forest

Cold Upland Forest Potential Vegetation Group – Within the Wallowa-Whitman cold upland forest potential vegetation group, very little active management would occur in the cold upland forest potential vegetation group. Only approximately 5 to 10 percent of the harvest activities would occur within the cold upland forest potential vegetation group. Much of the cold upland forest potential vegetation group is located within existing or proposed wilderness, roadless, or backcountry areas. Additionally, the cold upland forest potential vegetation group in general tends to exhibit the least amount of departure from the HRV. The historical fire regime was characterized by infrequent fire; therefore this forest type has experienced the fewest number of missed fires.

Under alternatives D and E, the projected percent of the landscape in each of the forested structural stages would vary from the desired condition ranges by a summed total of approximately 7 percent and 8 percent, respectively, at year 50 (table 261). However, under alternatives A, B, C, and F, the projected percent of the landscape in each of the forested structural stages would vary from the desired condition ranges by a summed total of approximately 11 to 14 percent at year 50. Under all of the alternatives, the projected percent of the landscape in each of the species composition tolerance classes would vary from the desired condition ranges by a summed total of approximately 1 to 3 percent at year 50 (table 270).

None of the alternatives would achieve the desired conditions for stand densities at year 50 (table 279). Under all of the alternatives, the percent of the landscape in open forest would remain above the desired condition range at year 50 due to mortality from wildfire, insects, and disease exceeding growth rates. With little active management occurring in the cold upland forest potential vegetation group under all of the alternatives which would alter structural stages, species composition, and stand densities, mortality from insects, disease, and wildfire would be expected to continue to result in stand-replacing events consistent with the historic disturbance regimes.

Dry Upland Forest Potential Vegetation Group – Within the Wallowa-Whitman dry upland forest potential vegetation group, the alternatives would result in a substantial difference in the reduction of insect and disease risk hazard because more active management would occur in the dry upland forest potential vegetation group. Approximately 60 to 90 percent of the harvest activities would occur within the dry upland forest potential vegetation group. Additionally, the dry upland forest potential vegetation group in general tends to exhibit the greatest amount of departure from the HRV. The historical fire regime was characterized by frequent fire; therefore these forest types have experienced the greatest number of missed fires.

At year 50, alternatives D and E would result in the greatest reduction in insect and disease risk hazard and greatest improvement in overall forest health because these alternatives would result in the closest achievement of the desired conditions for forested structural stages (table 262), species composition (table 271), and stand densities (table 280) within the Wallowa-Whitman dry upland forest potential vegetation group. Alternatives D and E would result in increased ecological resiliency within the Wallowa-Whitman dry upland forest potential vegetation group by decreasing stand densities and creating a more open forest structure that more closely resembles the historical forest structure and species composition that existed prior to interruption of the historical frequent fire regime. This is because of the increased levels of timber harvest activities associated with these alternatives. At year 50, under alternatives D and E, the projected percent of the landscape in each of the forested structural stages would vary from the desired condition ranges by a summed total of approximately 66 percent; the projected percent of species composition tolerance classes would vary from the desired condition ranges by a summed total of approximately 21 percent and 35 percent, respectively; and, the projected percent of the landscape in open and closed forest would vary from the desired condition ranges by a summed total of approximately 6 percent and 22 percent, respectively.

Within the Wallowa-Whitman dry upland forest potential vegetation group, alternative C would be the least effective alternative in reducing the insect and disease risk hazard because this alternative would result in the greatest amount of variation from the desired conditions for structural stages (table 262), species composition (table 271), and stand densities (table 280) at year 50. Under alternative C, the percent of the landscape in each of the structural stages would vary from the desired condition ranges by a summed total of approximately 77 percent at year 50. Under alternative C, the projected percent of the landscape in each of the species composition tolerance classes would vary from the desired condition ranges by a summed total of approximately 59 percent at year 50. Under alternative C, the projected percent of the landscape in open and closed forest would vary from the desired condition ranges by a summed total of approximately 56 percent at year 50. Alternative C would result in the least amount of improvement in overall forest health and ecological resiliency within the Wallowa-Whitman dry upland forest potential vegetation group by maintaining higher stand densities and a more departed forest structure that less resembles the historical forest structure and species composition that existed prior to interruption of the historical frequent fire regime.

Moist Upland Forest Potential Vegetation Group – Within the Wallowa-Whitman moist upland forest potential vegetation group, the alternatives would result in a difference in the reduction of insect and disease risk hazard. However, the difference between the alternatives would not be as substantial as in the dry upland forest potential vegetation group. The moist upland forest potential vegetation group would be less actively managed than the dry upland forest potential vegetation group. Only approximately 10 to 30 percent of the harvest activities would occur within the moist upland forest potential vegetation group. Additionally, in comparison to the dry upland forest potential vegetation group, the moist upland forest potential vegetation group in general exhibits a lesser amount of departure from the HRV because the historical fire regime was characterized by fires that burned with mixed frequency and severity. Therefore, these forest types have experienced a fewer number of missed fires.

All of the alternatives would result in a general reduction in insect and disease risk hazard due to decreased stand densities (table 281). Alternative C would result in achievement of the desired conditions for stand densities. Under alternative C, the projected percent of the landscape in open and closed forest would be within the desired condition ranges at year 50. Under alternatives A, B, and F, the projected percent of the landscape in open and closed forest would vary from the desired condition ranges by a summed total of approximately 2-6 percent at year 50. Under alternatives D and E, the projected percent of the landscape in open and closed forest would vary from the desired condition ranges by a summed total of approximately 26 percent and 18 percent, respectively, at year 50. Alternatives D and E would result in slightly more open stand conditions at year 50 than the HRV/desired condition range. When taken in the context of climate change, slightly more open stand conditions would be desirable to reduce insect and disease risk hazards that are anticipated to increase with increasing temperatures.

Within the Wallowa-Whitman moist upland forest potential vegetation group, alternatives D and E, would result in a further reduction in insect and disease risk hazard by year 50 because these alternatives result in the closest achievement of the desired conditions for forested structural stages (table 263) and species composition (table 272). This is because of the increased levels of timber harvest activities associated with these alternatives. At year 50 under alternatives D and E, the projected percent of the landscape in each of the structural stages would vary from the desired condition ranges by a summed total of approximately 12 percent and 14 percent, and the projected percent of the landscape in each of the species composition tolerance classes would vary from the desired condition ranges by a summed total of approximately 12 percent and 13 percent, respectively.

Within the Wallowa-Whitman moist upland forest potential vegetation group, alternatives A and C would be less effective at reducing the insect and disease risk hazard because these alternatives would result in a greater amount of variation from the desired conditions for structural stages (table 263) and species composition (table 272) at year 50. Under alternatives A and C at year 50, the percent of the landscape in each of the structural stages would vary from the desired condition ranges by a summed total of approximately 32 percent and the projected percent of the landscape in each of the species composition tolerance classes would vary from desired condition ranges by a summed total of approximately 21 percent.

Lands Suitable for Timber Production for Each Alternative

The NFMA requires that National Forest System lands be classified as to their suitability and availability for timber harvest and production. National Forest System lands were originally reserved with the intent of providing goods and services that would contribute to public interest and needs for the long term, including a sustainable supply of timber and related forest products.

Three important considerations exist for classifying National Forest System lands as suitable for timber production or unsuitable for timber production, but available for timber harvest:

1. Achieving and maintaining forest desired conditions using planned and regulated timber harvest
2. Restoring fire-adapted ecosystems and associated species habitats
3. Providing wood products that contribute to sustaining a wood products processing industry that is essential to continued forestland restoration.

To address these considerations, some level of regulated forest production is necessary and appropriate on forested lands within the administrative boundary of the national forest. Where biophysical, socio-economic, or legal constraints preclude scheduling planned and/or periodic harvests, some forested lands may not be deemed suitable for timber production even though they meet the definition of forested lands. In other areas, lands that are classified as unsuitable for timber production could be made available for timber harvest where such harvests are implemented on an unregulated basis with the intent to achieve multiple-use resource management objectives associated with a specific management area or prescription. Lands suitable for timber production form the basis for the calculation of the allowable sale quantity (ASQ) and the long term sustained yield capacity (LTSYC).

A timber suitability analysis following the NFMA and 36CFR 219.14 was completed as a part of the planning process (see Countryman 2010 process paper). The following paragraphs summarize the process. This process is basically a series of subtractions of land from the total forest land base utilizing the following 3 broad categories to identify lands not available for timber production:

1. National Forest System lands that have been withdrawn from wood product production. These are lands designated by Congress, the Secretary of Agriculture, or the Chief of the

Forest Service for other multiple-use objectives that preclude timber production (e.g., units of the National Wilderness Preservation System and Research Natural Areas).

2. National Forest System lands (exclusive of withdrawn areas) that are not forested, including lands that are incapable of supporting 10 percent tree cover; administrative sites; and lands maintained in a nonforest condition, such as power line rights-of-way.
3. Available forestland physically unsuited for timber production due to the inability to ensure adequate restocking or the potential for irreversible damage to soils or watersheds. However, acres within these forest types are considered available for timber harvest where irreversible damage to soils or watersheds would not result and where such activities contributed to underlying management emphases and objectives.

Forestlands remaining after identifying the subset of unsuitable forestlands described above are those that are tentatively available for and capable of timber production, and are also referred to as tentatively suitable forestland. Tentatively suitable forestlands represent the maximum number of acres that could be managed for regular and predictable wood product outputs (i.e., timber production). These acres remained constant as a starting point for the development of alternatives. Tentatively suitable lands were then separated into two categories based on the design parameters and objectives for each alternative. The lands were identified as:

1. Suitable for timber production
2. Unsuitable for timber production, but available for timber harvest if needed to meet desired conditions and objectives (NFMA sec (6)(k))

Areas that may have been identified as tentatively suitable, but later identified as unsuited for production during the development of alternatives, include riparian management areas, old forest, and undeveloped backcountry areas. Table 291 displays lands tentatively suitable for timber production by forest. See the comparison of alternatives for a display of suitable acres by alternative.

Table 291. Lands tentatively suitable for timber production (step A of 36CFR 219.14)

Category	MAL	UMA	WAW
1. NFS lands total (acres)	**1,700,000**	**1,400,000**	**1,800,000**
a. Non-forest land	215,000	199,000	250,000
b. Potential for irreversible damage	0	0	0
c. No assurance of adequate restocking	139,000	37,000	150,000
d. Forest land withdrawn from production	101,000	347,000	390,000
2. Total unsuitable land (acres)	455,000	583,000	790,000
3. Tentatively suitable forest land (acres)	1,245,000	817,000	1,010,000

Inventoried roadless areas (IRAs) were also subtracted from lands tentatively suitable for timber production, thus reducing the number of acres available. While IRAs are not suitable for timber production, silvicultural treatments which focus on the removal of generally small diameter timber could occur on an infrequent basis to improve TES species habitat or to reduce the risk of uncharacteristic wildfire.

The design of the alternatives further influenced the acres suitable for timber production. Table 292 displays the acres suitable for timber production under each of the alternatives by national forest. Each alternative started with the areas identified as tentatively suitable (see 36CFR 219.14

timber resource land suitability) for timber production displayed in table 291. Design parameters for each alternative resulted in a subtraction in acres suitable for timber production from the tentatively suitable acres. The main factors/criteria resulting in a change from suitable to unsuitable included changing classification of the following types of areas to unsuitable: old forest, riparian management areas, MA 3A and 3B (backcountry),MA 1B (preliminary administratively recommended wilderness areas), and specially designated areas (RNAs, municipal watersheds, and so on; see Countryman 2011 timber suitability process paper). Under most of the alternatives, these management areas were not compatible with the definition of timber production (regularly scheduled entries) or objectives of the alternatives.

Table 292. Acres suitable for timber production

National Forest	Tentatively Suitable	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F
MAL	1,245,000	780,000	770,000	530,000	1,080,000	770,000	770,000
UMA	817,000	380,000	420,000	260,000	610,000	420,000	420,000
WAW	1,010,000	590,000	530,000	310,000	770,000	530,000	530,000

Table 293. Lands suitable for timber production as a percentage of National Forest System lands (forested)

National Forest	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F
MAL	52	52	35	72	52	52
UMA	35	38	24	55	38	38
WAW	37	33	19	48	33	33

Alternatives B, E, and F would result in the same number of acres suitable for timber production because these alternatives contain the same standards, guidelines, and similar management allocations that influence suitability. Even though the acres of MA 1B (preliminary administratively recommended wilderness areas) and MA 3 A and 3B would differ between alternatives B, E, and F, the difference would not result in a substantial change in suitability because the acres that would be shifted into or out of recommended wilderness areas would be classified as unsuitable for timber production. Suitable acres would be approximately 30 to 50 percent of the entire forested landbase, as displayed in table 298.

Alternative C would result in the fewest acres suitable for timber production because this alternative would result in a greater number of acres of recommended wilderness and wider riparian management areas, both of which are unsuitable for timber production. Alternative C would also retain all of the old forest management areas from alternative A. Old forest management areas and old forest stands would be unsuitable for timber production. Additional areas in wildlife corridor management areas identified would be unsuitable for timber production. Lands suitable for timber production would be approximately 19 percent of the total forested landbase within the Wallowa-Whitman National Forest, approximately 24 percent within the Umatilla National Forest, and approximately 35 percent within the Malheur National Forest.

Alternative D would result in the highest number of acres suitable for timber production within all three national forests. Under alternative D, riparian management areas would be narrower. Additionally, old forest would be reclassified as suitable for timber production. Alternative D would result in the highest percent of lands suitable for timber production within all three national forests, when compared to the total forested landbase; approximately 48 percent within the Wallowa-Whitman National Forest; approximately 55 percent within the Umatilla National Forest; and approximately 72 percent within the Malheur National Forest.

Allowable Sale Quantity Effects

The allowable sale quantity is the upper limit of the amount of timber volume potentially available for harvest on forestlands suitable for timber production during a specified time period, usually a decade, while moving the landscape towards the desired conditions and while meeting other planning rule requirements. This volume is not a guaranteed harvest volume. Allowable sale quantity is the maximum amount of volume potentially available on timber suitable lands unconstrained by budget. The actual volume offered would be the aggregate of individual project proposals and would be dependent upon a number of factors, including annual budget and organizational capabilities. Actual volumes offered may also include volumes harvested from lands unsuitable for timber production but available for timber harvest, such as riparian management areas and old forest. Allowable sale quantity volume is also described as chargeable volume because it would be applied toward the decadal allowable sale quantity.

Allowable sale quantity includes only those volumes that meet utilization standards and that would be removed from lands suitable for timber production. The calculation of allowable sale quantity assumed any restrictions associated with the current landscape condition. Volume not in the allowable sale quantity includes unsound material, salvageable dead logs (unless included in yield tables), fuelwood, or any volume generated from harvest activities within unsuitable forestland. Yield tables were developed using the forest vegetation simulator (FVS), (Wykoff 1986) and VDDT. Yields were assigned based on a combination of vegetation state class (tree size class and canopy cover) and type of treatment (e.g., commercial thin, selection, and regeneration harvest). Total volume estimates were generated for each alternative by multiplying the total acres treated with a particular prescription, times the yield for a particular vegetation state class.

The base schedule of treatment activities in the model reflects the intensities of management and the amount of timber utilization consistent with the goals, assumptions, and standards contained or used in development of a proposed alternative. The base schedule is a timber sale schedule formulated on the basis that the quantity of timber planned for sale and harvest for any future decade is equal to or greater than the planned sale and harvest for the preceding decade, and that this planned sale and harvest for any decade is not greater than the long-term sustained yield capacity (see following section). This definition expresses the principle of nondeclining flow. In addition to the long-term sustained yield capacity requirements, the first decade allowable sale quantity must meet the nondeclining flow requirements unless departure from the base schedule is determined to be warranted. The need for considering departures has not been identified at this time, so all of the alternatives would be consistent with the nondeclining flow requirements.

Wood product yields from suitable forestlands likely to result from an alternative management strategy depend on several factors, including the mix of allocations, the respective management emphasis, and associated forested vegetation desired conditions. As discussed under the methodology section, the VDDT model was used to estimate allowable sale quantity for each of the alternatives based on the assumptions discussed.

Table 294, table 295, and table 296, display the allowable sale quantity by alternative for each national forest. Under all of the alternatives, allowable sale quantity would be lower than those analyzed for the 1990 forest plans. This is the result of suitable acres being decreased under all of the action alternatives compared to the 1990 forest plans. This would also be partially due to differences in the models that were used to predict harvest (FORPLAN versus VDDT).

While suitable lands are a primary component of allowable sale quantity, it is also based on the existing vegetation conditions (mix of structural stages and productivity classes), management emphasis, and the requirement to schedule a nondeclining flow of timber. In some instances, these factors can combine to create a nonlinear relationship between suitable acres and allowable sale quantity.

Table 294. Malheur National Forest timber sale program quantity (TSPQ), allowable sale quantity (ASQ), and long term sustained yield capacity (LTSYC) (million board feet per year)

Activity	1990 Forest Plan*	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F
TSPQ	234-plus	30	31	16	87	56	37
ASQ	234	55	55	34	88	55	55
LTSYC	234-plus	86	86	59	125	86	86

Table 295. Umatilla National Forest timber sale program quantity (TSPQ), allowable sale quantity (ASQ), and long term sustained yield capacity (LTSYC) (million board feet per year)

Activity	1990 Forest Plan*	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F
TSPQ	159	27	29	16	76	56	36
ASQ	124	51	51	31	73	51	51
LTSYC	184	53	53	32	79	53	53

Table 296. Wallowa-Whitman National Forest timber sale program quantity (TSPQ), allowable sale quantity (ASQ), and long term sustained yield capacity (LTSYC) (million board feet per year)

Activity	1990 Forest Plan*	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F
TSPQ	206	24	27	15	80	50	34
ASQ	141	46	46	22	75	46	46
LTSYC	215	66	66	38	100	66	66

Alternative D would result in the highest allowable sale quantity within all three national forests. Under alternative D, allowable sale quantity would range from 73 million board feet within the Umatilla National Forest to 88 million board feet within the Malheur National Forest. Due to fewer acres allocated to wilderness, riparian areas, wildlife corridors, and old forest, alternative D would result in the greatest number of acres suitable for timber production. Alternative D would also be the least restrictive alternative in terms of timber harvest. The level of harvest would attempt to utilize a substantial portion of the net growth per year.

Alternative C would have the lowest allowable sale quantity within all three national forests. Under alternative C, allowable sale quantity would range from 22 million board feet within the Wallowa-Whitman National Forest to 31 million board feet within the Umatilla National Forest. Due to a greater number of acres allocated to wilderness, riparian areas, wildlife corridors, and old forest, alternative C would result in the fewest number of acres suitable for timber production. Alternative C would also be the most restrictive alternative in terms of timber harvest.

Alternatives B, E, and F would result in the same allowable sale quantity because these alternatives would have the same number of acres suitable for timber production, which is the primary component of allowable sale quantity. Old forest and riparian management areas would be classified as unsuitable for timber production.

Long-term Sustained Yield Capacity Effects

Long-term sustained yield capacity (LTSYC) is the maximum amount of timber volume that can be sustainably harvested on lands suitable for timber production once the desired future conditions have been achieved. Long-term sustained yield capacity was summarized for the future time period of year 200 to 300. Generally, long-term sustained yield capacity is equivalent to annual increment. In order for yield or timber harvest to be sustainable in the long-term, annual yield or harvest would be equivalent to annual growth. In plain language, once desired conditions are achieved, harvest would not exceed growth so that desired conditions would be maintained over time. Long-term sustained yield capacity is calculated based on the determination of yield by prescription from regenerated stands, including, where appropriate, intermediate yields selected in the solution for a specific alternative. Calculations of long-term sustained yield capacity were not constrained by budget. The decadal allowable sale quantity cannot exceed long-term sustained yield capacity.

Table 294, table 295, and table 296 display the long-term sustained yield capacity by alternative for each national forest. Alternative D would result in the highest long-term sustained yield capacity within all three national forests. Alternative D would be the least restrictive alternative, in terms of timber harvest activities and would not allocate additional acres to wilderness, old forest, or wildlife corridors. Alternative D would also contain the most narrow riparian management areas. This would result in the greatest number of acres suitable for timber production under alternative D when compared to the other alternatives. In the long-term, alternative D would be able to sustain the largest timber harvest volumes due to fewer restrictions and an increased number of suitable acres. Long-term sustained yield capacity would range from 79 million board feet within the Umatilla National Forest to 125 million board feet within the Malheur National Forest.

Alternative C would have the lowest long-term sustained yield capacity within all three national forests. This is because alternative C would be relatively restrictive in terms of timber harvest activities. Additionally, alternative C would allocate a substantial amount of acres to wilderness, riparian areas, wildlife corridors, and old forest, which would result in a substantial decrease in the number of acres suitable for timber production. Under alternative C, long-term sustained yield capacity would range from 32 million board feet within the Umatilla National Forest to 59 million board feet within the Malheur National Forest.

As shown in table 296, alternatives B, E, and F would result in the same level of long-term sustained yield capacity within each national forest. This is because these alternatives have the same number of acres suitable for timber production.

Total Sale Program Quantity Effects

Total sale program quantity is the actual level of harvest volume predicted for each alternative. Total sale program quantity can come from lands suitable for timber production and lands unsuitable for timber production, as well as volume removed outside of the utilization standards. These estimates of volume were constrained by the budget assumptions assigned to each alternative. Lands unsuitable for timber production are available for timber harvest activities where harvest would contribute to meeting restoration objectives and desired conditions. Fuelwood was generally assumed to be included in timber sale program quantity and not allowable sale quantity, regardless of whether it is removed from suitable or unsuitable forestland.

Table 294, table 295, and table 296 display the timber sale program quantity by alternative within each national forest. Alternative D would result in the highest timber sale program quantity within all three national forests. This is because alternative D would result in the highest number of acres suitable for timber production. It would also be the least restrictive alternative in terms of timber harvest. Due to the increase in timber production under alternative D, the budgets required for vegetation management would need to be increased by approximately 170 to 195 percent from current levels. The budgets required for fuels reduction would also need to be increased by approximately 5 to 20 percent from current levels. Under alternative D, harvesting on lands suitable for timber production would occur at the allowable sale quantity. Total sale program quantity would exceed allowable sale quantity because the higher budget levels would also enable the harvesting of additional acres unsuitable for timber production, but available for harvest. Under alternative D, timber sale program quantity would range from 76 million board feet within the Umatilla National Forest to 87 million board feet within the Malheur National Forest.

Alternative E would result in the second highest timber sale program quantity within all three national forests because it would result in the second highest number of acres suitable for timber production. Due to the increase in timber production under alternative E, the required budget level for vegetation management would be approximately 65 to 80 percent higher than current levels. Higher budget levels for fuels reduction would also be required. An increase in the budget for fuels reduction of approximately 20 to 35 percent would be required to implement alternative E. Under alternative E, harvesting on lands suitable for timber production would occur at the allowable sale quantity. Total sale program quantity would exceed allowable sale quantity because the higher budget levels would also enable the harvesting of additional acres unsuitable for timber production, but available for harvest. Under alternative E, timber sale program quantity would range from 50 million board feet within the Wallowa-Whitman National Forest to 56 million board feet within the Umatilla and Malheur National Forests.

Alternative C would result in the lowest timber sale program quantity within all three national forests because alternative C would result in the fewest number of acres suitable for timber production. Alternative C would also be the most restrictive alternative in terms of timber harvest. Due to the decrease in timber production under alternative C, budget levels required for vegetation management would be approximately 45 to 50 percent less than current budget levels. Budget levels required for fuels reduction would be approximately 25 to 55 percent less than current levels. Under alternative C, funding for vegetation management and other ground disturbing activities would be de-emphasized in favor of watershed restoration (road closure and decommissioning, and stream channel and fish passage improvements), invasive species control, and habitat improvements in the dry forest. As a result, timber sale program quantity would be lower than the allowable sale quantity. Greater restrictions on harvesting would also prevent full utilization of the volume available. Under alternative C, timber sale program quantity would range from 15 million board feet within the Wallowa-Whitman National Forest to 16 million board feet within the Malheur and Umatilla National Forests.

Table 297 displays the timber sale program quantity level of harvest as a percent of the estimated annual growth on lands suitable for timber production. Annual growth was estimated using data from the CVS plots for net growth per acre per year and multiplying it by the suitable acres for each alternative. The percent figures in table 297 were then calculated using the CVS estimated growth and timber sale program quantity. These estimates may be slightly high because timber sale program quantity includes some volume from lands unsuitable for timber production. However, the estimated annual growth was determined for just suitable lands. If the ratio of timber sale program quantity to growth was calculated for all lands where harvest was possible (i.e., lands available for harvest, but unsuitable for timber production), then the ratio of harvest to growth would be much smaller.

Alternatives D and E would result in the harvesting of the largest percent of the estimated annual growth, averaging approximately 40 to 70 percent within the three national forests. The Umatilla National Forest would have the highest ratio of harvest to growth under all of the alternatives, relative to the other two national forests. Alternative C would result in the lowest ratio of harvest to growth within all three national forests. All alternatives fulfill mandates of sustainability, which include the concept of harvesting not exceeding growth. However, one of the purposes of timber harvest is to restore the ecosystem by changing the existing conditions in such a way as to move them towards the desired conditions. The consequences of not harvesting or reducing biomass by fire would be an increased risk of mortality from uncharacteristic wildfire, insects, and disease. The increase would be primarily due to growth exceeding mortality (from insects and disease and fire), making it difficult to achieve desired stand densities.

Table 297. Annual harvest as a percentage of annual net growth

National Forest	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F
MAL	23%	24%	18%	48%	43%	29%
UMA	39%	38%	34%	69%	74%	47%
WAW	18%	22%	21%	45%	41%	28%

Cumulative Effects

Potential cumulative effects were analyzed by considering the effects of the alternatives in the context of past, present (ongoing), and reasonably foreseeable future activities that have occurred within the vegetation cumulative effects analysis area. This analysis area consists of the 25 sub basins (HUC 4) which contain the Malheur, Umatilla, and Wallowa-Whitman National Forests and other lands. The time period into the future considered was 50 years. The effects that past activities have had on forested vegetation are discussed in the Forested Vegetation, Timber Resources, and Wildland Fire Section under the History and Affected Environments sections and are reflected in the forested vegetation existing conditions. Present and foreseeable future activities that could affect forested vegetation are summarized below:

Human Population Increases and/or Shifts toward Wildland-Urban Interface

For the last several decades, there has been more human development within the wildland-urban interface (WUI). The trend indicates that people will continue to move to western states and build houses adjacent to National Forest System lands, resulting in additional areas designated as wildland-urban interfaces during the life of the forest plan. Adjacent ownerships and inholdings of private property can influence management options for fuels treatments and prescribed fire. Human development within the wildland-urban interface has had effects on forested vegetation by influencing the locations of hazardous fuels reduction treatments. Implementing fuels reduction treatments within a wildland-urban interface may postpone or override the opportunity for vegetation treatments intended to meet other resource needs in areas located away from communities. Public support and concerns will also affect fire and fuels projects and may affect the use of fire by limiting fire in some areas because of social and political issues and smoke concerns. These trends are likely to continue in the future. Additionally, with a greater number of people living and recreating in the wildland-urban interface areas, there is a greater probability of more human-caused wildfire ignitions that could affect forested vegetation.

Community assistance plans that identify wildland-urban interface areas and opportunities for fuels treatments in areas adjacent to national forests would enhance the Forest Service's ability to treat these areas and protect high risk, high value areas. Community Wildfire Protection Plans (CWPPs) emphasize a collaborative approach to fuel reduction projects on both public and private land and place priority on treatment areas identified by communities themselves. CWPPs involve identifying fuel hazards, the risk of wildfire occurrence, structures and other community values at risk, and local preparedness capabilities. CWPPs would help to establish community priorities, recommendations, and develop an action plan and assessment strategy for communities at risk. Currently, all of the counties located within the cumulative effects analysis area have prepared Community Wildfire Protection Plans, including Baker, Umatilla, Grant, Harney, Morrow, Union, Wallowa, Asotin, Columbia, Garfield, Idaho, Nez Perce, Walla Walla, Adams, Wheeler, Washington, Crook, Malheur, Gillian, and Deschutes Counties. The ability to reduce fire hazard across agency boundaries and on private ownership contributes to long-term forest health, mitigation of large fires, reduction of suppression costs, and greater firefighter and public safety. The amount treated annually is difficult to predict due to a number of factors, but is predicted to increase.

Increased Regulation and Concern over Smoke Emissions

The ability to implement the vegetation treatments under alternatives A, B, C, E, and F is dependent upon prescribed burning (both within and outside harvest units), as well as using wildland fire (unplanned ignitions) for resource benefits. Therefore, to the extent that air quality regulations may become more stringent concerning the quantity and timing of smoke emissions, there could be substantial effects in limiting vegetation treatments using prescribed burning.

Alternative C would be most negatively affected by increased regulation and concern over smoke emissions because alternative C would rely mainly on the use of fire (planned and unplanned ignitions) to reduce stand densities. Due to the high percent of the dry upland forest potential vegetation group in closed stand densities and the potential for very high levels of tree mortality, the window or timeframe under which fire could and would be managed to achieve the desired conditions would be limited. Since alternative C would utilize fire to achieve the desired conditions, and current conditions limit the ability to reintroduce low severity fire effects, the window or timeframe may prove unrealistic. The levels of smoke emissions generated under alternative C would be substantially increased, further limiting burn windows and the amount of acres that could be burned due to the increased levels of particulate matter generated. Impacts to public health from the likelihood of exceeding air quality standards would also substantially limit the amount of acres that could be burned under alternative C. Alternative C would likely result in increased fire severity, decreased ecological resiliency, and loss of key ecosystem components and functions due to scope and scale of fire severity outside that which historically occurred within the dry upland forest potential vegetation group.

Alternative D would be the least negatively affected by increased regulation and concern over smoke emissions because alternative D would not utilize prescribed fire (planned ignitions) outside of harvest units. Additionally, the majority of the fuels treatments within the harvest units would be accomplished by removal or crushing, instead of burning.

Timber Product Manufacturing Infrastructure and Economics

The ability of the national forests within the Blue Mountains to positively manage forested vegetation is partially dependent upon the ability to sell forest products to manufacturing companies and to use the harvesting processes, including residual slash disposal activities. If the forest products industry continues to decline in areas surrounding the Blue Mountains to the extent that it is more difficult to sell forest products, or if stumpage prices decrease substantially, it would affect the number of acres that could be treated during the planning period. While some treatments could be accomplished by using only prescribed burning treatments, it is generally too risky within the wildland-urban interface or may result in unacceptable levels of mortality, thus making it difficult to achieve the desired conditions for forested vegetation. Other treatment options may be cost-prohibitive. Additionally, smoke emissions generated by “burn only” treatments would be high and would limit the number of acres that could be treated.

Alternatives D and E would provide the greatest support of the forest products industry within the cumulative effects analysis area because these alternatives would result in the greatest increase in timber volume harvested. Under alternative D, the amount of timber volume produced within the Blue Mountains forests would increase by 200 percent, when compared to alternative A. Under alternative E, the amount of timber volume produced within the cumulative effects analysis area would increase by 100 percent, when compared to alternative A. Under alternative A, the amount of timber volume produced would remain the same and would not result in a change in the total timber volume produced within the cumulative effects analysis area. Under alternative C, the amount of timber volume produced within the cumulative effects analysis area would decrease by 42 percent, when compared to alternative A.

Conservation Efforts for Whitebark Pine

The U.S. Fish and Wildlife Service (USFWS) recently determined that this tree species warranted listing as a threatened or endangered species, but that it was precluded due to higher priority species. The species is now designated as a Federal Candidate species and it is on the Region 6 Sensitive Species list. One of the major threats to this species is climate change. As the result of climate change, whitebark pine may be particularly vulnerable to loss of favorable habitat due to the restriction of its range to the upper subalpine zone (Aubry et al. 2008). The predicted impacts of increased temperatures include a severe decline in suitable habitat; increased mountain pine beetle activity; an increase in the number, intensity, and extent of wildfires; and perhaps an increase in white pine blister rust-related mortality.

The present lack of scientific tools to predict climate change on regional or local scales limits the ability to quantify potential future impacts that can be applied to management decisions at the forest or stand level. However, a number of new initiatives that focus on the impacts of climate change on western forests provide information and tools that could be used to create management strategies for whitebark pine in the Pacific Northwest that incorporate climate change. Part of the regional five- year action plan is the development of specific management recommendations for whitebark pine and associated species that incorporate the best available science on the predicted impacts of climate change on whitebark pine (Aubry et al. 2008).

The forests within the Blue Mountains have implemented some restoration efforts for this species and these activities would likely continue or intensify, contingent upon funding. If this tree species is eventually listed as a Federal threatened or endangered species, there could be effects to the vegetation and fire management programs within the Blue Mountains national forests due to additional emphasis placed on whitebark pine restoration actions.

All of the alternatives would contain desired conditions for special habitats such as whitebark pine. The desired condition would stress the desire that whitebark pine persists on the landscape. Furthermore, whitebark pine would provide high quality habitat for associated species and be resilient and sustainable considering the range of possible climate change scenarios.

Carbon Sequestration

Forests are an important part of the global carbon (C) cycle as they help slow the rising of atmospheric CO_2 concentrations by storing carbon in forest biomass and soils, as well as in some forest products. Carbon fluxes between the atmosphere and forests are complex, and vary spatially and temporally. The Malheur, Umatilla, and Wallowa-Whitman National Forests store and sequester approximately 13 percent of the total Pacific Northwest Region carbon and CO_2 (data obtained from Heath et al. 2011).

Factors that could potential influence whether carbon stocks shift from regional carbon sinks to carbon sources include increasing temperatures, changes in precipitation, changing disturbance regimes, such as more frequent fires, and land use that decreases forested area. Fire and bark beetle outbreaks play a large role in regional carbon balances. How the complex interactions between climate, fire, and insects outbreaks will affect the carbon cycle within the Blue Mountains is challenging to quantify with any certainty because the science is still developing in this area.

Under simulations, eastern Oregon gains ecosystem carbon as a result of the expansion of forest and woodland vegetation, while experiencing more and larger wildfires at the same time (Millar et al. 2006). This has implications for carbon sequestration as well as timber production. Timber productivity could increase through three mechanisms: through CO_2 fertilization, through warming in cold climates extends growing seasons where precipitation also increases, or through precipitation increases under currently water-limited conditions (Fischlin et al. 2007). However, the magnitude of these effects remains uncertain. Countering these potential increases in timber productivity are the effects of increased fire and insect disturbance.

Mitigation options that can help reduce climate change impacts on carbon include maximizing the forests' capacity to store carbon, decreasing carbon loss potential from disturbance, and utilizing biomass for energy. However, these options need to weigh tradeoffs and risks, and must ultimately be coupled with adaptation strategies. A forest's carbon capacity could be maximized by retaining large diameter trees or by extending rotation age. Carbon loss potential from disturbance could be decreased through fuels reduction treatments that decrease fire severity and increase ecological resiliency.

Timber management projects can influence carbon dioxide sequestration in three main ways: (1) by increasing new forests (afforestation), (2) by avoiding damage or destruction of forests (avoided deforestation), and (3) by manipulating existing forest cover (managed forests). Land-use changes, specifically deforestation and regrowth, are by far the biggest factors on a global scale in forests' role as sources or sinks of carbon dioxide, respectively (IPCC, Intergovernmental Panel on Climate Change, 2000). Projects that create forests or improve forest conditions and capacity to grow trees tend to increase carbon sequestration. Research by Hurteau and North (2009) found that, in wildfire-prone forests, tree-based carbon stocks were best protected by fuel treatments that produced a low-density stand structure dominated by large, fire-resistant pines. However, other findings suggest that reducing the fraction by which carbon is lost in a wildfire requires the removal of a much greater amount of carbon, since most of the carbon stored in forest biomass remains unconsumed even by high-severity wildfires (Mitchell et al. 2009). Most of the treatments simulated resulted in a reduced mean stand carbon storage.

Within the dry upland forest potential vegetation group, where approximately 60 to 90 percent of the harvesting treatments would occur, alternatives E and D would result in the greatest improvement in ecosystem resiliency. When compared to the other alternatives, alternatives E and

D would promote the greatest change in diversity in vegetation composition and structure that would lead to increased ecological resiliency in the face of climate change, and therefore result in the lowest risk of damage or destruction by fire or insects. However, alternatives E and D would also harvest the greatest amount of timber, removing a substantial amount of carbon.

Climate Change

Of all of the ongoing and foreseeable future actions that have the potential to affect forest vegetation within the Blue Mountains, climate change potentially may be the most important factor. The effects of climate change may combine with some of the effects that result from implementing the alternatives to produce cumulative effects. Although increases in temperature, changes in precipitation, higher atmospheric concentrations of carbon dioxide (CO_2), and higher nitrogen (N) deposition may change ecosystem structure and function by the end of the 21st century, the most rapidly visible and most significant short-term effects on forest ecosystems may be caused by altered disturbance regimes (Vose et al. 2012). In general, given the existing condition of the forested vegetation within the Blue Mountains, the potential effects (and uncertainties) that climate change may have on forested vegetation can be summarized as follows:

- Increased wildfires and more severe fire behavior within all forest types
- Increased insect-related mortality
- Reduction in or loss of whitebark pine populations
- Reduction in or loss of aspen
- Reduction in subalpine forest
- Shifts in species compositions and distributions within upland forest potential vegetation groups
- Shifts from forests, woodlands, and shrublands to grasslands and deserts
- Drought-induced tree mortality
- Declines in vegetation productivity

In the future, climate change is anticipated to contribute to the character of the Blue Mountains forests, disturbance regimes, and timber productivity (Schmoldt et al. 1999). At the most fundamental level, plant physiology may change in response to increased temperatures and CO_2 concentrations, in some cases reducing transpiration and water loss. The potential for CO_2-induced increases in plant water use efficiency are not well known. There is a potential for increased forest growth in areas that become warmer and wetter, and decreased growth in areas that become warmer and dryer (Fischlin et al. 2007). Where forest growth increases, there could be an accompanying increase in water demand because of higher evapotranspiration rates resulting from increased temperatures.

Climate change, primarily through increases in temperatures and CO_2 and changes in precipitation, could result in shifts in species composition and distributions of forest communities. Climate changes have, and could continue to, result in earlier initiation of the growing season, longer growing season length, earlier plant senescence, and mismatches between climate characteristics and plant phenology. Plant species respond individually to changes in temperature and precipitation regimes, atmospheric CO_2, and disturbance regimes. Hence, new plant associations may develop in the future as a result of climate change. More broadly, in future vegetation simulations produced by Bachelet et al. (2001a), areas of subalpine forest and alpine tundra in the Pacific Northwest are projected to decrease as temperatures increase at higher elevations (Bachelet et al. 2001b, Shafer et al. 2010). They also project an expansion of forest and woodland into areas of eastern Oregon currently dominated by grassland and shrubland as a result of projected increases in precipitation, a longer growing season, and increased plant water-use efficiency produced by increased atmospheric CO_2 concentrations. General increases in precipitation could result in expansion of woody species and shifts from grasslands to shrublands, or from grasslands and shrublands to woodlands and forests. Conversely, decreases in effective precipitation could cause declines in vegetation productivity and shifts from forests, woodlands, and shrublands to grasslands and deserts. Some species have the potential to expand upslope with increases in temperature. Some native forest species may be displaced where climate change favors invasive species. Changes in forest composition, structure, seasonality and productivity could have consequences for wildlife species dependent on forested habitats.

Inadequate water availability coupled with drying conditions could contribute to an overall increase in the vulnerability of forests to insects, fire, and drought. Recent forest dieback in the western United States, and model simulations, indicate that the frequency and magnitude of some disturbance events (e.g., drought, wildfire, and insect outbreaks) may be changing (Allen et al. 2010). The relative influence of climate and fuels on fire behavior and effects varies regionally and subregionally across the western United States (McKenzie 2004). However, an increase in fire activity is expected for all major forest types in the Blue Mountains under projected climate changes (Bachelet et al. 2001, Whitlock et al. 2003, Keeton et al. 2007). A warmer climate has already led to more frequent fires, more severe fires, earlier initiation of the fire season, and a longer fire season in the western United States (Westerling et al. 2006). Littel et al. (2009) built statistical models of the associations between seasonal and annual precipitation, and temperature and fire extent for 1916-2002 for the 11 contiguous western states. They found that relatively modest changes in mean climate will lead to substantial increases in area burned, particularly in crown-fire ecosystems in which distinct thresholds of fuel moisture and fire weather exist (Littel 2009). For a mean temperature increase of 4 °F (expected by the mid-21st century), annual area burned by wildfire is expected to increase by a factor of 1.5 to 5. Summer temperature forces the change in area burned, likely as a result of overall drought patterns and fuel dryness. Large fires (greater than 1,000 acres) account for most of the area burned in the Blue Mountains in a given year. Regional-level relationships between climate and fire differ, depending on seasonal and annual variability in climatic drivers, fire frequency and severity, and the legacy of previous-year climate in live and dead fuels (Veblen et al. 2000, Hessl 2004). Current-year drought is typically associated with more area burned, but the effects of antecedent conditions differ owing to interactions among climatic effects (Littel 2009). In the Pacific Northwest, direct associations exist between fire extent and current-year drought (Hessl 2004, Wright and Agee 2004, Heyerdahl et al. 2001, Heyerdahl et al. 2008). In the cold upland forest potential vegetation group and some moist upland forest potential vegetation groups where fine fuel production is not limited by climatic variability, short-term synoptic fluctuations in atmospheric conditions play an important role in forcing extreme wildfire years (Johnson 1993, Gedalof et al. 2005).

In general, there is a greater range of area burned under hot, dry conditions than under cool, wet conditions. Whereas cool, wet conditions nearly always lead to reductions in area burned, favorable fire conditions do not necessarily lead to increases in area burned. This difference in response is linked to the sequence of events required to cause large fire increases. Although drought is important, fires will not occur unless drought is accompanied by an ignition source and strong winds. As long as weather conditions do not become unfavorable for wildfire, forests will remain flammable and ignition and rapid spread could occur at any point during the fire season. It remains to be seen how increases in conditions favorable for wildfire could impact the ability to use prescribed burning as a management tool.

Insect lifecycles depend on a complex interaction of temperature, moisture, and suitable hosts. Although outbreak dynamics differ from species to species and from forest to forest, climate change appears to be one driving factor for some of the current forest insect outbreaks in western North America. Temperature influences everything in an insect's life, from the number of eggs laid by a single female, to the insects' ability to disperse to new hosts, to individuals' over-winter survival and developmental timing. Elevated temperatures associated with climate change, particularly when there are consecutive warm years, can speed up reproductive cycles and reduce cold-induced insect mortality. Additionally, shifts in precipitation patterns and associated drought can also influence insect outbreak dynamics by weakening trees and making them more susceptible to attacks. For many forest insect species (primarily beetles; notably Ips and Dendroctonus species), the influence of elevated temperatures on outbreak dynamics is most notable at higher elevations and latitudes where some beetles have shifted to completing their development in a single year, rather than two or even three years or, in some cases, have shifted to completing multiple generations per year. All else remaining constant, this decrease in generation time translates to an increasing rate of population growth.

Depending on the magnitude of the temperature increase, which may vary by elevation, high elevation forests could be at greater risk than lower elevation forests, where warmer temperatures may disrupt the insects' seasonality. Elevated winter temperatures are associated with increased winter survival; however, it should be noted that increased winter survival does not always coincide with increased population success based on developmental timing. Each process is affected by temperature patterns occurring at different times of the year.

The combined expectations regarding increases in water limitation, wildfire activity, high elevation adaptive mountain pine beetle seasonality, and forest vulnerability to drought, fire and insects, suggest that Blue Mountains forests are likely to be fundamentally affected by altered disturbance regimes as the region's climate changes.

Fire Regime Condition Class

The emphasis on treatments of fire regime condition class areas out of historical range (condition class 2 and 3) would continue. This is applicable to Bureau of Land Management, State lands, and National Forest System lands. In general, non-Forest Service lands are dominated by condition class 2 and 3.

Wildfire and Other Disturbance Mechanisms

Most of the vegetation types in the analysis area have evolved with fire. Fire frequency and intensity varied historically by vegetation type, and vast acres of shrub and timber burned each year (Agee 1993). There is evidence that Native Americans used fire to herd game and provide feed for stock. According to fire records, in the first half of the 20th century an average of 30 million acres burned each decade in the west.[4] Before that, settlers report seeing vast acreages of blackened land (Gruell 1985). With the settlement of the west came the notion that fires were bad. Following the fires of 1910, the Forest Service began its campaign to suppress wildfires. Instead of fire, settlers employed plows, railroads, saw blades, sluice boxes, cattle, sheep, and other accoutrements as disturbance agents. Settlers converted many acres of rangelands to farm ground, primarily in the lower elevations, while ranchers grazed horses, cattle and sheep on less

[4] http://www.nifc.gov/fire_info.html

productive and higher elevation sites. At the turn of the last century, livestock grazing occurred throughout the forest, introducing a new disturbance on what would later become National Forest System lands. High levels of livestock grazing reduced the fine fuels (grasses and shrubs) that carried low severity surface fires, resulting in a substantial reduction in fire disturbances on National Forest System lands.

Timber harvest replaced fire as the major disturbance on the national forest, but it did not affect an equivalent number of acres. This has led to a decrease in forests of older age classes and an increase in some areas of dense forests of smaller diameter classes. This change in age and size classes has resulted in conditions that are less resilient than desired.

Uncharacteristically severe wildfires are on the rise, especially in the dry upland forest potential vegetation group. Over the past 10 years, lightning-caused fires ranged from approximately 808 to 2,170 per year in the northwest. Human-caused fires ranged from approximately 1,078 to 2,666 fires per year in the northwest.[5] More fires are occurring adjacent to residential areas as people build more subdivisions and structures along public land boundaries. These changes are occurring across the west.

Most of the higher elevation cold upland forest potential vegetation group in the cumulative effects area is located in National Forest System lands. Therefore, management activities affecting these vegetation types would be initiated by the Forest Service. Much of the cold upland forest potential vegetation group is located within existing or proposed wilderness, roadless, or backcountry areas. Under all of the alternatives, only approximately 5 to 10 percent of the harvest activities in Forest Service System lands would occur within the cold upland forest potential vegetation groups. The majority of vegetation effects resulting from management actions within the cold forest potential vegetation group would occur as the result of wildfire managed for resource benefits. The cold upland forest potential vegetation group was historically characterized by infrequent, high severity fire. Managing wildfires for resource benefits could result in stand-replacing events with high levels of mortality. If climate change causes fires to increase in size and severity, managing wildfires for resource benefits to achieve desired conditions may become more difficult. Not every natural ignition would be managed for resource benefits. For each unplanned ignition, a decision would be made whether to suppress or manage the fire to benefit the resources in accordance with the Fire Management Plan. Under all of the alternatives, all ignitions would be managed based on safety, values at risk, and the consistency of predicted fire effects with the desired conditions. Responses can range from monitoring to full suppression.

Within the dry upland forest potential vegetation group, existing vegetation conditions tend to be more highly departed from the HRV due to the historic, frequent fire regime and a greater number of missed fires. All of the alternatives would attempt to address, to varying amounts, some of the negative effects of the past events that have occurred within the dry upland forest potential vegetation group within the cumulative effects analysis area. Under alternatives D and E, the dry upland forest potential vegetation group would be expected to exhibit decreased fire-related mortality due to more open stand densities resulting from increased levels of timber harvest activities. Approximately 60 to 90 percent of the mechanical treatments would occur within the dry upland forest potential vegetation group. Under alternative D, approximately 72 to 77 percent of Forest Service lands within the cumulative effects analysis area would contain open stand densities at year 50. Under alternative E, approximately 69 to 70 percent of Forest Service lands within the cumulative effects analysis area would contain open stand densities at year 50. Under these alternatives, the majority of the landscape would be fairly open. Conditions would be

[5] http://www.nifc.gov/fireInfo/fireInfo_stats_lightng.html

conducive to the reintroduction of low severity fire. There would be more opportunities to use prescribed fire and to manage unplanned ignitions for resource benefits to achieve desired conditions.

Decreased stand densities would also result in regeneration of more shade intolerant/fire tolerant tree species. Within the dry forest potential vegetation group, it would be beneficial to increase the percent of the landscape in shade intolerant/fire tolerant species because this would result in decreased fire behavior and decreased risk of uncharacteristically severe wildfire across the cumulative effects area. This would also result in decreased fire risk to adjacent land ownerships. If climate warms over time and fires increase in size and severity, a landscape dominated by more open stand conditions with shade intolerant/fire tolerant tree species would be at decreased risk for catastrophic, uncharacteristically severe wildfire and more sustainable and ecologically resilient.

Difficulties may arise due to the mixture of land ownerships that occurs within the lower elevation, dry upland forest potential vegetation group within the cumulative effects analysis area. Other ownerships adjacent to or surrounded by lands administered by the Forest Service affect opportunities to use fire and, therefore, to emulate historical fire effects on large landscapes. In general, private landowners use timber harvest rather than fire to manage their vegetation. Fire may be used to treat activity fuels, but treatments are often limited in extent and effect. The proximity or inclusion of private lands affects, in particular, the use of fire because these fires can burn large areas for long time periods depending on the vegetation, fuels, weather, and other factors. However, fire management activities can be coordinated with managers of adjacent public lands, such as the BLM and adjacent national forests, or other agencies. In this case, effects of managing wildfire could extend beyond lands administered by the Forest Service. Prior to managing wildfire, a site-specific, prescriptive plan must be in place. This is included in the Fire Management Plan. Not every unplanned ignition would be managed for resource benefits. For each unplanned ignition, a decision would be made whether to suppress or manage the fire to benefit the resources in accordance with the Fire Management Plan. Under all of the alternatives, all ignitions would be managed based on safety, values at risk, and the consistency of predicted fire effects with the desired conditions. Responses can range from monitoring to full suppression. Agreements are currently in place with the BLM and the State of Oregon and State of Washington on protection responsibilities.

Restoration activities occurring within the dry upland forest potential vegetation group would most likely occur in National Forest System lands. Restoration activities, such as prescribed burning or managing for old forest, would be beneficial to the overall functioning of these ecosystems and would improve wildlife habitat within these vegetation types. Some vegetation components may take many years before noticeable changes occur on the landscape. Other more localized changes would be dramatic and immediate. For example, removing large trees affects not only size class distributions of forest stands, but also the recruitment of snags over time and would reduce the density of large snags on a landscape basis. Given the existing conditions, large tree removal on or off National Forest System lands would affect distribution of the large tree component and future snags and coarse woody debris at a landscape scale. Therefore, the retention and future development of these critical components on National Forest System lands would be essential to providing habitat elements needed by many species. Improvements to these components would cumulatively affect and improve the conditions within the lower-elevation ponderosa pine, dry upland forest potential vegetation groups. Disturbances such as fire, insects, disease, and windthrow would migrate across a landscape, depending upon conditions, and may move from National Forest System lands to other ownerships or vice versa. Vegetative conditions would have a substantial influence on the spread, extent, and direction of disturbances.

All of the proposed forested vegetation treatments would reduce stand density and thereby reduce risks from bark beetles for a 15- to 25-year period. These vegetation treatments and prescribed fire would enhance ponderosa pine and western larch; however, prescribed fire would increase the risk of bark beetle attack in the short-term (1 to 3 years) because bark beetles are attracted to fire-killed and fire-damaged trees which would occur as a result of prescribed fire. In the long term, tree mortality from prescribed fire and associated insect infestations would work together to reduce stand density and reduce the risk of bark beetle infestation for 15 to 25 years. The reduced density of conifers would extend the opportunity for seedling ingrowths and herb/shrub-component enhancement, which would increase structural complexity and species diversity. Complexity and diversity are important in maintaining long-term site productivity (Franklin et al. 1989).

The forested vegetation treatments would reduce density to a prescribed level on a somewhat consistent basis across the treatment areas. Forested vegetation treatments would offer more control in achieving desired structural relationships than prescribed fire, whose affects are more random and less controlled. In the long term, where species that are more fire-resistant occur, lower stand densities would foster the use of prescribed fire to manage fuel loadings. Prescribed fire reduces tree density on a more random and mosaic basis depending on fuel distribution, resulting in variations in fire intensity and tree mortality. All of the proposed forested vegetation treatments and prescribed fire would reduce overall fuel loadings, increase average stand diameter, favor thicker-barked, self-pruning, early-seral species, and make the areas slightly less prone to uncharacteristic effects from wildfire. Such treatments are needed for restoration of landscape structure and fuel conditions. Hahn and others, in An Assessment of Ecosystem Components in the Interior Columbia Basin (Quigley and Arbelbide 1997), report that “without restoration of landscape structure and fuel conditions, the probability of returning to the succession/disturbance regimes that existed historically (that is, the native system) was determined to be low.”

Terrestrial Wildlife Species

This section describes the affected environment, existing conditions, and environmental consequences of the alternatives on a variety of terrestrial wildlife species. The majority of changes to wildlife results from the proposed management of other resources, such as vegetation, access, wildland fire, and livestock grazing. The projected impacts to wildlife from these activities are described in this section, but the actual activities are discussed in more detail in their respective sections. Although the life of a forest plan is 10 to 20 years, impacts to wildlife are displayed on a decadal basis out to 50 years to clearly depict the trajectory for the element being discussed. Different levels of management are proposed for each of the alternatives, and each is described in detail in chapter 2 and appendix A. Unless otherwise noted, the description of effects is only for National Forest System lands in the Blue Mountains (excluding Hells Canyon Natural Recreation Area), and therefore references to the planning area, analysis area, or national forest are to public lands administered by the Forest Service, unless specifically noted otherwise.

Because of the high number of species, wildlife species are placed into different categories and the affected environment and environmental consequences are discussed by groups, representing varying management focus. This section is organized by the following groups of species:

- Viability analysis
    - ♦ focal species – a set of species selected to represent the full array of wildlife responses to conditions projected under management alternatives
    - ♦ threatened and endangered species – those species listed or proposed for listing under the Endangered Species Act
    - ♦ Forest Service sensitive species – species of conservation concern in the Blue Mountains from the 2010 Regional Forester's Sensitive Species List
- Management indicator species – species required by the 1982 NFMA regulations for monitoring purposes
- Resident and migratory birds
- Hunted species
- Wildlife habitat connectivity.

Introduction

The conservation of wildlife species is integral to the maintenance of viable plant and animal populations and biological diversity. National Forest System lands administered by the Forest Service in the Blue Mountains have long served an important role in supporting a variety of wildlife species that are critical to the needs and values of the human population. The diversity of Blue Mountains wildlife habitat is outstanding as a result of the abrupt changes in vegetation that result from changes in aspect, elevation, temperature, moisture, geology, soil depth, the effects of fire, and the management activities and influence of humans. More than 300 wildlife species occur in the Blue Mountains (Baydeck 1999, Thomas 1979), although many of the bird species occur only as migrants.

Federal land management agencies and the state wildlife agencies share legal co-trustee responsibility for the protection and management of wildlife. The Forest Service continues to work closely and cooperatively with both the Oregon Department of Fish and Wildlife (ODFW) and Washington Department of Fish and Wildlife (WDFW) for the conservation and management of wildlife resources, including habitat, within the Malheur, Umatilla, and Wallowa-Whitman National Forests. Such cooperation is important to meet the needs of a growing human population that places increasing demands and competing values on resources, which ultimately impact the wildlife resource.

Managing ecosystems to sustain terrestrial wildlife species depends on maintaining the appropriate mix of habitat quantity, quality, and distribution across the landscape. Most habitats for terrestrial wildlife species are shaped by vegetation characteristics, although in some cases it is an individual component, such as snags or talus slopes. Landscapes are diverse, highly complex systems influenced by many factors, including the interaction of soils, aspect, elevation, climate, disturbance events, and humans. Together these influences have shaped vegetative composition and patterns that have influenced the distribution and quality of wildlife habitats across the landscape (Hessburg et al. 1999).

Fire has historically been a dominant influence in the Blue Mountains (Agee 1993). Fire, insects, storms, disease, animals, and plant succession have been the agents most responsible for modification of habitat and altering species' habitat use (Hessburg et al. 1994, Heyerdahl et al. 2001). Over time, ecosystem conditions fluctuate within some range of variability related to the type and intensity of disturbances that occur. The term historical range of variability (HRV) has been used to describe these fluctuations in ecosystems, using conditions prior to Euro-American settlement as a reference point (Morgan 2004). Historically, low-elevation forests in the Blue Mountains burned frequently (every few years) with low-intensity ground fires, leaving most of the large trees alive. In contrast, high-elevation forests usually burned with stand-replacing fires that killed most trees but at infrequent intervals (hundreds of years).

The categories and types of wildlife species within the planning area reflect the diversity of available habitat. Some species, such as mule deer and Rocky Mountain elk, are steeped in local culture and tradition and have long been important to the local people and communities. However, many nongame species have recently gained more recognition for the economic, aesthetic, and ecological values they provide. For example, as a resource, resident and migratory bird species in the United States generate more than 85 billion dollars in overall economic output and are enjoyed by more than 46 million people (USFWS 2003); however, they are more recognized for the ecological values they offer in terms of insect control, pollination, and seed dispersal. Some of the wildlife species that occur within the planning area are migratory and/or wide ranging and can utilize several habitat types, while others are more sedentary and utilize only a single habitat or individual component within a habitat type. Because of the high number of species, wildlife species are placed into different categories and discussed as groups.

Affected Environment – Terrestrial Species Viability

The implementing regulations (36 CFR 219.19) for the National Forest Management Act of 1976 (NFMA) call for providing viable populations of native and desired nonnative wildlife. Andelman et al. (2001) conducted a review of viability assessments conducted under NFMA and concluded that there was no single accepted or standardized approach for viability analysis, and the debate continues at the national level. Comprehensive viability analysis requires significant data inputs on species demography and life history that are, to this day, unavailable for most species (Ruggiero et al. 1994). The fact that a species occurs in an area is indicative of its persistence, but species generally are tolerant of a range of environmental conditions, resulting in increasingly complicated predictions when using models (Haufler et al. 1996).

Special management emphasis is given to species for which there is a documented viability concern. Species listed in compliance with the Endangered Species Act are placed in one of four categories based on viability concerns: threatened (T), endangered (E), proposed (P), and candidate (C). The Forest Service has a legal requirement to maintain or improve habitat conditions for TEP species to comply with the Endangered Species Act. Administrative direction also exists to maintain or improve conditions for species included on the Regional Forester's Sensitive Species List as addressed in FSM 2670. Currently, there are two threatened and endangered (TE) terrestrial wildlife species (Canada lynx and gray wolf) that either occur or have habitat present within the planning area. TE species are of particular concern because of their status and their need for special management attention. Additionally, 33 species identified by the regional forester as sensitive either occur or have habitat within the planning area.

Species listed in compliance with Endangered Species Act are given special consideration at the project level through biological assessments that are completed to identify possible effects to these species. These evaluations determine at a much finer scale whether or not a project may affect a TEP species or its habitat and are used for consultation with the U.S. Fish and Wildlife Service in compliance with Section 7 of the Endangered Species Act.

Managing habitat to sustain terrestrial wildlife species depends on maintaining the appropriate mix of habitat quantity, quality, and distribution across the landscape. Landscapes are diverse, highly complex systems influenced by many factors, including the interaction of soils, aspect, elevation, climate, disturbance events, and humans. Together these influences have shaped vegetative composition and patterns that, in turn, have influenced the distribution of biodiversity across the landscape. A detailed discussion regarding departure of vegetation from historical conditions is in the Forested Vegetation, Timber Resources, and Wildland Fire affected environment for forested vegetation section.

Changes in vegetation due to natural or human-caused disturbances and human influence on the landscape have affected terrestrial wildlife species and their habitat within the Blue Mountains national forests. For example, early timber and fire management strategies within the dry forest have resulted in an ecosystem that is highly departed from what occurred historically. This leads to concern for the viability of some species, such as the white-headed woodpecker, that rely heavily on this ecosystem. Spatial characteristics of landscapes, such as patch size and distribution, connectivity, and fragmentation, are largely determined by management actions and interactions with fire, insects, disease, and other natural disturbances. The extent of human influence within habitats can affect patch quality and connectivity and thereby affect wildlife presence and/or movement across the landscape. An example would be the I-84 corridor which may impede the movement of large carnivores between preferred habitats.

Within the planning area, major vegetation types that provide habitat for wildlife species have been described by various authors (Hall 1973, Hann et al. 1997, Johnson and Clausnitzer 1992, Johnson and O'Neil 2001, Thomas et al. 1979). Following procedures found in Powell et al. (2007), Countryman (2009) classified 60 plant association groups (PAG) into 22 potential vegetation groups (see "Forested Vegetation, Timber Resources, and Wildland Fire" section). Assessments of the planning area have been conducted to establish existing conditions (Countryman 2008, Countryman 2008a, Countryman and Justice 2010) and to compare to what is considered HRV (Countryman and Swanson 2008 (revised 2010), Countryman and Justice 2010, Mason and Countryman 2010). In general, alterations to vegetation types have been most significant in the lower elevations and least significant in the higher elevations, and past timber harvest has influenced many vegetation types and associated wildlife habitats. Some loss of ecological function has occurred as a result of these changes. Change in ecological function helps identify where the potential for active restoration is often higher, such as in ponderosa pine, and where the potential is lower, such as in higher elevation spruce-fir and alpine tundra types where deviation from historical conditions is less. Approximately 31 percent of the planning area is in inventoried roadless areas, designated wilderness areas, or other specially designated areas that contain representative vegetation types (Countryman 2009a). IRAs and/or wilderness area qualities offer large areas of wildlife habitat that are relatively undisturbed by humans and are especially important for some wildlife species.

Recent habitat assessments of landscape conditions and trends on lands administered by the Forest Service within the Blue Mountains have identified several major factors influencing change in forested and nonforested habitat conditions that have occurred since early Euro-American settlement (Countryman and Justice 2008, Countryman and Swanson 2008 (revised 2010), Mason and Countryman 2010, Quigley and Arbelbide 1997, Wisdom et al. 2000, Wissmar et al. 1994). Depending upon the vegetation type examined, these factors include fire exclusion, timber harvest, road and urban development, livestock grazing, and recreational uses associated with a rapidly growing human population, resulting in changed conditions and trends with implications for wildlife species that include:

- Changes in forest structure and composition that may contribute to uncharacteristic wildfire behavior in lower elevation forest types
- Roads that fragment habitat, with densities varying from about 14 miles per square mile to about 0.3 mile per square mile
- Competition from invasive plant species that compromises plant diversity and habitat quality and connectivity
- A reduction or degradation of habitats for some wildlife and plant species where human impacts have occurred, and/or where natural disturbance regimes have been altered
- Urban development and infringement into some traditionally important wildlife habitats (including big game winter range), typically at lower to moderate elevations
- A rapidly increasing human population that places uses and demands upon the landscape that alter habitat security and cause disturbance to wildlife species

Wisdom et al. (2000) used the concept of focal species in an attempt to streamline the assessment of ecological systems by monitoring a subset of species and use of a focal species can be a pragmatic response to dealing with ecosystem complexity (Noon 2003, Roberge and Angelstam 2004). The key characteristic of a focal species is that its status and trend provide insights to the integrity of the larger ecological system to which it belongs (Andelman et al. 2001, Lambeck 1997, Noss et al. 1997, Noon 2003). Focal species serve an umbrella function in terms of encompassing habitats needed for other species, are sensitive to the changes likely to occur in the area, or otherwise serve as an indicator of ecological sustainability (Andelman et al. 2001, Lambeck 1997, Noss et al. 1997).

Species assessments have been prepared for 197 of the 300 terrestrial wildlife species present in the Blue Mountains (Lehmkuhl et al. 1997). These species assessments brought together available information at differing scales in order to help assess the habitat wildlife species utilize, along with management information and research needs. Wisdom et al. (2000) reviewed these initial assessments and, utilizing seven criteria to determine if a species should be further assessed, compiled a list of 91 broad scale species. Another 82 fine scale species were added, resulting in a final list of terrestrial vertebrate species for the Columbia Basin analysis. Not all of these species occur in the Blue Mountains. The 91 species that were assessed by Wisdom et al. (2000) were further refined by Rafael et al. (2001) and reduced to 28 species in 12 different families thought to represent the full array of species' responses to projected conditions. These works were used as a starting point for developing an initial list of terrestrial vertebrate species for assessment in the Blue Mountains planning area.

Within the planning area, 175 species were identified as having some level of local and/or regional conservation concern. These 175 species were evaluated and 38 species representing 26 families or groups based on similarity of habitat use were selected for assessment. In selecting 38 species for more detailed analysis, the concept of focal species (Lambeck 1997) was applied and the findings of Wisdom et al. (2000) were consulted. Terrestrial species were grouped by habitat associations; risks and threats were identified for the group, and a representative species (focal species) was selected for the group. The groupings displayed in table 298 are based on the terrestrial families in the Forest Service Region 6 terrestrial assessment (USDA Forest Service

2010). The use of terrestrial families may have tenuous value when applied to a small area like a subbasin, but when applied to large landscapes it can be an effective analysis tool (Raphael et al. 2001, USDA and USDI 2000). All species, however, contribute to, or influence, the ecological processes that maintain biodiversity within the planning area.

Table 298 is an updated list of species for the Blue Mountain planning area and shows whether they were used as a focal species for the group or not. Additionally, the table associates all of the sensitive species for the Blue Mountains to groups and families. Based upon knowledge of ecological relationships of the species evaluated, the smallest number of groups possible was chosen that still allow a meaningful aggregation of species and habitats reflecting important patterns in source habitats. Groups were then aggregated into families to help describe how similar groups of species are related to each other. Families include one or more groups that are associated with similar broad scale vegetative conditions. These generalized vegetative conditions are often used by managers to interpret broad scale patterns and trends. By using a hierarchical evaluation of species, groups, and families, the analysis process addresses single- and multi-species needs as well as identifying broad-scale patterns of habitat change, as did Wisdom et al. (2000).

Analysis Assumptions

Several general overriding assumptions are used throughout this assessment. **A key assumption is that managing for the historical range of variability across ecosystems will result in maintaining viability for most species.** [6] Therefore, if management activities can produce conditions close to or within HRV, species that are adapted to these conditions will have a stronger likelihood of persistence (Aplet and Keeton 1999, Landres et al. 1999, Swanson et al. 1994). Use of HRV relies on two concepts: that past conditions and processes provide context and guidance for managing ecological systems today and that disturbance-driven spatial and temporal variability is a vital attribute of nearly all ecological systems. Approximating historical conditions for source habitats provide a management strategy likely to sustain diverse focal species, even for those species where little information is available (Hunter et al. 1988; Landres et al. 1999; Swanson et al. 1994). Similarly, because of limited understanding about ecosystems, approximating past conditions offers one of the best means for predicting and reducing impacts to current ecosystems (Kaufmann et al. 1994). Therefore, if the amount and structure of source habitats are within HRV, associated wildlife species will have a greater likelihood of sustainability than if the amount and structure of source habitats are outside HRV (Raphael et al. 2001; Spies et al. 2006).

Throughout this analysis, acres of potential vegetation groups, road miles, acres of treatments, etc., are all best estimates based on the information available at the time. Change in forested vegetation was simulated using the vegetation dynamics development tool (VDDT) model (see the Forested Vegetation, Timber Resources, and Wildland Fire section for detailed discussion of VDDT). The analysis using these estimates is intended to indicate the relative differences between alternatives and is not intended to predict absolute amounts of activities, outputs, or effects.

[6] Hunter et al. 1988, Baydeck 1999, Landres et al. 1999, and Samson et al. 2003.

Table 298. Species of conservation concern identified in the Region 6 terrestrial species assessment (USDA Forest Service 2010), their family, group, and representative focal species (F) analyzed (indicated by X) for the Blue Mountains national forests as well as other status categories by species

Family	Group	Common Name	Focal Species	Federally Listed[1]	Sensitive[2]	Management Indicator[3]
Alpine/boreal	Alpine	Gray-crowned rosy-finch	X		O	
		Black Rosy Finch			O	
Alpine/boreal	Boreal forest	Spruce grouse				
		Boreal owl	X			
		Pine grosbeak				
		Water vole	X			
		Canada lynx		FT		
		Moose				
Forest mosaic	All forested communities	Northern goshawk	X			A
		Blue grouse				
		Great gray owl			W	
		Long-eared owl				
Medium/large trees	All forested communities	Sharp-shinned hawk				
		Rufous hummingbird				
		Williamson's sapsucker				
		Hammond's flycatcher				
		Cordilleran flycatcher				
		Mountain chickadee				
		Yellow-rumped warbler				
		Cassin's finch	X			
		Long-legged myotis				
		Silver-haired bat				
		Hoary bat				
		Northern flying squirrel				
Medium/large trees	Cool/moist forest	Vaux's swift				
		Pileated woodpecker	X			X

Family	Group	Common Name	Focal Species	Federally Listed[1]	Sensitive[2]	Management Indicator[3]
		Chestnut-backed chickadee				
		Brown creeper				
		Winter wren				
		Golden-crowned kinglet				
		Ruby-crowned kinglet				
		Townsend's warbler				
		Varied thrush				
		American marten	X			A
		Fisher				
Medium/large trees	Dry forest	Flammulated owl				
		White-headed woodpecker	X		X	X
		White-breasted nuthatch				
		Pygmy nuthatch				
Open forest	All forested communities	Rubber boa				
		Calliope hummingbird				
		Dusky flycatcher				
		Western bluebird	X			
		Chipping sparrow				
		Dark-eyed junco				
		Purple finch				
		Pine siskin				
		California myotis				
		Fringed myotis	F		O	
		Long-eared myotis				
		Fox sparrow	X			
		Lazuli bunting				
Upland grassland	Upland grassland	Upland sandpiper	X		O	
Open forest	Post-fire habitat	American kestrel				

Family	Group	Common Name	Focal Species	Federally Listed[1]	Sensitive[2]	Management Indicator[3]
		Lewis's woodpecker	X		X	A
		Three-toed woodpecker				A
		Black-backed woodpecker	X			A
		Olive-sided flycatcher				
		Western wood-pewee				
Human disturbance	Habitat generalist	Peregrine falcon	X		X	
		Gray wolf		FE	X	
		Wolverine	X	FC	X	
Woodland/grass/shrub	Woodland/grass/shrub	Pygmy horned lizard				
		Side-blotched lizard				
		Striped whipsnake			W	
		Ferruginous hawk				
		Golden eagle	F			
		Prairie falcon				
		Mourning dove				
		Common nighthawk				
		Common poorwill				
		White-throated swift				
		Black-billed magpie				
		Rock wren				
		Lark sparrow	X			
		Brewer's blackbird				
		Western small-footed myotis				
		Yuma myotis				
		Spotted bat			O	
		Pallid bat	F		X	
Woodland/grass/shrub	Juniper woodland	Ash-throated flycatcher	X		W	
		Pinyon jay				

Family	Group	Common Name	Focal Species	Federally Listed[1]	Sensitive[2]	Management Indicator[3]
Woodland/grass/shrub	Woodland/shrub	Sagebrush lizard				
		Night snake				
		Gray flycatcher			W	
		Loggerhead shrike	F			
		Green-tailed towhee			W	
		Merriam's shrew				
Woodland/grass/shrub	Shrub	Desert horned lizard				
		Greater sage-grouse		FC	O	
		Sage thrasher	X			
		Brewer's sparrow				
		Black-throated sparrow				
		Sage sparrow				
		Pygmy rabbit			O	
		Black-tailed jackrabbit				
Woodland/grass/shrub	Grass/shrub	Sharp-tailed grouse			O	
		Long-billed curlew				
		Burrowing owl				
		Horned lark				
		Oregon vesper sparrow				
		Western meadowlark				
		Preble's shrew			W	
		White-tailed jackrabbit				
		Sagebrush vole				
		American badger				
		Pronghorn				
		Mountain goat			W	
		Rocky Mountain bighorn sheep	X			
		California bighorn	X			

Family	Group	Common Name	Focal Species	Federally Listed[1]	Sensitive[2]	Management Indicator[3]
Woodland/grass/shrub	Grassland	Northern harrier	X			
		Swainson's hawk				
		Short-eared owl				
		Grasshopper sparrow			O	
Chambers/caves	Chambers/caves	Townsend's big-eared bat	F		X	
Riparian	Shrubby/deciduous riparian	Mountain quail			W	
		Yellow-billed cuckoo				
		Western screech-owl				
		Black-chinned hummingbird				
		Broad-tailed hummingbird				
		Red-naped sapsucker	F			
		Willow flycatcher				
		Red-eyed vireo				
		Barn swallow				
		Black-capped chickadee				
		Veery				
		Orange-crowned warbler				
		Yellow warbler				
		American redstart				
		MacGillivray's warbler	X			
		Wilson's warbler				
		Yellow-breasted chat				
		White-crowned sparrow				
		American goldfinch				
		Water shrew				
Riparian	Conifer riparian	Inland tailed frog	X		X	
		Black swift	F		O	
Riparian	Marsh with adjacent large trees	Great blue heron				

Family	Group	Common Name	Focal Species	Federally Listed[1]	Sensitive[2]	Management Indicator[3]
		Black-crowned night-heron	F			
Riparian	Riparian/large tree or snag/open water	Wood duck	F			
		Harlequin Duck	F		X	
		Bufflehead			O	
		Common goldeneye				
		Barrow's goldeneye				
		Hooded merganser				
		Common merganser				
		Bald eagle	X		X	
Wetland	Pond/small lake/backwater	Western toad				
		Columbia spotted frog	X		O	
		Northern leopard frog				
		Painted turtle	F		O	
		Spotted sandpiper				
Wetland	Marsh	American bittern				
		Virginia rail				
		Marsh wren	X			
		Tricolored blackbird			O	
		Yellow-headed blackbird				
Wetland	Marsh/wet meadow	Sandhill crane				
		Black-necked stilt				
		American avocet				
		Greater yellowlegs				
		Willet				
		Wilson's snipe	X			
		Wilson's phalarope				
		Bobolink			X	

Family	Group	Common Name	Focal Species	Federally Listed[1]	Sensitive[2]	Management Indicator[3]
Wetland	Marsh/open water	Eared grebe	F			
		Blue-winged teal				
		Northern shoveler				
		Northern pintail				
		Green-winged teal				
		Canvasback				
		Redhead				
		Ring-necked duck				
		Lesser scaup				
		Ruddy duck				

1 Federally listed as threatened (FT), endangered (FE), proposed (FP), or as a candidate (FC)

2 Regional Forester's Sensitive Species List for Oregon (O) or Washington (W) or both states (X)

3 Management indicator species for action alternatives (X) or only for alternative A (A)

The long-term sustainability of a focal species is assumed to be representative of a group of species with similar ecological requirements, and this group is assumed to respond in a similar manner to environmental change (Suring et al. 2011). By providing for adequate amounts and distribution of habitat and managing risks for focal species, it is assumed that the ecological conditions needed to maintain viability of other associated species will also be provided (USDA Forest Service 2010).

It is also assumed that implementing projects following the guidance of the forest plan would impact at least one individual of each species of conservation concern during the plan period. Disruptions to an individual's normal behavior patterns, such as breeding, foraging, and sheltering, are considered impacts to that individual. For example, it is assumed that wildland fire would be used as a management tool to help achieve desired conditions outlined in the forest plan. Inherently the use of fire will disrupt the normal behavior of species due to smoke and could actually cause mortality in less mobile species, such as land snails. Snags and down logs are also vulnerable to loss from fire (Bagne et al. 2008, Randall-Parker and Miller 2002). It is reasonable to assume that during the plan period at least some snags/down logs that provide shelter, nest sites, plucking posts, or foraging structure for various species would be lost, therefore disrupting an individual's behavior.

Another example would be ground nests. Although considered a random event (Jensen et al. 1990) with a low probability of occurrence (Beck and Mitchell 2000), Fondell and Ball (2004) documented that the nests of grassland species in Montana were destroyed by livestock trampling. Since domestic livestock would graze within the national forests, it is likely that at least some individuals would be disturbed.

Although Hamann et al. (1999) focused on birds other authors (Boyle and Samson 1985, Gaines et al. 2003, Taylor and Knight 2003) have documented the impacts of recreation on wildlife, which include the continuum of responses from habituation at one extreme to habitat abandonment at the other. Whether it is a snowmobile that disturbs a wolverine's foraging behavior or a hiker scrambling up a talus slope crushing a snail, individuals of species of conservation concern will most likely be impacted by recreational activity during the life of the plan.

Forest plans do not actually authorize site-specific activity but provide the umbrella under which projects would be designed and implemented. Project level analysis would be based on current and more site-specific information about existing conditions where the actions would be proposed. Historical conditions, current conditions, and desired conditions would be analyzed at a finer scale of resolution to better predict project outcomes. As such, it is assumed that the conditions presented in this analysis are representative of conditions as a whole across the national forest; however, there are sites within the national forest that, when analyzed at the project scale, would not be representative of the bigger picture (e.g., grazing intensity on an individual allotment that may exceed what would be presented for the national forest as a whole).

The Forest Service developed alternatives that have desired conditions for vegetation that strive to be within the bounds of HRV. The potential to diminish biological diversity is greater if current and anticipated conditions are outside and remain outside HRV. As stated previously, the effects described in this DEIS are designed to show the relative differences between alternatives but not precisely predict the amount or location of management activities that would occur during the plan period should an alternative be selected for implementation.

Environmental Consequences – Terrestrial Species Viability

This analysis describes how alternatives contribute to, address, or mitigate patterns of habitat alteration and fragmentation and wildlife disturbance, and identifies terrestrial source habitat that occur at levels less than estimates for the historical, forestwide scale. The discussion includes how alternatives address:

- progress towards achieving habitat desired conditions
- species that have a viability concern
- species affected by human influences

In particular, the analysis focuses on species and their habitats where sustainability may be affected and/or where the species has status as a Federal threatened, endangered, proposed, or candidate species or as a Regional Forester's Sensitive Species.

Changes in wildlife habitat occur at several scales and at differing intensities depending on the home range size and habitat requirements of individual species. The desired conditions are the same for the action alternatives, while management area designations, standard and guidelines, and the anticipated amount and rate of progress towards achieving desired conditions vary. Therefore, effects analyses for wildlife are broad, forestwide, and programmatic by design. The effects from probable management activities that could potentially affect wildlife communities can be grouped into three broad categories:

1. Changes in the type, quantity, and quality of source habitat:

Habitat changes from management activities would affect wildlife. Restoration, regeneration, and forest health goals exist for each alternative. The management activities needed to achieve those goals could include timber harvest; fuel treatments; livestock grazing; road reconstruction, maintenance, and decommissioning; prescribed fire; managed wildland fire; planting; and other similar activities. The Vegetation Dynamics Development Tool (VDDT), a modeling program, was used to project changes in vegetation from management actions as well as natural disturbances (i.e., wildfire and insects and disease).

2. Direct mortality, reduced survival, or increased susceptibility to mortality:

Management activities, such as prescribed burning, road construction, timber harvesting, trail construction, and construction of recreational facilities, could result in direct mortality to individual species. Motorized equipment, logging, road construction and maintenance, fire line construction, and off-road vehicles can kill individual animals. Individuals, as well as groups of species, can be killed by both natural and management ignited fires. Some activities could increase both the likelihood of disease transfer to wildlife populations and competition with nonnative species.

3. Increased disturbance:

Several variables influence disturbance and therefore the response of an animal to disturbance. These variables include type, predictability, frequency, magnitude, timing, and nearness of disturbance. Often due to group size, age, or sex, individuals respond differently to the same disturbance (Bejder et al. 2009). These responses may vary during different life stages of a given species (Wisdom et al. 2000). Disturbance could cause wildlife to change home range use patterns to avoid major disturbances, which in turn may force animals to use inferior quality habitat. Depending on the longevity, intensity, and type of disturbance, shifts in home range utilization may be temporal, seasonal, or permanent.

Roads and OHV access can create barriers to wildlife movement and dispersal. For very immobile species, such as terrestrial snails, reptiles, or amphibians, the impacts could result in isolation of local populations. Improved motor vehicle access can also result in increasing the vulnerability of popular game species, such as elk, deer, and black bears, to mortality from hunting.

Wildlife generally responds to human activities in the forms of avoidance, attraction, habituation, or indifference (as in no response) (Bjeder et al. 2009). Construction of recreation facilities, such as parking lots, campgrounds, trails, and snow play areas, could reduce the habitat suitable for wildlife through direct conversion and by increasing the distribution and level of human disturbance. Disturbance to wildlife would be expected from moderate- to high-use recreation facilities (e.g., campgrounds, picnic sites, boat launches, interpretive centers, and parking lots); special uses; motor vehicle routes and areas open to the public (including snowmobile use); and recreation trails (e.g., mountain bike, horseback, and hiking).

General Effects of National Forest Management

What follows is a description of general effects to wildlife habitat from other resource management activities. Although the amount or distribution of these activities differs by alternative, the general types of effects from the activities would be the same for all alternatives.

Timber Harvest

Timber harvest activities would alter vegetation components that comprise habitat for almost all terrestrial species. Harvesting can change vegetation composition, density, size, amounts, and distribution, and move successional trend toward or away from HRV. These changes in vegetation can have positive or negative effects on different species (Bunnell et al. 1997, Zwolak 2009). For example, past harvest of late old structure pine was detrimental to the white-headed woodpecker, a species that depends on large trees and snags, but may have been beneficial for other species, such as the fox sparrow, that prefer open, brushy habitats (Finch et al. 1997). Post-fire salvage logging can reduce the use of an area by cavity-nesting species, such as the black backed woodpecker, that evolved with fires where trees were not removed (Cahall and Hayes 2009) but may result in more favorable conditions for Lewis's woodpecker (Saab et al. 2007).

The mechanical processes involved in timber harvest often cause disturbance to wildlife because of equipment use or human presence. In areas where roads are built and maintained for long-term use, vehicle access can increase threats to some wildlife species (Forman 2000, Frair et al. 2008, Trombulak and Frissell 2000). Snags are usually removed adjacent to roads for safety reasons, and roads provide ready access to people wanting firewood (Bate et al. 2007). This reduces the habitat for species that require snags/logs. The timing of activities can also have different effects. For instance, localized harvest activities may disturb elk calving during a relatively short period in the spring, but not at other times of the year.

The amount of active management being proposed varies. Alternative D anticipates the most mechanical treatment during the life of the plan. It also would have the most movement towards HRV potential vegetation groups and would result in the greatest improvement for source habitats for many of the forested wildlife species. At the same, it would result in the greatest amount of potential disturbance to a variety of wildlife species. Although no new road construction is proposed, special habitat features, such as snags, that are important to certain species would be at greater risk.

The least amount of mechanical treatments is proposed for alternative C, which also would have the fewest acres of National Forest System lands suitable for active management. For most wildlife species, source habitat would improve the least, while the risk of disturbance to wildlife and special habitats would be smallest. Salvage harvest would be prohibited for alternative C, whereas it would not be expressly prohibited for alternative D. All alternatives include standards and guidelines that would provide some protection to post fire habitats as well as snag habitat.

Fire Management

Fire management activities change vegetation. Fire use or its exclusion can change vegetation composition, density, size, and amount and distribution of both live and dead material, as well as successional trends (Kennedy and Fontaine 2009).

Long-term fire exclusion causes an increase in vegetation quantity above levels that were historically present. In white-head woodpecker habitat, this has caused a reduction in habitat quality because of increasing tree density and higher composition of shade-tolerant tree species (Altman 2000). Long-term fire exclusion in the same type of habitat has benefitted other species, such as the pileated woodpecker, that prefer multi-storied tree stands and abundant snags and logs for feeding sites (*ibid*). The timing of fire can have different effects. Historically, fire created disturbance that altered vegetation at fairly regular intervals and at intensities that varied by potential vegetation group (Saab et al. 2007). Vegetation and animals evolved with fire, which is a common disturbance in many environments. As discussed, the change in vegetation resulting from fire can have positive or negative effects on different species depending on fire intensity, frequency, and timing.

Alternatives vary in the tradeoffs of fire risk to vegetation change. Potential effects to wildlife habitat and species from fire management will vary by alternative theme and management area assignments. Alternative C would rely greatly on both natural and management ignited fires as the agent of change for achieving desired conditions. The likelihood of natural fires would be greatest for alternative C, whereas implementing alternative D would make little use of management ignited fires and, due to the amount of anticipated vegetation treatment, would have the lowest probability of natural fire occurring.

Livestock Grazing

Domestic livestock grazing directly competes with wildlife for the use of available forage. Grazing results in plant defoliation, mechanical changes to soil and plant material, and nutrient redistribution (Belsky and Blumenthal 1997). These and other factors also influence successional trends. Succession is affected by the grazing frequency (times grazed), intensity (amount of plant removal), and opportunity (time the plant needs to meet its physiological growth needs). Timing (spring, summer, and/or fall) of grazing can also have different effects on vegetation, such as reduction of flowering parts or physical damage to plants if conditions are too wet in the spring. Grazing can alter the density and composition of herbaceous and shrub vegetation, which can have either a positive or negative effect on wildlife (Bock et al. 1993, Finch et al. 1997, Short and Knight 2003). Vegetation is sometimes altered to increase forage for livestock, which also increases forage for some wildlife species.

The presence of livestock can affect some wildlife species by attracting cowbirds in open forest settings, which lay eggs in (parasitize) other bird nests (Friedmann 1963). The presence of livestock may be giving cowbirds an ecological advantage over other bird species in the area (Goguen and Mathews 1998). In all cases, it is important to distinguish between historical and current livestock impacts. For example, some species, such as mule deer (Clements and Young

1997, Mule Deer Working Group 2003), and some bird species that rely on shrubs for nesting may have actually benefitted from the early heavy grazing in the West (Saab et al. 1995).

Grazing by domestic sheep can increase the risk of disease transmission to bighorn sheep (George et al. 2008). Bighorn sheep are highly susceptible to some strains of Pasteurella that are carried by domestic sheep (Foreyt et al. 1994). The disease, which does not affect domestic sheep, is usually fatal to bighorn sheep. Transmission of the disease can occur when bighorn sheep and domestic sheep occupy the same area and come in physical contact with each other (Coggins 2002, Clifford et al. 2009).

As with the forested landscapes, all alternatives have the desired condition of achieving historical vegetative conditions in those areas that are subjected to grazing. However, alternative C would be likely to achieve historical conditions the fastest and would reduce the potential threat of negative effects to wildlife from domestic livestock grazing the most. It proposes the least amount of area considered suitable for domestic livestock grazing and proposes the most stringent utilization standards. It also would have the widest riparian management areas (MA 4B). Alternatives A, B, and D likely would be the slowest to achieve rangeland HRV and also would pose the highest potential threat of negative effects to wildlife. In addition, alternative D would have the narrowest width for riparian management areas and would have the most area suitable for livestock grazing. While alternatives E and F are very similar to alternative B, they would have lower utilization levels and therefore should achieve desired conditions faster than alternatives A, B, and D.

Road and Trail Construction and Use

The majority of roads constructed on National Forest System lands during the last 50 years have been developed primarily for timber management activities. Historically, trails were developed for livestock management activities, mining, and fire lookout access. More recently, however, trails have been constructed for recreational activities.

Construction and use of roads and trails removes vegetation from the travel surface. This removal directly reduces the amount of vegetation that can be used as habitat and indirectly affects adjacent habitat (Frair et al. 2008). The relative effects of roads on wildlife depend on the interaction of topography, vegetation type and condition, and frequency of human use (Edge and Marcum 1991). One of the primary direct effects is increased human access to areas. Improved access increases mortality risk, fragmentation of habitat, and displacement/avoidance responses (Trombulak and Frissell 2000). Access can increase the risk of nonnative plants becoming established, and many of these plants are not used as habitat or forage by native wildlife. Access on roads and trails can be restricted during certain times of the year to reduce or eliminate these effects; however, the increasing human population trend for Oregon is likely to continue, and growth will likely increase human use of public lands during all seasons of the year.

No new road construction is anticipated for any of the alternatives. The alternatives provide a range of desired open motor vehicle route densities within the management areas. With the exception of alternative D, the alternatives include a desired condition of 2.4 miles of open motor vehicle routes per square mile for the general forest area (MA 4A) where most of the roads and active management occur. Alternative D includes a desired condition of 3 miles per square mile for MA 4A. Because the areal extent of MA 4A varies between the alternatives, alternative C would have the lowest overall open motor vehicle route density, followed closely by alternatives E and F. Because alternative D has the highest desired open motor vehicle route density and the greatest amount of MA 4A, it would pose the greatest risk of human disturbance to wildlife.

Minerals Management

Mining exploration and development can influence wildlife in a number of ways, including road construction to mineralized areas, increased human interaction, and loss of vegetation that was used as habitat (Wilcove et al. 1998). Mining at the turn of the twentieth century influenced extensive areas and resulted in considerable changes to the landscapes where it occurred. Dredging of areas like Sumpter Valley left a highly scarred landscape that is just recently beginning to recover. Some of the first roads constructed were to gain access to mineral deposits. Mining operations have different requirements for support facilities and access. In areas where mineral reserves justify the construction of a mill, impacts may include buildings, equipment, utilities, tailings, and human presence. Today most mining is in the form of placer mining. Although mining operations on public lands are required to file operating plans, it is still a ground-disturbing activity with a higher level of human activity that is not always compatible with wildlife.

The scale of mineral development has differing effects on habitat and displacement/avoidance associated with the extent, timing, and duration of activities. Exploration activities are usually brief compared to mineral production, which can displace wildlife for many years in some cases. Some mining activities use or produce toxic material. If improperly handled, this material can cause mortality to wildlife.

The ability to access minerals would be the same for each alternative, therefore effects to habitat and wildlife species would not vary. Mineral development is a function of worldwide market values. Areas may be withdrawn from mineral exploration or development by Congress or administratively. There are no proposals to directly withdraw any areas through plan revision, although land allocation decisions could indirectly influence mineral withdrawals in the future, depending on Congressional action.

Recreation

Recreation is a function of social demands related to desired, available, and provided experiences on National Forest System lands. Developed and dispersed camping can decrease the habitat capability for some species (Cole and Landres 1995). Wildlife species that require snags are usually negatively affected by hazard tree removal (for safety reasons) and firewood collection. Long-term use of dispersed sites can modify the vegetation that wildlife species depend on. Wildlife disturbance or disruption from recreation during breeding/nesting periods can also occur (Boyle and Samson 1985, Saab 1998).

Winter recreation, such as cross-country skiing and snowmobiling, can stress wintering animals during deep snow periods (Eckstein et al. 1979, Goldberg 2010, Goodrich and Berger 1994). Over-the-snow trails provide some animals with access to areas they usually cannot use during the winter because of deep snow conditions.

The increasing human population trend for Oregon is likely to continue. Likewise, the public desire for differing recreational activities will continue to increase. This increase in recreation use has resulted in increased conflicts with wintering wildlife, particularly big game. Most big game winter ranges have motorized access restrictions to reduce stress to wildlife during periods of deep snow; additional restrictions for big game winter ranges are not anticipated.

Though none of the alternatives would actively promote an increase in recreational use of National Forest System lands, in all likelihood, recreation demand within the national forests will increase during the plan period as the human population increases. With motor vehicle recreation being the most disruptive to wildlife, the roads and trails discussion would best describe the degree of recreation impacts to impact wildlife. Alternative D would have the greatest potential for impacts, while alternative C would have the least.

General Effects of Non-native Plants

Over time, many nonnative plants have been introduced into the planning area. Some plants were intentionally introduced while others were not. Non-native plants change the value of wildlife habitat by displacing native plant species. Some nonnative species are not usable by native wildlife species as habitat or forage, and their presence decreases the habitat carrying capacity. Some nonnative plants influence fire regime and create conditions that may cause areas to burn more frequently. An increasing fire frequency can cause a reduction in woody species that are valuable as habitat. Additionally, nonnative plants compete with native vegetation for moisture, nutrients, and space, all of which can reduce habitat quality and quantity. All alternatives would provide parameters for noxious weeds treatments, but some may be more successful than others due to variable factors, such as access, detection, and vectors of establishment and spread.

Focal Species

The focal species assessment is intended to assist in the development of forest plans by helping frame the goals and desired conditions for ecosystems within the landscape, the management focus for implementing the plan, the anticipated accomplishments during the life of the plan, and the development of standards and guidelines where the risks and/or threats were not sufficiently ameliorated through other plan components. This section examines how the management alternatives for forest plan revision either contribute to or mitigate the changing patterns of habitat alteration and fragmentation and disturbance to wildlife. Raphael et al. (2001) suggested that the total amount of source habitat for any given species is best interpreted as the upper limit to the potential of an area to support that species, but should be tempered with factors that determine habitat quality to refine the potential carrying capacity of an area.

Table 299, table 300, and table 301 display the level of concern regarding the probability that species viability is maintained or improved; however, it should be noted that forest plans cannot remove all uncertainty and risk regarding species viability. Only those species that have model outcomes of high (H) or medium/high (M/H) displayed in the tables and have no improvement in the level of concern for all alternatives (e.g., ash-throated flycatcher) are discussed in detail here. The assumption is that those species with a moderate (M) or low (L) level of concern have minimal risk of becoming nonviable during the life of the plan. Alternatives with model outcomes demonstrating positive changes in source habitat compared to the existing condition are assumed to improve viability of the species, unless the outcome for risk factors or quality of habitat did not show a corresponding change. A detailed analysis for these species (Wales et al. 2011) is in the project record but, in general, habitats were more than 40 percent of the historical level (Denoël and Ficetola 2007, Olson et al. 2004, Radford et al. 2005, Svancara et al. 2005, Tear et al. 2005, With and Crist 1995), were adequately distributed across the landscape, and threats/risks had been reduced to an acceptable level.

Table 299, table 300, and table 301 highlight those focal species where modeling demonstrates no improvement from the current concern level and the focal species continue to have a high level of concern (H or M/H). The analysis is organized by first discussing source habitat trends for each focal species, and, because the threats and risks are similar for several focal species, they are discussed following the source habitat analysis. As a Federal candidate species, the wolverine is discussed in detail in the "Threatened, Endangered, Proposed, Candidate, and Sensitive (TEPCS) Wildlife Species" section.

Table 299. Change in the level of concern (from existing condition) at year 20 for each focal species for each alternative for the Malheur National Forest; gray shaded cells indicate species analyzed in detail

Species	Existing Condition	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F
Boreal owl	H	M	M/H	M	M/H	M/H	M/H
Water vole	L	L	L	L	L	L	L
Northern goshawk	L	L	L	L	L	L	L
Cassin's finch	H	M	M	M	M/L	M	M
Pileated woodpecker	L	L	L	L	L	L	L
American marten	M/H	M	M	M	M	M	M
White-headed woodpecker	H	H	H	H	H	H	H
Western bluebird	H	H	H	H	M/H	M/H	H
Fox sparrow	H	H	H	H	M/H	M/H	H
Lewis' woodpecker	M/H	M/H	M/H	M/H	M/H	M/H	M/H
Black-backed woodpecker	M	M	M	M	M	M	M
Wolverine	H	H	H	M/H	H	H	H
Lark sparrow	L	L	L	L	L	L	L
Ash-throated flycatcher	H	M/H	M/H	M/H	M/H	M/H	M/H
Sage thrasher	M	M	M	M	M	M	M
Northern harrier	L	L	L	L	L	L	L
Bald eagle	L	L	L	L	L	L	L
MacGillivray's warbler	M	M	M	M/L	M	M	M
Columbia spotted frog	M	M	M	M/L	M	M	M
Marsh wren	L	L	L	L	L	L	L
Wilson's snipe	L	L	L	L	L	L	L
Inland tailed frog	MAL is outside of species' range						
Peregrine falcon	Extremely limited habitat; not analyzed						

Level of Concern Classification: L - low; L/M – low to moderate; M - moderate; M/H - moderate-to-high; H - high

Table 300. Change in the level of concern (from existing condition) at year 20 for each focal species for each alternative for the Umatilla National Forest; gray shaded cells indicate species analyzed in detail

Species	Existing Condition	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F
Boreal owl	M	M	M	M	M/H	M	M
Water vole	L	L	L	L	L	L	L
Northern goshawk	L	L	L	L	L	L	L
Cassin's finch	M/H	M/H	M/H	M/H	M	M	M/H
Pileated woodpecker	L	L	L	L	L	L	L
American marten	L	L	L	L	L	L	L
White-headed woodpecker	H	H	H	H	H	H	H
Western bluebird	H	H	H	H	M/H	H	H
Fox sparrow	M	M	M	M	M/L	M/L	M
Lewis' woodpecker	M	M/H	M/H	M/H	M/H	M/H	M/H
Black-backed woodpecker	M	M	M	M	M	M	M
Peregrine falcon	L/M	L/M	L/M	L/M	L/M	L/M	L/M
Wolverine	M/H	M/H	M/H	M	M/H	M/H	M/H
Lark sparrow	L	L	L	L	L	L	L
Ash-throated flycatcher	H	M/H	M/H	M/H	M/H	M/H	M/H
Sage thrasher	M	M	M	M	M	M	M
Northern harrier	L	L	L	L	L	L	L
Inland tailed frog	L	L	L	L	L	L	L
Bald eagle	L/M	L/M	L/M	L/M	L/M	L/M	L/M
MacGillivray’s warbler	M	M	M	M/L	M	M	M
Columbia spotted frog	M	M	M	M/L	M	M	M
Marsh wren	L	L	L	L	L	L	L
Wilson’s snipe	L	L	L	L	L	L	L

Level of Concern Classification: L - low; L/M – low to moderate; M - moderate; M/H - moderate-to-high; H - high

Table 301. Change in the level of concern (from existing condition) at year 20 for each focal species for each alternative for the Wallowa-Whitman National Forest; gray shaded cells indicate species analyzed in detail

Species	Existing Condition	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F
Boreal owl	M	M	M	M	M	M	M
Water vole	L	L	L	L	L	L	L
Northern goshawk	L	L	L	L	L	L	L
Cassin's finch	H	H	H	H	M	M/H	H
Pileated woodpecker	M	M	M	M	M	M	M
American marten	L/M	L/M	L/M	L/M	L/M	L/M	L/M
White-headed woodpecker	H	H	H	H	H	H	H
Western bluebird	H	H	H	H	M/H	M/H	H
Fox sparrow	M	M	M	M	M/L	M	M
Lewis' woodpecker	M	M/H	M/H	M/H	M/H	M/H	M/H
Black-backed woodpecker	L	L	L	L	L	L	L
Peregrine falcon	L/M	L/M	L/M	L/M	L/M	L/M	L/M
Wolverine	M/H	M/H	M/H	M	M/H	M/H	M/H
Lark sparrow	L	L	L	L	L	L	L
Ash-throated flycatcher	H	M/H	M/H	M/H	M/H	M/H	M/H
Sage thrasher	M	M	M	M	M	M	M
Northern harrier	L	L	L	L	L	L	L
Inland tailed frog	M	M	M	M	M	M	M
Bald eagle	M	M	M	M	M	M	M
MacGillivray's warbler	M	M	M	M/L	M	M	M
Columbia spotted frog	L	L	L	L	L	L	L
Marsh wren	L	L	L	L	L	L	L
Wilson's snipe	L	L	L	L	L	L	L

Level of Concern Classification: L - low; L/M – low to moderate; M - moderate; M/H - moderate-to-high; H - high

Cold Forest

The boreal owl was identified as the focal species for the alpine/boreal group that represents high elevation forests and is dependent on the availability of snags for nesting. Eight other species are found within this source habitat group (see table 298). Boreal owls inhabit mid- to high-elevation forests with large diameter trees and abundant snags and down logs. The boreal owl is primarily associated with closed-canopied cold, dry forests. Source habitats are defined as closed canopy (60 percent or greater) forests with trees 15 inches d.b.h. or greater. Home ranges for the boreal owl vary between seasons (Hayward et al. 1993) and average more than 2,000 acres with some home ranges being estimated in excess of 8,000 acres (Hayward 1994a). Home ranges of several males can overlap but breeding territories of approximately 95 acres are defended (Hayward and Hayward 1993 and Hayward et al. 1993).

Malheur and Wallowa-Whitman National Forests – Wales et al. (2011) indicated that habitat loss was the primary viability concern for the boreal owl and other species associated with high elevation, older forests with closed canopies. Habitat loss has occurred due to wildfires and past timber harvest. For both the Malheur and Wallowa-Whitman National Forests, an improvement in source habitat would occur for all alternatives during the first five decades after forest plan implementation. Within the Wallowa-Whitman National Forest, more than half of the source habitat occurs in protected areas. Although never abundant, the Malheur National Forest would have the greatest increase in source habitat during the first five decades.

Umatilla National Forest – The overall trend for source habitat within the Umatilla National Forest would decline in all alternatives for the first three decades before beginning to improve (see figure 20). Less than half of boreal owl habitat occurs within the area actively managed for timber harvest (MA 4A) within the Umatilla National Forest. During the first decade, commercial harvest would occur from a low of 0.2 percent of the cold forest potential vegetation group for alternative A to a high of 4.1 percent for alternative D (see table 300). These projected harvest levels cannot account for the five and 10 percent decline in habitat for alternatives A and D respectfully, indicating that natural processes (i.e., wildfire and insects and disease) as simulated in the VDDT model are probably influencing a greater portion of the cold forest within the Umatilla National Forest.

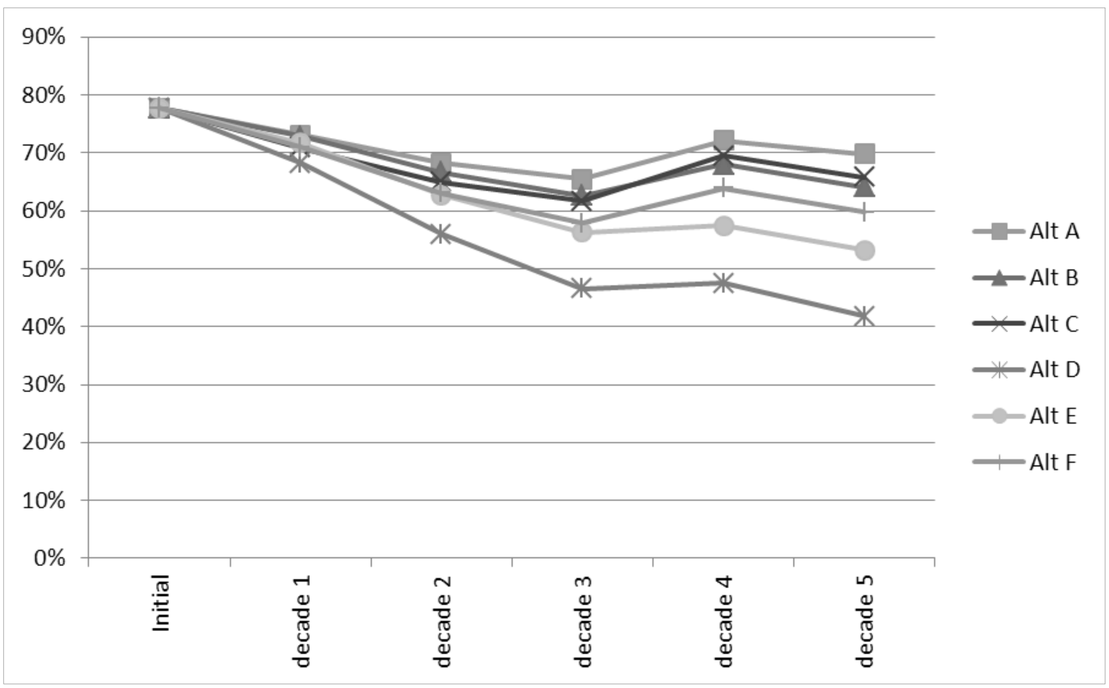

Figure 20. Decadal changes of Umatilla National Forest boreal owl source habitat expressed as a percentage of the mid-point of what would have been expected historically

According to Hayward et al. (1993) boreal owls occupy a narrow life zone at low population densities in isolated patches that represent a relatively small percentage of the landscape. They have large home ranges and, although not well studied in North America, the European subspecies has been well studied. Distances between breeding areas of the same individual have been reported to be hundreds of kilometers, and median dispersal distances for juveniles has been reported to be between 21 and 88 kilometers (Hayward and Verner 1994). In essence, the boreal owl occurs in habitat that is naturally fragmented and not well distributed and has the ability to disperse over great distances through nonbreeding habitat to colonize available suitable habitat (Hayward and Verner 1994). As such, the distribution of habitat is less of a concern than the overall loss of habitat. Other species in the group represented by boreal owl also have relatively good dispersal capability (see table 298).

Raphael et al. (Raphael et al. 2001) suggested that the total amount of source habitat for any given species is best interpreted as the upper limit to the potential of an area to support that species, but should be tempered with factors that determine habitat quality to refine the potential carrying capacity of an area. Availability of snags greater than 20 inches in diameter influences the quality of habitat for the boreal owl as their distribution and abundance is largely tied to nest cavity availability and prey populations (Hayward et al. 1993). The boreal owl model utilized DecAID data (Mellen-McLean et al. 2009) for montane mixed conifer, small/medium trees vegetation condition of snags 50 centimeters d.b.h. or greater (DecAID figure MMC_S.inv-3) to establish snag categories for assessing habitat quality. The categories for snags 20 inches d.b.h. or greater are: low is 2.6/ha or less (less than 30 percent tolerance); moderate is 2.6 to 6.6/ha (30 to 50 percent); high is 6.6 to 18.3/ha (50 to 80 percent); very high is 18.3/ha or more (greater than 80 percent). According to DecAID figure MMC_S.inv-15, the high and very high snag densities historically would have been expected on more than 50 percent of the landscape. Within most watersheds (71 percent), more than half of the source habitat has moderate to low snag densities, indicating snag distribution is probably less than what would have occurred historically.

Table 302. Percent of the cold forest potential vegetation group proposed for treatment by type of treatment for each alternative for the Umatilla National Forest

Type of Treatment	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F
Salvage	0.0%	0.0%	0.0%	0.8%	0.4%	0.2%
Prescribed fire	0.3%	0.8%	1.1%	0.0%	1.4%	0.9%
Precommercial thin	0.7%	0.9%	0.8%	1.2%	0.9%	0.9%
Commercial	0.2%	0.7%	0.4%	4.1%	1.3%	0.9%
Totals	1.3%	2.4%	2.3%	6.0%	4.0%	3.0%

VDDT modeling indicates a downward trend in source habitat for all alternatives, but the level of concern is highest for alternative D, although the amount of projected active management alone cannot account for the downward trend. Alternative D is of concern since its downward trajectory is steeper and would approach 40 percent in the fifth decade. Several authors (Rompré et al. 2010, Svancara et al. 2005, With and Crist 1995) have indicated that landscapes containing at least 40 percent of source habitat for a species should sustain that species over time. The other alternatives would maintain more than 50 percent of the habitat that occurred historically, which would reduce the immediate concern for persistence of the boreal owl and species associated with this habitat. There are plan components in place that should lead to improved habitat for all of these alternatives. For example, although it will take time to replace large snags, there are desired conditions (see appendix A, 1.14 Snags and Down Wood) that mimic what is thought to have occurred across the landscape historically (see the threats/risks section for more discussion). There also are desired conditions for forest composition, density, and structure that are designed to mimic historical conditions.

Dispersal ability is an important component of population viability (Lamberson et al. 1994, King and With 2002), and most species of the group have good dispersal capability (see table 298).

King and Worth (2002) point out that dispersal success is usually not a concern when habitat exceeds 40 percent of the landscape. Although there is a degree of uncertainty, since all alternatives would maintain more than 50 percent of the landscape in source habitat during the first two decades, populations would likely be viable for all alternatives during the life of the plan. Because source habitat would be reduced for all alternatives and uncertainty exists, changes in source habitat for the boreal owl due to management or disturbances that can be mapped, such as wildfires, as well as risk factors, should be reevaluated once every two years.

Dry Forest: Medium/Large Trees

The white-headed woodpecker was chosen as the focal species to represent the medium-large trees/dry forest group. The white-headed woodpecker is associated with open-canopied ponderosa pine forests (Bull et al. 1986, Frederick and Moore 1991, Garrett et al. 1996, and Kozma 2009) and specifically with large trees and snags, which are important habitat components for five other species in the group and family (USDA Forest Service 2010). White-headed woodpeckers rely on mature, cone-producing trees during winter (Garrett et al. 1996, Milne and Hejl 1989). For the purpose of this analysis, source habitat for both current and historical conditions is considered to be the dry forest potential vegetation group with single- and multi-stories, large-tree structure (greater than 20 inches d.b.h.), and open canopies (i.e., less than 40 percent).Other factors that were considered in the evaluation of habitat for this species included snag availability, open motor vehicle route density, and shrub cover (Wales et al. 2011). The ability of white-headed woodpecker to disperse across the planning area is not considered an issue.

Several studies have documented the importance of large diameter ponderosa pine snags for white-headed woodpeckers (Dixon 1995, Dixon 1995a, Milne and Hejl 1989, Raphael and White 1984). Frenzel (2002) found that of 405 nests of white-headed woodpeckers, all but 12 were in completely dead trees. The focal species assessment model utilized DecAID data (Mellen-McLean et al. 2009) for ponderosa pine/Douglas-fir, large tree vegetation condition for snags 50 centimeters d.b.h. or greater (DecAID figure PPDF_L.inv-3) and dry grand fir, large tree vegetation condition for snags 50 cm or greater (DecAID figure EMC_ECB_L.inv-3) to establish snag categories to be used in assessing habitat.

The white-headed woodpecker is a focal species, sensitive species, and a management indicator species (see table 298). The concept of focal species differs from the concept of management indicator species as described in the regulations written to implement NFMA (36 CFR 219.19). The use of management indicator species was considered a means of evaluating the effects of implementing the forest plan and assumes that the predicted changes in population trends would be reflective of the predicted changes in amount and quality of habitat from management practices resulting from implementing a forest plan. Because the planning regulations (39 CFR 219) require that alternatives are evaluated for habitat of management indicator species, the white-headed woodpecker is also addressed in the management indicator species analysis. As Owen (2010) and Hayward et al. (2004) point out, management indicator species may or may not be used in the NFMA viability assessment; so to maintain clarity and to meet the intent of the focal species analysis, the viability assessment for the white-headed woodpecker and its associated species will be discussed.

Model outcomes for all three national forests displayed in table 299 through table 301 indicate a high concern for viability of this species for all alternatives. Within all three national forests, improvement in source habitat is predicted for all alternatives. The projected viability outcome is low primarily due to the low amount of open-canopied large tree forests as compared to HRV (Wales et al. 2011). Loss of habitat has occurred for a variety of reasons, including wildfire and past timber harvest. Habitat has also been lost due to fire suppression, which resulted in stands becoming denser.

Malheur National Forest – White-headed woodpecker habitat within the Malheur National Forest is well below historical levels, which causes a high level of concern for the viability of the species. As displayed in figure 21, the alternatives would have increases in source habitat between 165 and 260 percent by year 20, but none would come close to the 40 percent level that has been identified as the threshold for viability (Tear et al. 2005, Rompré et al. 2010, With and Crist 1995). Although the fastest trajectory of habitat improvement is projected for alternative D, it would come with the cost of increased short-term disturbance levels. Even so, such a trajectory would indicate that populations should be stable throughout the plan period, assuming no other complicating factors occur. This assumption is based on the management emphasis in the proposed forest plan to restore dry forest habitat occupied by this species, including reductions in fuels and thus reduced risk of fire and insects outbreaks.

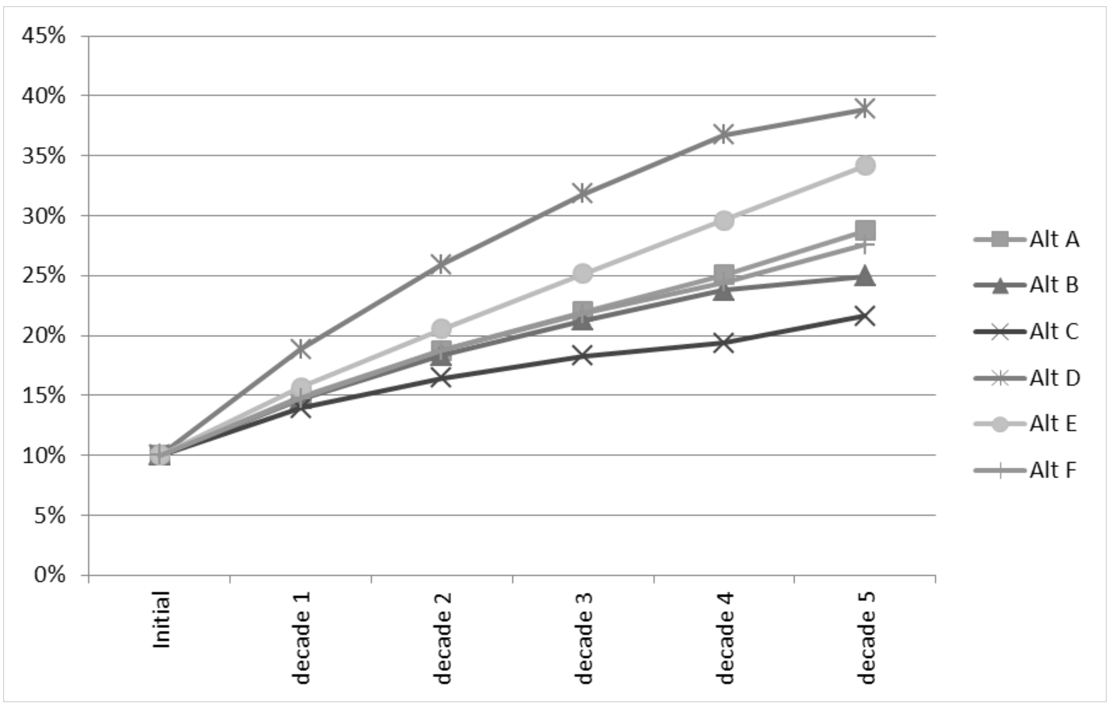

Figure 21. Decadal changes of Malheur National Forest white-headed woodpecker source habitat expressed as a percentage of the mid-point of what would have been expected historically

Mason and Countryman (2010) utilized CVS plot data to summarize snag conditions within the Blue Mountains. Bate et al. (2007) identified some of the shortcomings of using CVS data for snag analysis but concluded that, with the exception of human access variables such as distance to nearest town, the patterns of distribution were similar between CVS data and the more stratified data that they collected. They also identified a variety of risks that affected snag density, which are discussed in more detail later. Table 303 displays that snag densities across the landscape are similar to what would be expected historically. High densities of large diameter snags (80 percent tolerance level) in both the dry and moist potential vegetation groups are lower than what would be expected, which may be a relic of past harvest practices as management during the past decade has emphasized the retention of large diameter snags. Although snag densities may be similar to historical levels, it is recognized that distribution across the landscape may different than what was found historically (Nutt et al. 2010).

Table 303. Snag density per acre for 30, 50, and 80 percent tolerance levels found at white-headed woodpecker nest and roost sites, and percent of historic and current landscape at these levels for the Malheur National Forest

d.b.h. (inches)	Potential Vegetation Group Associations	Tolerance levels[1]			Percent of landscape that historically met species tolerance levels[2]			Percent of landscape that currently meets species tolerance levels[3]		
		30%	50%	80%	30%	50%	80%	30%	50%	80%
≥ 10	Ponderosa pine /Douglas-fir	0.5	1.9	4.0	67%	67%	19%	71%	71%	18%
≥ 20		0.5	1.8	3.8	79%	79%	15%	82%	82%	13%
≥ 10	Eastside mixed conifer	0.3	1.9	4.0	34%	34%	26%	36%	36%	24%
≥ 20		0.0	1.5	3.8	62%	62%	24%	64%	64%	18%

1 From Mellen-McLean (2011) management indicator species information sheet

2 From tables 8 and 9 in Mason and Countryman (2010)

3 From tables 14 and 15 in Mason and Countryman (2010)

All alternatives would have the same desired condition for snags (see appendix A 1.14 Snags and Down Wood). In the case of the dry potential vegetation group, all alternatives except alternative D would have a standard to retain snags greater than 21 inches d.b.h. and 50 percent of snags between 12 and 21 inches (WHAB-12 S7). Although this would help maintain current snag levels (see table 303), it is possible that future snag recruitment could be different between alternatives because of differing harvest levels. Friesen (2009) reviewed modeling efforts and literature to assess the impact on snag dynamics from thinning of forested stands. She found that thinning in young stands promotes the development of larger diameter green trees faster than in un-thinned stands. However, the reduced competition from the thinning reduces density-dependent mortality in the residual trees, allowing them to be healthier and live longer before succumbing to competition, insects, or disease to become a snag (Davis et al. 2007, Garman et al. 2003, Harrington et al. 2005). Friesen (2009) noted that modeling this question results in different answers from different models. Because traditional implementation of silvicultural systems will probably capture mortality and improve the health of the stand in general, it is assumed that snag recruitment would take longer for those alternatives with more commercial treatment. Although source habitat would increase the most for alternative D, it also would have the greatest impact on snag dynamics as more acres would be treated commercially (see table 249 in the Forested Vegetation, Timber Resources, and Wildland Fire section). However, at the landscape level areas of undisturbed forest are often skipped leaving habitat islands with diverse structural legacies and unique environmental conditions (Foster et al. 1998, Franklin et al. 2002, Friesen 2009). Less than 10 percent of the dry forest potential vegetation group would actually be treated commercially for alternative D (see table 310) within the Malheur National Forest in the first decade. Based on harvest alone, the potential for snag recruitment at the landscape level would not be significantly reduced during the life of the plan.

Umatilla National Forest – White-headed woodpecker habitat within the Umatilla National Forest is at far less than historical levels, which causes a high level of concern for the viability of the species. As displayed in figure 22, the alternatives would have increases in source habitat between 248 and 419 percent by year 20, but none would come close to the 40 percent level that has been identified as the threshold for viability (Rompré et al. 2010, Tear et al. 2005, With and Crist 1995). Although the fastest trajectory of habitat improvement is projected for alternative D, it would come with the cost of increased short term disturbance levels. Even so, such a trajectory would indicate that populations should be stable throughout the plan period, assuming no other complicating factors occur. This assumption is based on the management emphasis in the proposed forest plan to restore dry forest habitat occupied by this species, including reductions in fuels and thus reduced risk of fire and insects outbreaks.

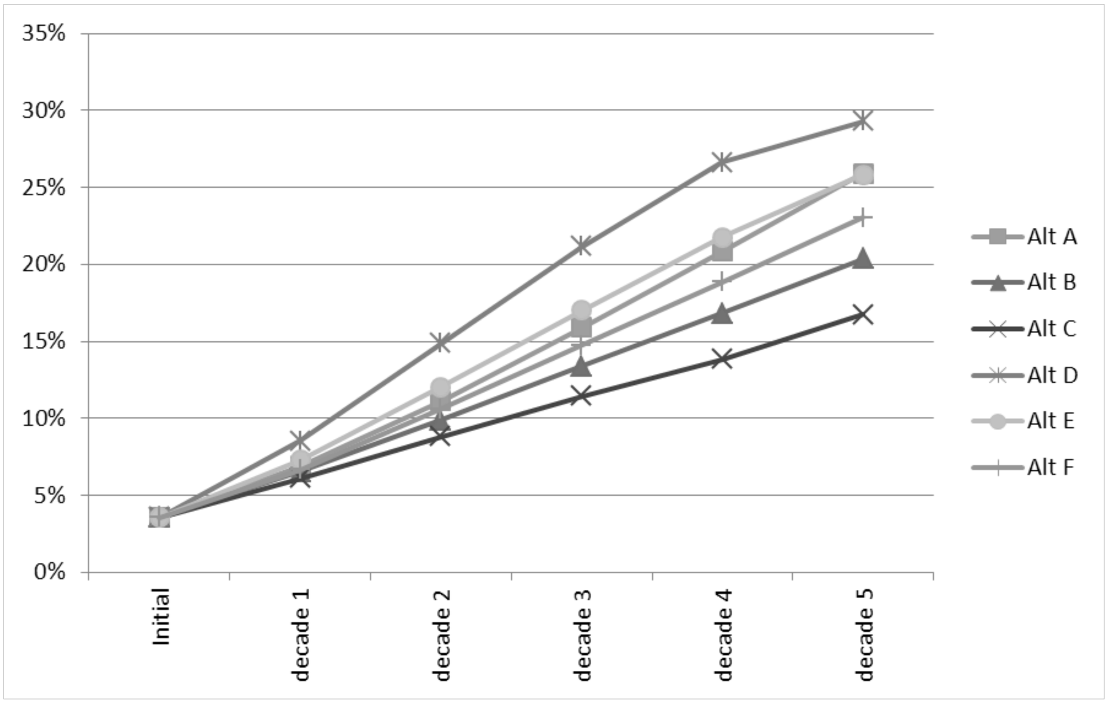

Figure 22. Decadal changes of Umatilla National Forest white-headed woodpecker source habitat expressed as a percentage of the mid-point of what would have been expected historically

Table 304 displays that snag densities are close to HRV with the possible exception of large snags at high densities in the dry potential vegetation group. As discussed for the Malheur National Forest, snag recruitment can be impacted by thinning. Only a small portion of the dry potential vegetation group within the Umatilla National Forest (see table 341) would be harvested during the life of the plan. Based on harvest alone, the potential for snag recruitment at the landscape level would not be significantly reduced.

Table 304. Snag density per acre for 30, 50, and 80 percent tolerance levels found at white-headed woodpecker nest and roost sites, and percent of historic and current landscape at these levels for the Umatilla National Forest

d.b.h. (inches)	Potential Vegetation Group Associations	Tolerance levels[1]			Percent of landscape that historically met species tolerance levels[2]			Percent of landscape that currently meets species tolerance levels[3]		
		30%	50%	80%	30%	50%	80%	30%	50%	80%
≥ 10	Ponderosa pine /Douglas-fir	0.5	1.9	4.0	53%	53%	23%	54%	54%	24%
≥ 20		0.5	1.8	3.8	70%	70%	19%	73%	73%	16%
≥ 10	Eastside mixed conifer	0.3	1.9	4.0	29%	29%	26%	29%	29%	25%
≥ 20		0.0	1.5	3.8	55%	55%	22%	54%	54%	23%

1 From Mellen-McLean (2011) management indicator species information sheet

2 From tables 8 and 9 in Mason and Countryman (2010)

3 From tables 14 and 15 in Mason and Countryman (2010)

Wallowa-Whitman National Forest – White-headed woodpecker habitat within the Wallowa-Whitman National Forest is at far less than historical levels, which causes a high level of concern for the viability of the species. As displayed in figure 23, the alternatives would have increases in source habitat between 194 to 359 percent by year 20, but none would come close to the 40 percent level that has been identified as the threshold for viability (Rompré et al. 2010, Tear et al. 2005, With and Crist 1995). Although the fastest trajectory of habitat improvement is projected for alternative D, it would come with the cost of increased short term disturbance levels. Even so, such a trajectory would indicate that populations should be stable throughout the plan period, assuming no other complicating factors occur. This assumption is based on the management emphasis in the proposed forest plan to restore dry forest habitat occupied by this species, including reductions in fuels and thus reduced risk of fire and insects outbreaks.

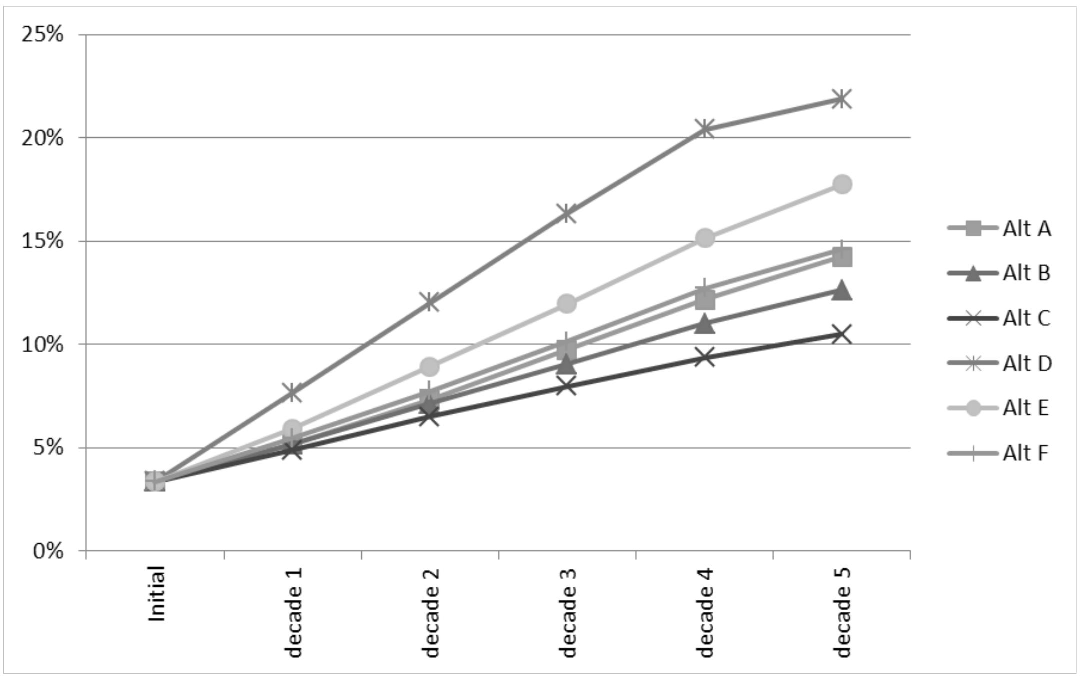

Figure 23. Decadal changes of Wallowa-Whitman National Forest white-headed woodpecker source habitat expressed as a percentage of the mid-point of what would have been expected historically

Table 305 indicates that snag densities are mostly close to HRV within the Wallowa-Whitman National Forest in the dry potential vegetation group. As discussed for the Malheur National Forest, snag recruitment can be impacted by thinning. Only a small portion of the dry potential vegetation group within the Wallowa-Whitman National Forest (see table 341) would be harvested during the life of the plan. Based on harvest alone, the potential for snag recruitment at the landscape level would not be significantly reduced.

Table 305. Snag density per acre for 30, 50, and 80 percent tolerance levels found at white-headed woodpecker nest and roost sites, and percent of historic and current landscape at these levels for the Wallowa-Whitman National Forest

d.b.h. (inches)	Potential Vegetation Group Associations	Tolerance levels[1]			Percent of landscape that historically met species tolerance levels[2]			Percent of landscape that currently meets species tolerance levels[3]		
		30%	50%	80%	30%	50%	80%	30%	50%	80%
≥ 10	Ponderosa pine /Douglas-fir	0.5	1.9	4.0	68%	68%	18%	68%	68%	19%
≥ 20		0.5	1.8	3.8	83%	83%	12%	84%	84%	11%
≥ 10	Eastside mixed conifer	0.3	1.9	4.0	40%	40%	23%	41%	41%	25%
≥ 20		0.0	1.5	3.8	69%	69%	18%	68%	68%	18%

1 From DecAID Figure PPDF_O.inv-3 and EMC_ECB_O.inv-3
2 From tables 8 and 9 in Mason and Countryman (2010)
3 From tables 14 and 15 in Mason and Countryman (2010)

All Forest Types: Medium/Large Trees

The Cassin’s finch was chosen as a focal species for medium and large tree forests in the all forest communities group, which includes 11 additional species (see table 298). One species in the group, northern flying squirrel, is probably better represented by another focal species in the family, the pileated woodpecker representing the cool/moist forest group. This finch occupies forests with large diameter trees and abundant snags and down logs at all elevation levels. It is found in all potential vegetation groups and was chosen as a focal species to represent medium and large trees, but more specifically to represent the open-canopied forests with which other species in this group and family are also associated. The Cassin’s finch has a negative association with grazing, as do other species it represents. Source habitats were defined as open canopy forests (less than or equal to 40 percent for dry forest and less than or equal 60 percent for other forested potential vegetation groups) with trees 15 inches d.b.h. and greater.

Loss of habitat is the primary viability concern for the Cassin’s finch and species associated with open forested habitats.

Malheur National Forest – Model outcomes for the three national forests displayed in table 299 indicate a strong improvement in the viability concern for this species within the Malheur National Forest, and therefore it is not discussed in detail for this national forest.

Umatilla National Forest – All alternatives would have reductions in source habitat for the Cassin’s finch during the first decade (see figure 24). Source habitat would increase for alternative D sufficiently during the second decade to reduce the level of concern for viability (see table 300). Although all alternatives would eventually exhibit an upward trend for source habitat, only alternatives D, E, F, and A would actually have more source habitat in year 50 than at the start of the plan period. Alternative C would have the greatest level of concern for the viability of this species. Although grazing is a risk factor (discussed in detail later in this section) in the assessment model, it was not weighted heavily (Wales et al. 2011). Due to increases in source habitat, alternatives D and E would have the greatest reductions in risk to species viability for the Cassin’s finch. Although the other alternatives would reduce source habitat availability, it would be fairly well distributed within the Umatilla National Forest. Due to the high dispersal capability of the Cassin’s finch and the other species it represents, individuals would be likely be able to interact and populations would likely be viable for all alternatives during the life of the plan.

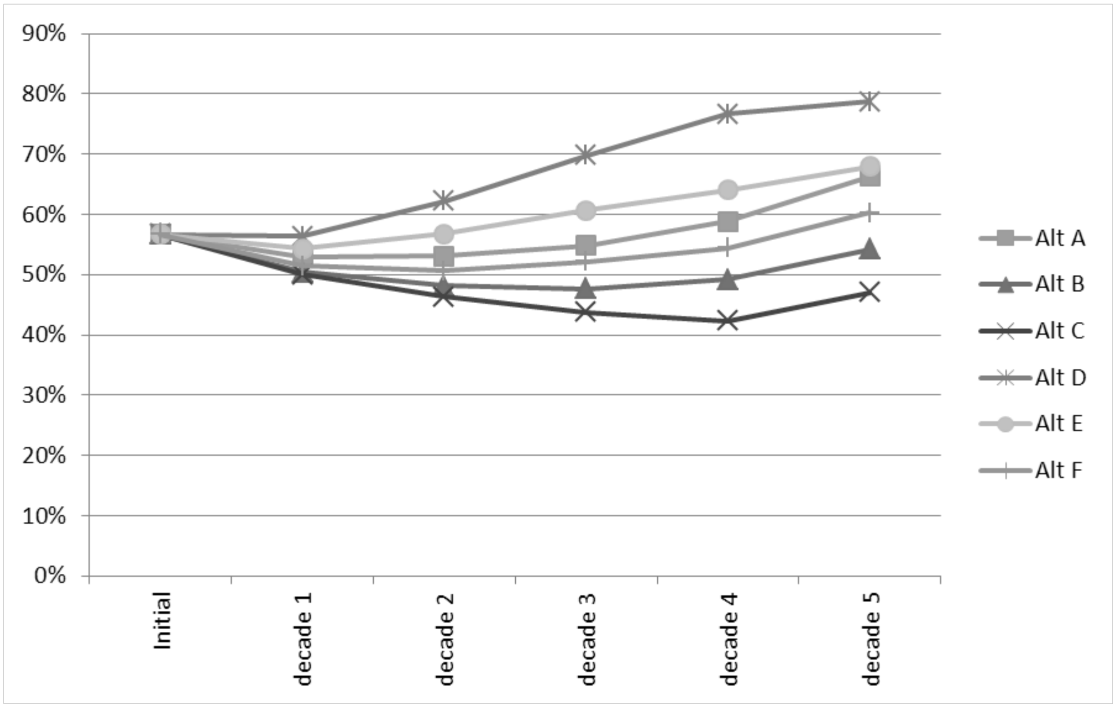

Figure 24. Decadal changes of Malheur National Forest Cassin's finch source habitat expressed as a percentage of the mid-point of what would have been expected historically

Wallowa-Whitman National Forest – There would be a high level of concern for the viability of the Cassin's finch within the Wallowa-Whitman National Forest. This is primarily due to the extensive departure in the amount of source habitat (see figure 25). Unlike the Umatilla National Forest, only alternative C would lead to a slight reduction in source habitat during the first decade. By the end of the second decade, all alternatives would have more source habitat than at the start of the plan period. The increases in source habitat for alternatives D and E would be sufficient enough to result in reduced concern for species viability. Because all alternatives show an improving source habitat trend, none would lead to an increased concern based on habitat alone. As discussed previously, risks associated with this species (discussed in detail later in this section) would not outweigh the improvement in habitat. As such, populations would likely be viable for all alternatives during the life of the plan.

Open Forest: All Forest Structure (Tree Sizes)

The western bluebird was identified as the focal species for the open forest/all forest group because it is widely distributed in open, low-elevation forests, and is limited by the availability of snags with existing cavities (Guinan et al. 2008). Western bluebirds are summer residents in Oregon, and this assessment is for breeding and rearing habitat. Source habitat was defined as the all forest structure (tree sizes) in the dry forest potential vegetation group with less than 40 percent canopy cover (Wales et al. 2011). Snag availability, open motor vehicle route density, and grazing were other factors used in the focal species assessment model to assess habitat quality. Some species in the group use down wood and it is assumed that if snags are present for the bluebird, down wood will be available as snags fall.

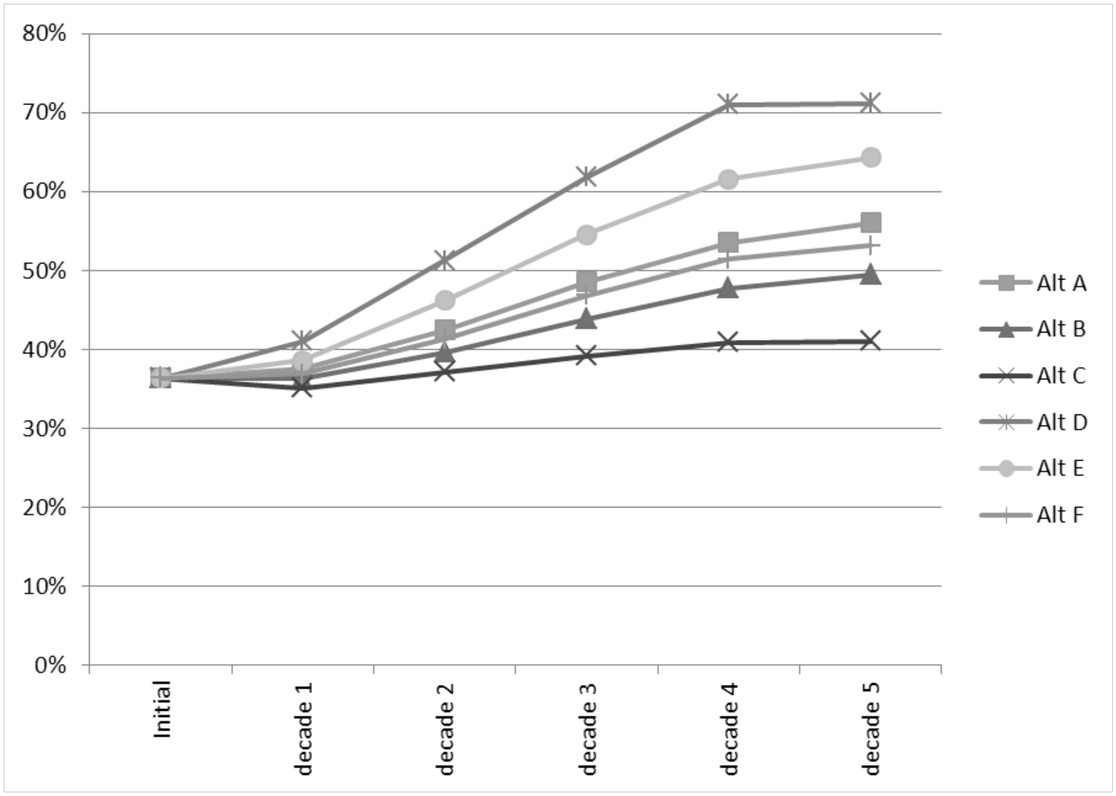

Figure 25. Decadal changes of Wallowa-Whitman National Forest Cassin's finch source habitat expressed as a percentage of the mid-point of what would have been expected historically

Outcomes for all three national forests displayed in table 299 through table 301 indicate a high concern for species viability both currently and for the alternatives. Although an improvement in source habitat would occur at the scale of the Blue Mountains, the projected viability outcome would remain low primarily because the amount of open habitats within forested communities would remain low compared to historical conditions (Wales et al. 2011). Loss of habitat has occurred for a variety of reasons, including wildfire suppression and possibly past livestock grazing practices, which resulted in stands becoming more dense.

Malheur National Forest – With the exception of alternative D, source habitat would be reduced to less than the existing condition during the first decade (see figure 26). By year 20, source habitat would exceed the existing condition only for alternatives D and E, resulting in reducing the level of viability concern from high to moderate-to-high for those alternatives (see table 299). The level of concern would continue to be high for the other alternatives. Although the concern would remain high, the habitat trend would be relatively stable. For all alternatives, it would be above the 40 percent level that has been identified as a threshold for viability (Rompré et al. 2010, Tear et al. 2005, With and Crist 1995). Source habitat was highly abundant (more than one million acres) within the Malheur National Forest. Although below what occurred historically, it is still relatively common. This reduces the immediate concern for the persistence of the western bluebird and other species associated with this habitat for all alternatives. With the exception of the rubber boa, most species within the group have high dispersal capabilities (see table 298), so individuals would likely be able to interact, thus maintaining viable populations for all alternatives during the life of the plan.

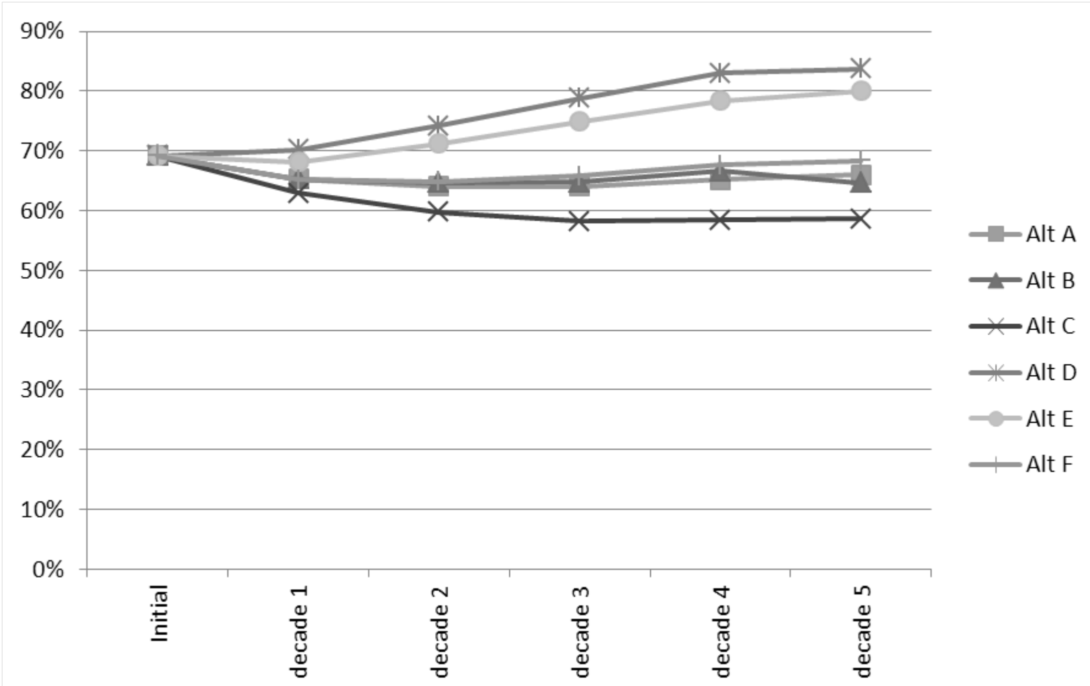

Figure 26. Decadal changes of Malheur National Forest western bluebird source habitat expressed as a percentage of the mid-point of what would have been expected historically

As indicated previously, habitat quality is affected by snag density and grazing. Risks to snag density from roads and management activities are discussed later in this section as well as the risks associated with grazing. Table 306 displays the snag levels analyzed and how they compare to what would be expected across the landscape based on Mason and Countryman (2010). It is important to note that because of the categories used in Mason and Countryman (2010), all three levels for ponderosa pine fall in the same category (zero to two snags per acre) and therefore the landscape percentages are the same. What it does point out is that high snag levels in the dry potential vegetation group approximate what would be expected across the landscape historically. However, when compared with the analysis at the watershed level (Wales et al. 2011) only three percent of the watersheds within the Malheur National Forest have 50 percent or more of source habitat with high or very high snag densities, indicating a distribution problem. Wales et al. (2011) estimated that historically half of source habitat would have had snag densities of one snag per acre or less and half would have snag densities greater than one snag per acre. As previously noted (see discussion of the white-headed woodpecker for the Malheur National Forest), it seems unlikely, given the plan components, that the potential for snag recruitment for any alternative would be reduced to a level that would offset increases in source habitat. At the same time, in all likelihood alternative C would not reduce threats to habitat quality sufficiently to compensate for the decrease in open habitats (see the risks discussion that follows).

Table 306. Snag density per acre for 30, 50, and 80 percent tolerance levels described in DecAID, and percent of the historic and current landscape at these levels for the Malheur National Forest

d.b.h. (inches)	Potential Vegetation Group Associations	Tolerance levels from unharvested inventory plots[1]			Percent of landscape that historically met species tolerance levels[2]			Percent of landscape that currently meets species tolerance levels[3]		
		30%	50%	80%	30%	50%	80%	30%	50%	80%
≥ 20	Ponderosa pine/Douglas-fir	0.0	0.0	1.1	79%	79%	79%	82%	82%	82%
≥ 20	Eastside mixed conifer	0.0	0.8	5.5	62%	62%	24%	61%	61%	20%

1 From DecAID Figure PPDF_O.inv-3 and EMC_ECB_O.inv-3

2 From tables 8 and 9 in Mason and Countryman (2010)

3 From tables 14 and 15 in Mason and Countryman (2010)

Umatilla National Forest – With the exception of alternative D, there would be a high level of viability concern for the western bluebird (see table 300). Source habitat would increase for all alternatives compared to the existing condition during the first decade (see figure 27) but would increase sufficiently by the second decade to reduce the level of concern from high to moderate-to-high only for alternative D. Although the concern would remain high for all of the other alternatives, the trajectory for habitat is strongly upward. Coupled with the fact that habitat is currently common (historically more than 500,000 acres) and that most species of the group have high dispersal ability, populations would likely be viable for all alternatives during the life of the plan (see discussion for the Malheur National Forest).

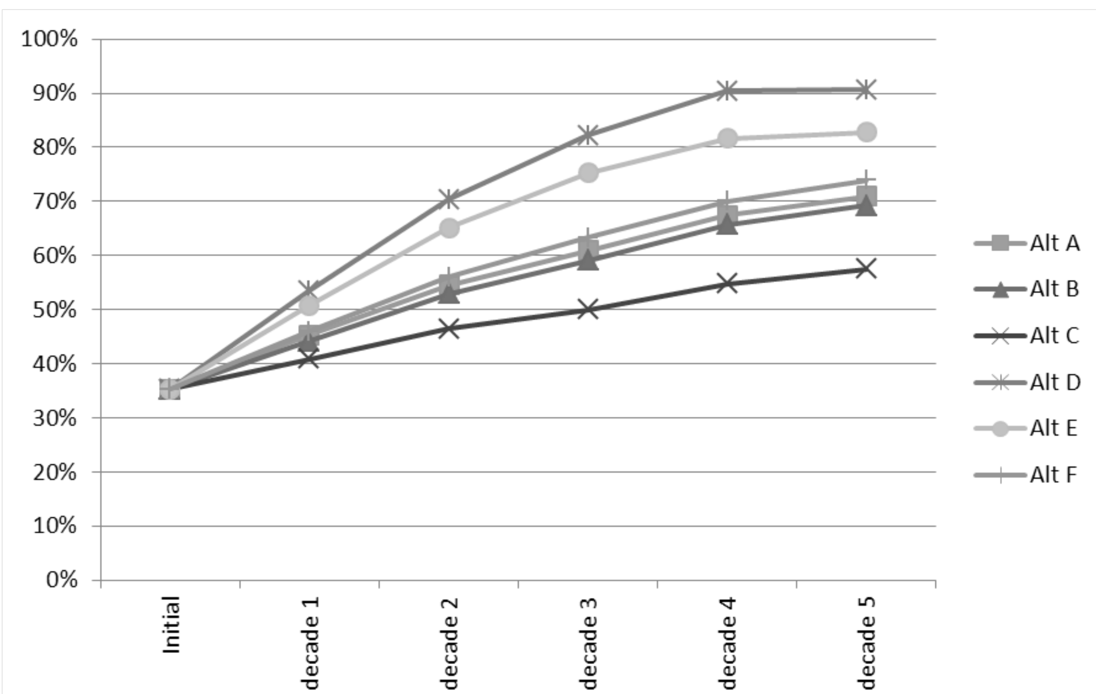

Figure 27. Decadal changes of Umatilla National Forest western bluebird source habitat expressed as a percentage of the mid-point of what would have been expected historically

Table 307 displays large snag availability across the landscape, which contributes to the quality of habitat for the western bluebird. The shortcomings of the snag data were discussed previously for the Malheur National Forest (see white-headed woodpecker under Dry Forest: Medium/Large Trees). Similar to the Malheur National Forest, it would appear that distribution across the landscape is of concern as only 34 percent of the watersheds within the Umatilla National Forest have 50 percent or more of source habitat with high or very high densities of large snags (Wales et al. 2011). As previously noted (see discussion of the white-headed woodpecker for the Malheur National Forest), it seems unlikely, given the plan components, that the potential for snag recruitment for any alternative would be reduced to a level that would offset increases in source habitat. At the same time, in all likelihood alternative C would not reduce threats to habitat quality sufficiently to compensate for the decrease in open habitats (see the risks discussion that follows).

Table 307. Snag density per acre for 30, 50, and 80 percent tolerance levels described in DecAID, and percent of the historic and current landscape at these levels for the Umatilla National Forest

d.b.h. (inches)	Potential Vegetation Group Associations	Tolerance levels from unharvested inventory plots[1]			Percent of landscape that historically met species tolerance levels[2]			Percent of landscape that currently meets species tolerance levels[3]		
		30%	50%	80%	30%	50%	80%	30%	50%	80%
≥ 20	Ponderosa pine/Douglas-fir	0.0	0.0	1.1	70%	70%	70%	73%	73%	73%
≥ 20	Eastside mixed conifer	0.0	0.8	5.5	55%	55%	22%	54%	54%	23%

1 From DecAID Figure PPDF_O.inv-3 and EMC_ECB_O.inv-3

2 From tables 8 and 9 in Mason and Countryman (2010)

3 From tables 14 and 15 in Mason and Countryman (2010)

Wallowa-Whitman National Forest – With the exception of alternatives D and E, there is a high level of concern for western bluebird viability (see table 301). The amount of source habitat would increase during the first decade for all alternatives (see figure 28), but would increase sufficiently by the second decade to reduce the level of concern from high to moderate-to-high only for alternative D. Although the concern for viability would remain high for all of the other alternatives, the trajectory for habitat is strongly upward. Coupled with the fact that habitat is still common (historically more than 600,000 acres) and that most species of the group have high dispersal ability; populations would likely be viable for all alternatives during the life of the plan (see discussion for the Malheur National Forest).

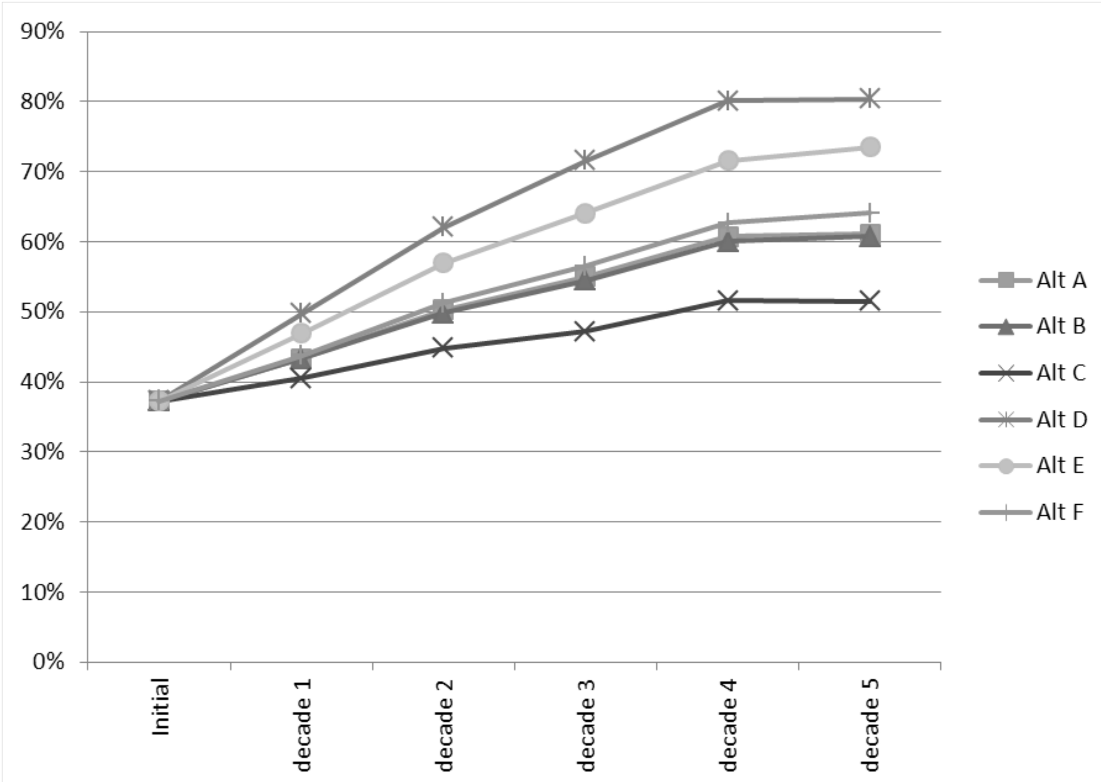

Figure 28. Decadal changes of Wallowa-Whitman National Forest western bluebird source habitat expressed as a percentage of the mid-point of what would have been expected historically

Table 308 displays large snag availability across the landscape, which is one of the attributes determining habitat quality for the western bluebird. The shortcomings of the snag data were discussed previously for the Malheur National Forest (see white-headed woodpecker under Dry Forest: Medium/Large Trees). Similar to the Malheur National Forest, it would appear that distribution across the landscape is of concern as only 10 percent of the watersheds within the Wallowa-Whitman National Forest have 50 percent or more of source habitat with high or very high densities of large snags (Wales et al. 2011).

Table 308. Snag density per acre for 30, 50, and 80 percent tolerance levels described in DecAID, and percent of the historic and current landscape at these levels for the Wallowa-Whitman National Forest

d.b.h. (inches)	Potential Vegetation Group Associations	Tolerance levels from unharvested inventory plots[1]			Percent of landscape that historically met species tolerance levels[2]			Percent of landscape that currently meets species tolerance levels[3]		
		30%	50%	80%	30%	50%	80%	30%	50%	80%
≥ 20	Ponderosa pine/Douglas-fir	0.0	0.0	1.1	70%	70%	70%	73%	73%	73%
≥ 20	Eastside mixed conifer	0.0	0.8	5.5	55%	55%	22%	54%	54%	23%

1 From DecAID Figure PPDF_O.inv-3 and EMC_ECB_O.inv-3

2 From tables 8 and 9 in Mason and Countryman (2010)

3 From tables 14 and 15 in Mason and Countryman (2010)

As previously noted (see discussion of the white-headed woodpecker for the Malheur National Forest), it seems unlikely that the potential for snag recruitment for any alternative would be reduced to a level that would offset increases in source habitat. At the same time, in all likelihood alternative C would not reduce threats to habitat quality sufficiently to compensate for the decrease in open habitats (see the risks discussion that follows).

Open Forest: Early Successional

The fox sparrow was chosen as the focal species to represent the early successional group of the open forest family. Banks (1970) as well as Weckstien et al. (2002) indicate that three subspecies occur in Oregon. They prefer dense, low shrub growth typical of such habitats and were susceptible to the effects of grazing by domestic livestock similar to other species in this group. Fox sparrows are breeding season residents of the planning area; therefore, this assessment is for breeding and rearing habitat. Source habitat was defined as all potential vegetation groups in the stand initiation, grass, or shrub (less than 5 inches) structural stages with open canopy (less than 10 percent cover).

Fox sparrows were strongly associated with riparian shrubs (e.g., willow [*Salix* spp.] and alder [*Alnus* spp.]) and the early shrub stage following disturbances such as fire and clearcut logging (Banks 1970, Fontaine et al. 2009, Hagar 1960, Kirk and Hobson 2001, Machtans and Latour 2003, Simon et al. 2002, Webster 1975, Weckstein et al. 2002). Although the amount of shrub cover is directly related to habitat quality for fox sparrow, it was not used in the model because of the high variability within the data set available for analysis (Wales et al. 2011).

Loss of habitat is the primary concern for the fox sparrow and species associated with open forest early successional habitats. Outcomes for the three national forests in table 299 through table 301 indicate a high level of concern exists only for the Malheur National Forest and therefore it is the only forest discussed.

Malheur National Forest – For all alternatives, the amount of source habitat for the fox sparrow would be increased during the first decade (see figure 29), but only alternatives D and E would increase habitat sufficiently by the end of the second decade to reduce the level of concern from high to moderate-to-high. Although concern would remain high for all of the other alternatives, the trajectory for habitat is strongly upward. Coupled with the high dispersal ability of the species of the group, the improvement in source habitat would improve viability for all alternatives during the life of the plan

Habitat quality for this species is affected by ungulate grazing which can reduce the amount of understory vegetation, indirectly affecting availability of nesting habitat and prey (insect) availability. Several authors reported a negative response of fox sparrows to grazing of riparian areas by domestic livestock (Page 1978, Knopf et al. 1988, Schulz and Leininger 1991) as well as native ungulates (Berger et al. 2001, Olechnowski and Debinski 2008). The risk of grazing to focal species habitat is discussed in detail in the risks discussion that follows.

Considering forest plan components for all alternatives, it seems unlikely that improvements in viability based on an increase in open habitats would be offset by threats to habitat quality (see risks discussion) for any of the alternatives.

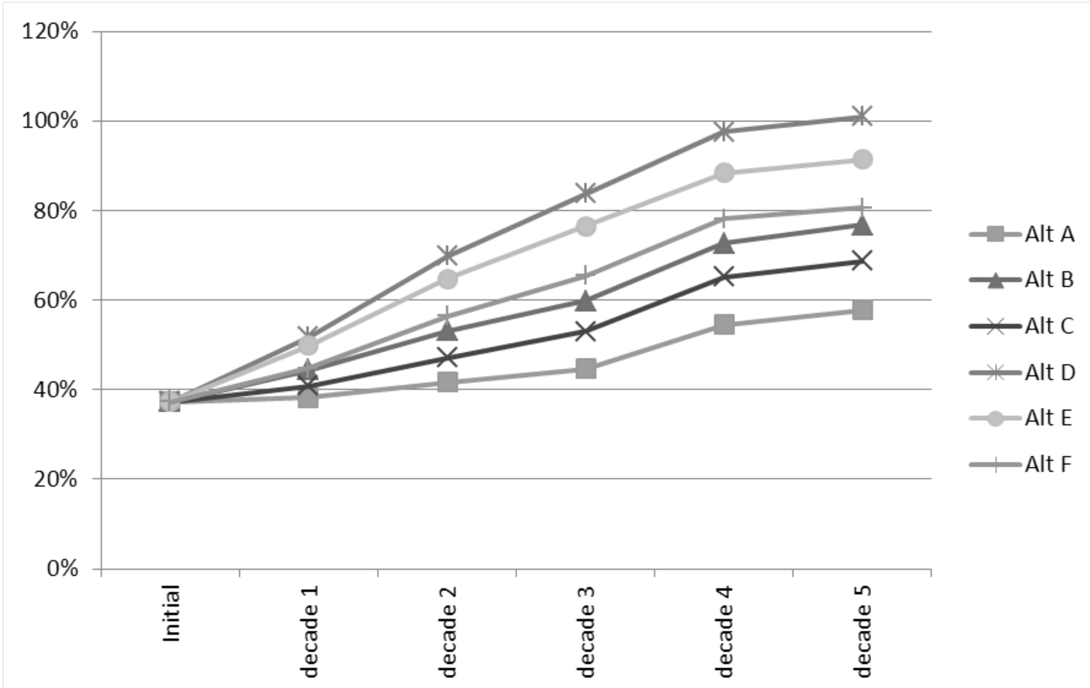

Figure 29. Decadal changes of Malheur National Forest fox sparrow source habitat expressed as a percentage of the mid-point of what would have been expected historically

Post Fire Habitats

Lewis's woodpecker was chosen as a focal species for the post fire habitat group. It represents post fire habitat with lower densities of large snags and trees unlike other species in the group that prefer post fire habitat with a high density of fire-killed trees. It was selected because it is closely tied to post fire habitats, is widespread across the western United States, and occurs in suitable habitat across the planning area. Lewis's woodpecker is also associated with unburned ponderosa pine forests with open canopies and large trees as well as cottonwood/willow habitat. It generally occurs at lower abundance in these habitats than in post fire habitat.

Lewis's woodpecker is a locally common but patchily distributed woodpecker usually seen in open forests of western North America. The combination of its sporadic distribution, its diet of adult-stage free-living insects (primarily aerial), its preference to nest in burned landscapes, and its variable migratory behavior makes it a unique member of New World woodpeckers (Abele et al. 2004). In Oregon, the Lewis' woodpecker breeds on the three national forests in Union, Baker, and Grant counties and elsewhere locally (Gilligan et al. 1994). It is opportunistic in its feeding habits, eating mostly insects in summer and switching in winter to acorns and other nuts, which are cached during the nonwinter months (Abele et al. 2004, Tobalske 1997). It is adept at capturing insects aerially through a variety of complex maneuvers and, although it may glean from the surfaces and crevices of tree bark, it seldom excavates for wood-boring insects (*ibid*). Lewis's woodpeckers are strongly associated with ponderosa pine throughout its range (Diem and Zeveloff 1980) but have also been found nesting in riparian habitats (Block and Brennan 1987, Saab and Vierling 2001). Some researchers have suggested an elevational relationship in which ponderosa pine forests are preferred at higher elevations and open riparian forests are preferred at low elevations (Tobalske 1997).

Wales et al. (2011) defined both primary and secondary source habitat for the Lewis's woodpecker. Primary source habitat was characterized as the dry forest potential vegetation group that was burned during the past five years (1999 through 2003) and was salvage harvested. Also included were areas that had burned between 1985 and 1999 without any regeneration harvest regardless of salvage history. Secondary habitat was characterized as the dry forest potential vegetation group with a canopy cover less than 50 percent and trees 40 cm d.b.h. or greater (15 inches). Cottonwood/willow habitat located primarily in riparian areas was also included as secondary source habitat (mapped using data from the National Wetlands Inventory).

Unlike other woodpeckers, Lewis's woodpecker is not morphologically well-adapted to excavate cavities in hard wood (Spring 1965). Lewis's woodpeckers tend to nest in a natural cavity, reuse preexisting cavities, or may excavate a new cavity in a soft snag (Raphael and White 1984, Saab and Dudley 1998, Tobalske 1997). Snag densities were assumed to be adequate in primary habitat (post fire). In secondary habitat, Wales et al. (2011) evaluated densities of snags 20 inches d.b.h. or larger using DecAID data (DecAID figure PPDF_L.inv-3) for ponderosa pine/Douglas-fir, large tree vegetation condition for snags 50 centimeters d.b.h. and greater.

Outcomes for all three national forests displayed in table 299 through table 301 indicate a moderate-to-high concern for viability of this species for all alternatives. This would be an increase in the level of concern for both the Umatilla and the Wallowa-Whitman National Forests and no change for the Malheur National Forest. The main factor leading to the high level of concern is the amount of source habitat (Wales et al. 2011). Both primary (post fire) and secondary source habitats occur at levels well below what was thought to have occurred historically. Wales et al. (2011) modeled the current situation for the Lewis's woodpecker but because of the uncertainty surrounding future fire occurrence, a focal species assessment model was not utilized to assess any of the alternatives.

Malheur National Forest – According to Wales et al. (2011), primary habitat for the Lewis's woodpecker would decrease from the current amount to less than the HRV median at year 20. Secondary source habitat (excluding cottonwood riparian habitat) would increase for all alternatives (see figure 30). Although secondary source habitat would increase nearly six fold for alternative D by year 20, the amount would not be sufficient to reduce the level of concern. Even though the trajectory for secondary habitat would be strongly upward, the viability concern would remain high for all alternatives due to the lack of primary source habitat

The forest plan includes a desired condition for fire to play a greater role in creating natural disturbances (see appendix A, 1.4.1 Wildland Fire). For example, table 238 in the Forested Vegetation, Timber Resources, and Wildland Fire section displays that 5 to 15 percent of the dry upland forest would have severe fire over time, the same as historical conditions. Currently, 50 percent of the dry upland forest within the Malheur National Forest has the potential for high severity fire (see table 242), which indicates that it would be possible to achieve the desired disturbance during the life of the plan. The use of fire is dependent upon the risk to life and or social/economic values. Higher risks would lead to more aggressive suppression, which makes it exceedingly difficult to actually predict how much and where post fire habitat might occur. Although predicting the amount of post fire habitat is highly uncertain, all alternatives have a desired condition to see fire play its ecological role. This, along with the projected increasing trend in secondary source habitat and the high dispersal capability of the Lewis's woodpecker, would result in a high likelihood of improving species viability.

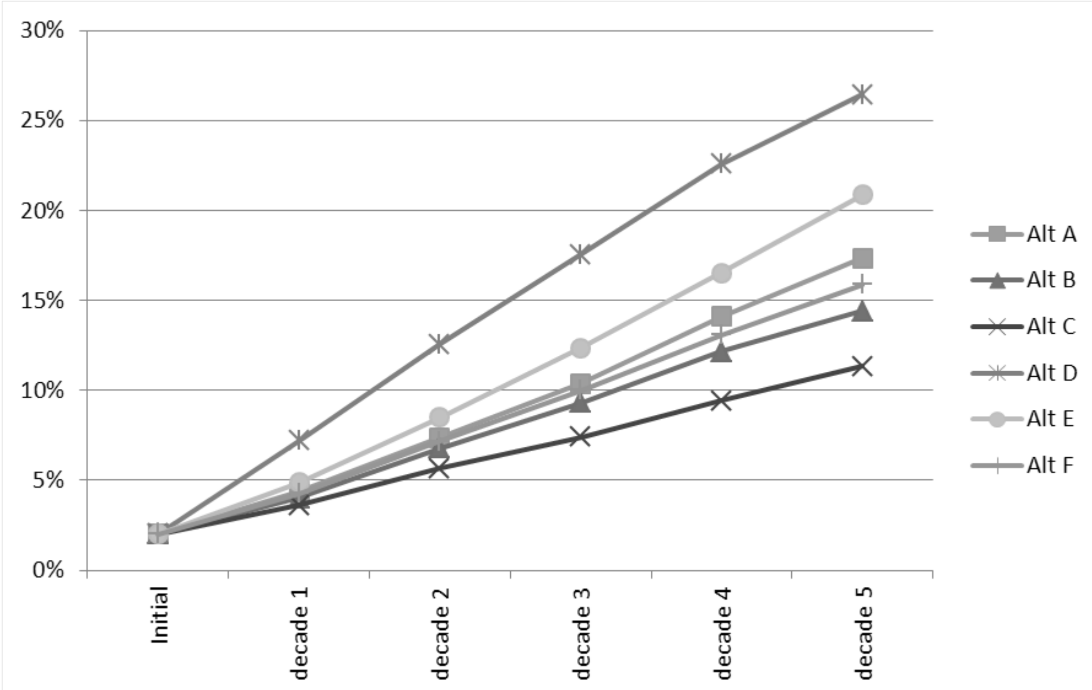

Figure 30. Decadal changes of Malheur National Forest Lewis's woodpecker source habitat expressed as a percentage of the mid-point of what would have been expected historically

Snag densities are assumed to be adequate in primary habitat (post fire). This is due in part to the species' tolerance of salvage harvest. Saab and Dudley (1998) and Saab et al. (2007) found nest success for this species to be greater in salvage harvested units than in unharvested units in Idaho. In Washington, Haggard and Gaines (2001) found this species primarily in stands with low snag density. Standards and guidelines for post fire habitat (WLD-HAB-19 G-4, WLD-HAB-20 G-5, and WLD-HAB-21 G-6) included in alternatives B, E, and F would provide more than adequate protection of source habitat for this species. Salvage harvest would be prohibited for alternative C, and alternative D would not have plan components specifically designed to guide management of post fire habitats within MA 4A.

Secondary source habitat quality is affected by large diameter snag density. Risks to snag retention have been discussed for the white-headed woodpecker and in the "Risks and Threats" section. Wales et al. (2011) categorized snag density in manner similar to that used for the western bluebird (see table 306). Although Mason and Countryman (2010) found large snag density distribution across the landscape to be comparable to historical levels (see western bluebird discussion), Wales et al. (2011) determined that there were no watersheds with high or very high levels of snags within the Malheur National Forest.

Umatilla National Forest – Similar to the Malheur National Forest, primary habitat for the Lewis's woodpecker would decrease to less than the HRV median at year 20 (Wales et al. 2011). Secondary source habitat (excluding cottonwood riparian habitat) would increase for all alternatives (see figure 31). Although secondary source habitat would increase nearly 10 fold for alternative D by year 20, the amount would not be sufficient to prevent an increase in the level of concern from moderate to moderate-to-high. Even though the trajectory for secondary habitat would be strongly upward, the level of concern would remain moderate to high for all of the other alternatives. This is due to the projected reduction in post fire habitat over time, which may or may not be an artifact of VDDT modeling. According to the wildfire severity effects analysis (see the Forested Vegetation, Timber Resources, and Wildland Fire section), the acres predicted to burn on National Forest System lands in the Blue Mountains would actually increase at year 20 compared to what has burned in the past 25 years.

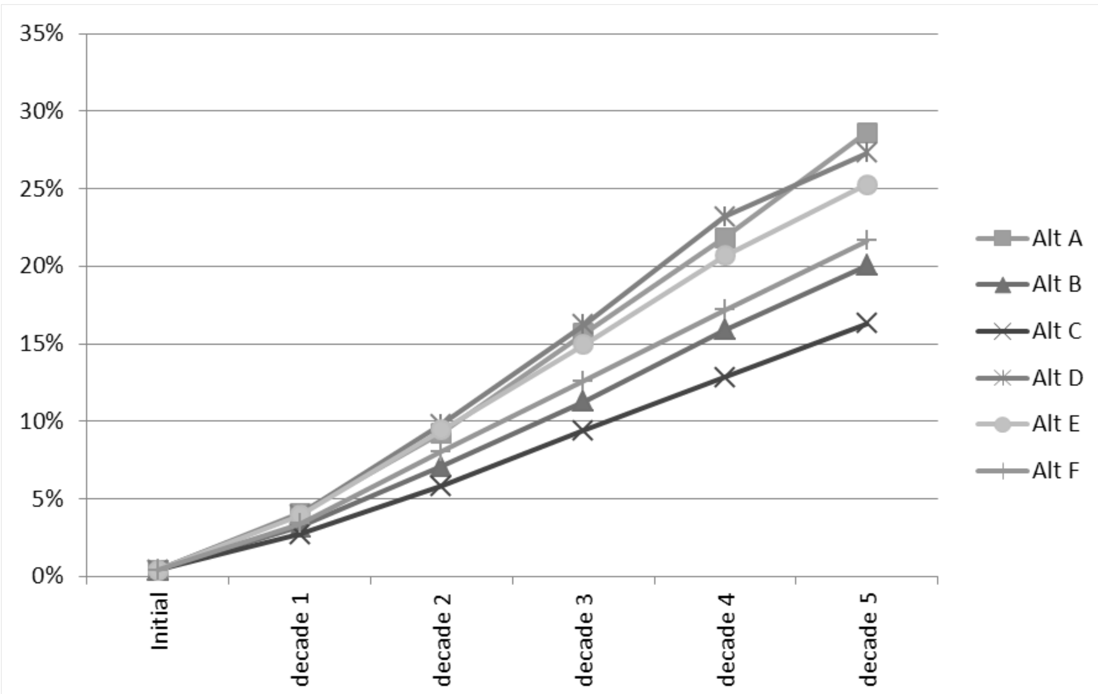

Figure 31. Decadal changes of Umatilla National Forest Lewis's woodpecker source habitat expressed as a percentage of the mid-point of what would have been expected historically

It is important to note that the alternatives with the greatest projected increases in secondary habitat would also have the greatest reductions to the risk of high severity fire (see table 264). Consequently, the probability of creating primary habitat would be reduced for those alternatives.

The forest plan includes a desired condition for fire to play a greater role in creating natural disturbances (see appendix A, 1.4.1 Wildland Fire). For example, table 238 displays that 5 to 15 percent of the dry upland forest would have severe fire over time, the same as historical conditions. Currently, more than 45 to 71 percent of the dry upland forest within the Umatilla National Forest has the potential for high severity fire (see table 242), which indicates that it would be possible to achieve the desired disturbance during the life of the plan. The use of fire is dependent upon the risk to life and or social/economic values. Higher risks would lead to more aggressive suppression, which makes it exceedingly difficult to predict how much and where post fire habitat might occur. Although predicting the amount of post fire habitat is highly uncertain, all alternatives have a desired condition to see fire play its ecological role. This, along with the projected increasing trend in secondary source habitat and the high dispersal capability of the Lewis's woodpecker, would result in a high likelihood of improving species viability.

Snag densities are assumed to be adequate in primary habitat (see the discussion for the Malheur National Forest). Standards and guidelines for post fire habitat (WLD-HAB-19 G-4, WLD-HAB-20 G-5, and WLD-HAB-21 G-6) included in alternatives B, E, and F would provide more than adequate protection of source habitat for this species. Salvage harvest would be prohibited for alternative C, and alternative D would not have plan components specifically designed to guide management of post fire habitats within MA 4A.

Secondary source habitat quality is affected by large diameter snag density. Risks to snag retention on the landscape have been discussed for the white-headed woodpecker and in the Risks and Threats section. Wales et al. (2011) categorized snag density in a manner similar to that used for the western bluebird (see table 307). Although Mason and Countryman (2010) found large snag density distribution across the landscape to be comparable to historical levels (see western bluebird discussion), Wales et al. (2011) determined that 53 percent of the watersheds had 50 percent or more of the source habitat with high or very high levels of snags within the Umatilla National Forest.

Wallowa-Whitman National Forest – Similar to the Malheur National Forest, primary habitat for the Lewis's woodpecker would decrease to less than the HRV median at year 20 (Wales et al. 2011). Secondary source habitat (excluding cottonwood riparian habitat) would increase for all alternatives (see figure 32). Although secondary source habitat would increase nearly 14 fold for alternative D by year 20, the amount would not be sufficient to prevent an increase in the level of concern from moderate to moderate-to-high. Even though the trajectory for secondary habitat would be strongly upward, the level of concern would remain moderate--to high for all of the other alternatives. This is due to the projected reduction in post fire habitat over time, which may or may not be an artifact of VDDT modeling. According to the wildfire severity effects analysis (see the Forested Vegetation, Timber Resources, and Wildland Fire section), the acres predicted to burn on National Forest System lands in the Blue Mountains would actually increase at year 20 compared to what has burned in the past 25 years.

It is important to note that the alternatives with the greatest projected increases in secondary habitat would also have the greatest reductions to the risk of high severity fire (see table 264). Consequently, the probability of creating primary habitat would be reduced for those alternatives.

The forest plan includes a desired condition for fire to play a greater role in creating natural disturbances (see appendix A, 1.4.1 Wildland Fire). For example, table 238 displays that 5 to 15 percent of the dry upland forest would have severe fire over time, the same as historical conditions. Currently, more than 35 to 64 percent (see table 242) of the dry upland forest within the Wallowa-Whitman National Forest has the potential for high severity fire, which indicates that it would be possible to achieve the desired disturbance during the life of the plan. The use of fire is dependent upon the risk to life and/or social/economic values. Higher risks would lead to more aggressive suppression, which makes it exceedingly difficult to predict how much and where post fire habitat might occur. Although predicting the amount of post fire habitat is highly uncertain, all alternatives have a desired condition to see fire play its ecological role. This, along with the projected increasing trend in secondary source habitat and the high dispersal capability of the Lewis's woodpecker, would result in the likelihood that species viability would be maintained.

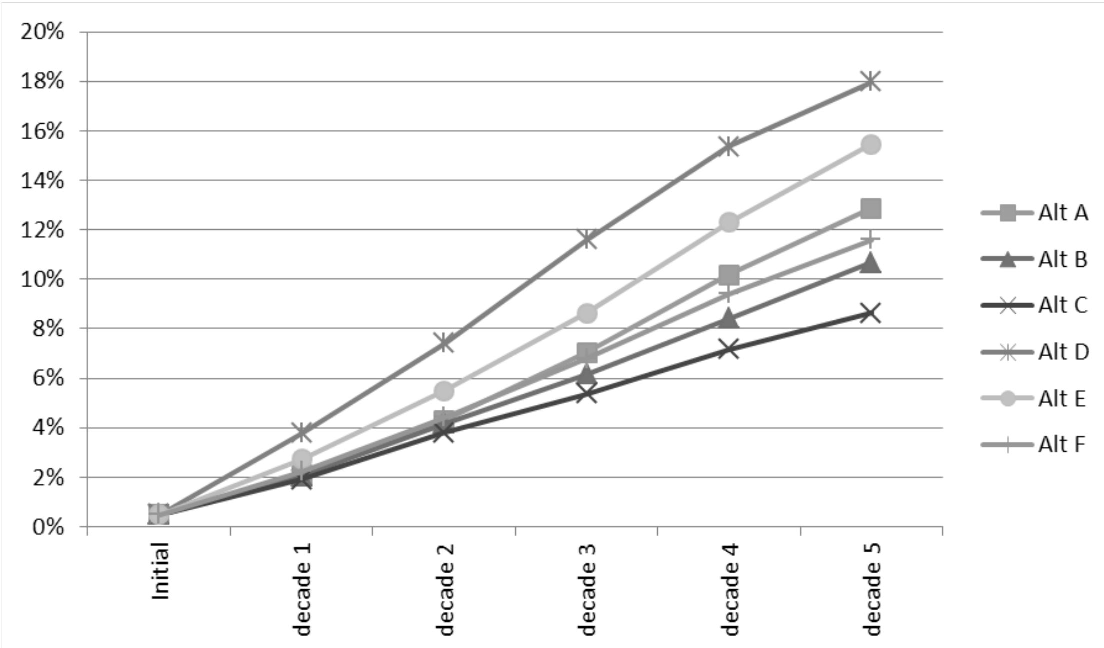

Figure 32. Decadal changes of Wallowa-Whitman National Forest Lewis's woodpecker source habitat expressed as a percentage of the mid-point of what would have been expected historically

Snag densities are assumed to be adequate (see discussion for the Malheur National Forest). Standards and guidelines for post fire habitat (WLD-HAB-19 G-4, WLD-HAB-20 G-5 (standard), and WLD-HAB-21 G-6) included in alternatives B, E, and F would provide more than adequate protection of source habitat for this species. Salvage harvest would be prohibited for alternative C, and alternative D would not have plan components specifically designed to guide management of post fire habitats within MA 4A.

Secondary source habitat quality is affected by large diameter snag density. Risks to snag retention on the landscape have been discussed for the white-headed woodpecker and in the “Risks and Threats” section. Wales et al. (2011) categorized snag density in a manner similar to that used for the western bluebird (table 308). Although Mason and Countryman (2010) found large snag density distribution across the landscape to be comparable to historical levels (see western bluebird discussion), Wales et al. (2011) determined that 45 percent of the watersheds had 50 percent of the source habitat with high or very high levels of snags within the Wallowa-Whitman National Forest.

Risks and Threats to Focal Species

Various risk and threat factors were incorporated into the analysis of focal species viability (see table 309) and are discussed in this section and where appropriate, identified by species or potential vegetation group.

Table 309. Threats and/or risks by focal species identified by Wales et al. (2011) that could impact source habitat quality and/or species viability

Species	Family	Group	Grazing	Risk to Snags	Roads
Boreal owl	Alpine/boreal	Boreal forest		X	X
Western bluebird	Open forest	All forest communities	X	X	X
Cassin's finch	Medium/large trees	All forest communities	X		
Fox sparrow	Open forest	Early successional	X		
White-headed woodpecker	Medium/large trees	Dry forest		X	X
Lewis' woodpecker	Open forest	Post-fire		X	X

Snag Density (all Potential Vegetation Groups)

Snag density is a habitat attribute that is important to at least one focal species with a high or moderate- to-high level of concern within all potential vegetation groups. All of the alternatives have the same desired condition for retention of snags as well as for downed logs on the landscape (see appendix A 1.14 Snags and Down Wood). Using CVS data, Mason and Countryman (2010) indicated that at the broad scale, the percent of the landscape with large snags is similar to historical levels. While snag numbers may appear similar to HRV for the landscape, distribution may be different than historical distribution (Nutt et al. 2010). Wales et al. (2011) demonstrated that in most cases, distribution within source habitat across watersheds within each of the national forests is not what would be expected.

It is assumed that the level of active management (i.e., timber harvest, fuel treatments, and prescribed fire) increases the risk of a reduction in snags due to safety reasons. Those alternatives proposing the most prescribed fire probably present the greatest risk to snag availability. Although it is commonly thought that prescribed fire will create snags, studies have indicated loss of snags is greater than recruitment (Randall-Parker and Miller 2002, Stephens and Moghaddas 2005, Tiedemann et al. 2000).

For all of the alternatives and each national forest, there would be such little use of prescribed fire (table 310) in the cold forest potential vegetation group (boreal owl) that the risk of snag loss would be negligible. Harvest of trees larger than 21 inches d.b.h. and salvage harvest would both be prohibited for alternative C, which therefore would pose the least risk to large snag recruitment. For alternative B, harvest of green trees larger than 21 inches d.b.h. would be allowed only for very specific conditions, which also would provide well for recruitment of large snags. Standards for alternative A prohibit harvest of live trees 21 inches d.b.h. and greater and provide for retention of snags 21 inches d.b.h. and greater post timber sales at 2.25 snags per acre. Alternative A provides for snag retention and recruitment at a rate second only to alternative C. Alternatives E and F would use an age limit to protect older trees, which could lead to slightly fewer trees 21 inches d.b.h. and greater being retained on the landscape as individual trees could reach this diameter at an earlier age and be available for harvest.

Table 310. Percent of potential vegetation group treated in the first decade by alternative, treatment type, and national forest

Vegetation Type	Type of Treatment	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F
Malheur National Forest							
Cold forest	Salvage	0.0	0.0	0.0	0.1	0.1	0.1
	Prescribed fire	0.3	0.4	0.9	0.0	0.9	0.9
	Precommercial thinning	0.3	0.5	0.6	1.0	0.6	0.6
	Commercial	0.5	1.2	0.9	6.1	3.4	2.4
	Totals	1.1	2.1	2.4	7.2	5.0	4.0
Cool/moist forest	Salvage	0.0	0.0	0.0	0.3	0.1	0.0
	Prescribed fire	0.2	0.1	0.6	0.0	0.6	0.6
	Precommercial thinning	0.0	0.1	0.1	0.1	0.1	0.0
	Commercial	0.4	1.3	0.8	5.9	2.5	1.5
	Totals	0.7	1.6	1.4	6.3	3.2	2.1
Dry forest	Salvage	0.1	0.1	0.0	0.4	0.1	0.1
	Prescribed fire	5.2	5.2	7.1	0.0	9.6	7.0
	Precommercial thinning	0.9	1.0	0.9	1.0	0.7	0.7
	Commercial	1.6	2.9	1.4	8.2	5.1	3.4
	Totals	7.7	9.1	9.3	9.6	15.5	11.2
Umatilla National Forest							
Cold forest	Salvage	0.0	0.0	0.0	0.8	0.4	0.2
	Prescribed fire	0.3	0.8	1.1	0.0	1.4	0.9
	Precommercial thinning	0.7	0.9	0.8	1.2	0.9	0.9
	Commercial	0.2	0.7	0.4	4.1	1.3	0.9
	Totals	1.3	2.4	2.3	6.0	4.0	3.0
Cool/moist forest	Salvage	0.0	0.0	0.0	0.1	0.1	0.0
	Prescribed fire	1.4	0.9	2.7	0.0	2.6	2.0
	Precommercial thinning	0.7	0.7	0.5	0.6	0.6	0.6
	Commercial	1.2	2.0	1.0	7.3	4.6	2.6
	Totals	3.3	3.6	4.2	8.1	7.8	5.2
Dry forest	Salvage	0.1	0.1	0.0	0.4	0.3	0.1
	Prescribed fire	5.7	6.0	7.5	0.0	7.3	7.1
	Precommercial thinning	1.8	2.0	1.4	2.0	1.8	1.8
	Commercial	1.2	3.1	1.3	8.8	6.2	3.9
	Totals	8.8	11.2	10.1	11.1	15.6	13.0
Wallowa-Whitman National Forest							
Cold forest	Salvage	0.1	0.0	0.0	0.2	0.2	0.1
	Prescribed fire	1.4	0.6	0.5	0.0	0.8	0.4
	Precommercial thinning	0.4	0.3	0.2	0.4	0.3	0.2
	Commercial	1.0	0.7	0.4	3.5	1.6	1.0
	Totals	2.8	1.5	1.1	4.1	2.9	1.7

Vegetation Type	Type of Treatment	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F
Cool/moist forest	Salvage	0.0	0.0	0.0	0.1	0.1	0.0
	Prescribed fire	5.0	2.4	2.3	0.2	3.7	2.3
	Precommercial thinning	0.7	0.6	0.5	0.8	0.6	0.5
	Commercial	1.2	1.2	0.7	5.8	3.1	2.1
	Totals	7.0	4.2	3.5	6.8	7.5	4.9
Dry forest	Salvage	0.1	0.0	0.0	0.3	0.3	0.1
	Prescribed fire	11.2	6.2	5.8	0.3	7.7	6.5
	Precommercial thinning	5.0	2.5	1.4	2.4	1.7	1.6
	Commercial	2.0	2.0	1.1	6.8	3.9	2.8
	Totals	18.4	10.6	8.3	9.8	13.6	11.0

Less than 10 percent of the cool-moist potential vegetation group acres are treated within any national forest (table 310) under any alternative. For the Malheur National Forest, alternative D would pose the least risk to snags, since it would have no prescribed fire. Although minor, the other alternatives, especially C, E, and F would have some prescribed fire. For the Umatilla National Forest, the greatest risk to snags would be posed by the management activities (more prescribed fire) projected for alternative E followed by alternative C. For the Wallowa-Whitman National Forest, alternative D would pose the least risk to snag retention because prescribed fire would not be used and desired conditions for snag density would be met in areas where mechanical treatments take place. Management activities for alternatives A and E would pose the greatest risk to snags, with A having the most risk due to prescribed fire use. Alternatives B, C, E, and F include a standard for the cool moist potential vegetation group to retain all snags greater than 21 inches and one-half of existing snags from 12 to 21 inches, except for danger/hazard trees (WLD-HAB-12), for all three national forests, but it only applies to mechanical treatment. Alternative A includes a standard to maintain 2.25 snags 21 inches d.b.h. and greater per acre after all timber sale activities.

In the dry forest (white-headed woodpecker, western bluebird, and Lewis's woodpecker) within all three national forests, alternative D would pose the least risk to snags as there would be no prescribed fire. Management activities projected for alternatives E and F would pose the greatest risk to snags for the Malheur and Umatilla National Forests. For the Wallowa-Whitman National Forest, alternative A would actually pose the greatest risk to snags as more prescribed fire would be anticipated, and alternatives E and F respectively would pose the next highest levels of risk.

In summary, all alternatives would have desired conditions to maintain snags at historical levels. Because prescribed fire presents the greatest risk to retaining snags on the landscape, alternative D most likely presents the least risk to snags from management actions for all three national forests. Since none of the alternatives are projected to treat more than 20 percent of any one potential vegetation group, the threat to snags from management activities is probably minimal at the landscape scale. The issue of distribution across the landscape, however, would probably continue to be of concern.

Open Motor Vehicle Routes Risk to Snag Density That Could Affect Boreal Owls, Western Bluebirds, White-Headed Woodpeckers, and Lewis's Woodpeckers

Bate et al. (2007), found that the density of snags greater than 9 inches (23 centimeters) d.b.h. were lower adjacent to roads and towns in the pine and larch forests of northeastern Oregon, presumably due to safety considerations, firewood cutters, and other management activities. Wisdom and Bate (2008) found similar results in western Montana. The snag density data utilized by Wales et al. (2011) came from a modeled data set that did not account for road associated factors. Therefore, in addition to snag densities, the model uses open motor vehicle route density as a variable to account for probable reduced snag densities along those routes. Watersheds were analyzed based on the amount of potential habitat within areas with different open motor vehicle route densities. Watersheds were classified from zero to high based on miles of open motor vehicle routes per square mile:

- Zero: less than 0.1 miles per square mile
- Low: greater than 0.1 to 1.0 mile per square mile
- Moderate: greater than 1.0 to 2.0 miles per square mile
- High: greater than 2.0 miles per square mile

Open motor vehicle route density was maintained as a constant in the modeling of alternative B. In evaluating risk to snag density from the other alternatives, more management activity does not necessarily equate to more motor vehicle routes remaining open to the public, since routes could be designated open only for administrative use. In general and across all potential vegetation groups(see table 311), alternative C would reduce the risk to snags the most as it has the least amount of active management and the lowest desired condition for open motor vehicle route density. Alternative D would have the greatest risk, due to a higher open motor vehicle route density desired condition and more active management.

Table 311. Percent of each national forest by alternative with an open motor vehicle route density desired condition less than 1.5 miles per square mile (based on acres of management areas)

National Forest	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F
MAL	5	16	36	12	17	17
UMA	23	42	55	32	41	41
WAW	23	37	58	31	38	38

Alternatives E and F both include a desired condition to reduce the hydrological connectivity of roads within watersheds that have anadromous fish and bull trout. To facilitate this analysis, the following assumptions have been made: 1) densities of 2 miles per square mile of existing road beds in anadromous fish watersheds and less than 1 mile per square mile in bull trout watersheds would achieve this desired condition: 2) the alternative with the most acres projected to be treated would have the greatest opportunity for a reduction in road beds across the national forests: and 3) even though it may not be possible to physically reduce roadbeds to the desired level, it is possible to reduce the open motor vehicle route densities to these levels. The impact by national forest would vary. For example, anadromous fish watersheds, with the assumption of 2 miles per square mile of road beds, make up almost 100 percent of the Umatilla National Forest. This could result in an additional 20 percent (see table 310) of the national forest with open motor vehicle route densities of 2 miles per square mile at the end of the planning period.

Since about half of the Malheur National Forest is in anadromous fish watersheds, it is likely that only half of the 20 percent of acres to be treated (see table 310) would trend toward the desired condition for road bed density within these watersheds. This assumed reduction in open motor vehicle route density, coupled with the results displayed in table 311, would indicate that alternative C would reduce risks to snags from open motor vehicle route density the most for the Malheur National Forest followed by alternative E and then alternative F (see figure 35 on page 248). For the Umatilla and Wallowa-Whitman National Forests, because of the higher probability of treatments occurring within anadromous fish or bull trout watersheds, alternative E would be likely to reduce risks to snags from open motor vehicle route density the most followed by alternatives F and C.

The impact from open motor vehicle route density to snag density likely would be greatest in the dry forest potential vegetation group since it currently has the greatest open motor vehicle route density per square mile of all the potential vegetation groups. The desired condition for open motor vehicle route density for MA 4A for all alternatives exceeds what was modeled as high (greater than two miles per square mile), and, therefore, the risk as modeled would only change measurably for alternative C since it includes MA 3C, which would have a desire condition that matches the low category. Alternatives E and F also include MA 3C for the Umatilla and Wallowa-Whitman National Forests, but MA 3C represents less than 1 percent of the landscape, which in all probability would not result in a measureable improvement.

The risk to larger snags (21 inches d.b.h. or greater) from firewood harvest is currently ameliorated on all three national forests by restricting harvest to within 300 feet of a road and to snags less than 20 inches d.b.h. per the firewood collection permit. With the exception of alternative D, it is assumed that the restriction on personal firewood collection would continue in order to comply with standard WLD-HAB-12 S-7 to retain snags greater than 21 inches d.b.h.

Livestock Grazing

Livestock grazing was evaluated as a risk factor for the Cassin’s finch, fox sparrow, and western bluebird based on the percent of source habitat for each of these species that occurred within an active grazing allotment by watershed. Saab et al. (1995) summarized the results of five studies that evaluated the effects of livestock grazing on Cassin’s finch. Three of the five studies found that Cassin’s finch responded negatively to grazing (Page et al. 1978, Schulz and Leininger 1991, Taylor 1986), one found a neutral effect (Medin and Clary 1991), and one found a positive relationship (Mosconi and Hutto 1982). Knopf et al. (1988), Page et al. (1978), and Schulz and Leininger (1991) all reported a negative response from fox sparrows associated with cattle grazing.

Livestock grazing is thought to reduce fire frequency in ponderosa pine forests through the elimination of grass that facilitated the spread of low-intensity fires (Hessburg and Agee 2003, Hessburg et al. 2005, Zwartjes et al. 2005). Grazing effects to bird species rarely result from the mere presence of livestock but rather the resulting change in vegetative structure (Bock and Webb 1984, Taylor 1986, Zwartjes et al. 2005). Because bluebirds are insectivorous, a large reduction in grass biomass is likely to have negative impacts on their prey base (Zwartjes et al. 2005). Bull et al. (2001) found western bluebirds to be more abundant at ponds that were protected from livestock grazing than those not protected, suggesting that the increase in vegetation might improve insect availability.

A basic premise in the ranking of alternatives is that an improvement in rangeland health would, for the most part, result in an improvement of source habitat. Dietz (1975) pointed out that excessive removal of grass leaves would have an adverse effect on grass root development. This often results in reduced plant growth, less forage production, lower plant vigor and lower reproduction. Holechek’s (1988) literature review indicated that utilization levels of 50 percent or greater were only applicable to humid or annual range lands, and that lower levels are appropriate for coniferous forests, mountain shrublands, oak woodlands, etc. where ranges are in less than good condition. Additionally, improvement in range condition is a direct reflection of utilization levels, or the residual biomass after grazing (Klipple and Costello 1960). Several studies (Hart et al. 1989, Hart et al. 1993, Herbel 1974, Hughes 1990, Pieper and Heitschmidt 1988, Van Poollen and Lacey 1979) indicate that stocking rate and utilization levels have more to do with successful range improvement than anything else. Other studies have indicated that heavy use (50-plus percent) at any time of the year, including the dormant season, is rarely compensated for by rest (Mueggler 1975, Sauer 1978, Snevea 1980, Trlica et al. 1977) with some plant species requiring more than six years to recover after heavy use. Because of this, those alternatives that propose low utilization levels are assumed to achieve the fastest range improvement.

Therefore, for all three national forests, alternative C would pose the least risk to focal species that are sensitive to grazing. Alternative C would have the least amount of acres suitable for domestic livestock grazing (see tables GR7, GR8 and GR9 in the Livestock Grazing and Rangeland Vegetation section) and it also would have the lowest utilization levels in both the uplands (see table 312) and riparian management areas (see appendix A, MA 4B RMA-RNG-2 G-115, table A-55a). Although alternative D would have the greatest number of upland acres suitable for domestic livestock grazing, both alternatives A and B would have higher utilization levels, which potentially would result in less herbaceous material left for wildlife. Although alternatives A, B, E, and F would have the same amount of acres within active allotments, alternatives E and F should have the least impact due to a lower utilization level, followed by alternative B and then alternative A (see table 312 and appendix A, MA 4B RMA-RNG-2 G-115, table A-55a).

Table 312. Percent maximum utilization levels proposed for upland habitats with moderate to low departure from HRV by alternative and national forest

National Forest	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F
Malheur	50-60	35-55	30	45-50	35-40	35-40
Umatilla	50-60	35-55	30	45-50	35-40	35-40
Wallowa-Whitman	50-60	35-55	30	45-50	35-40	35-40

Countryman (2011) conducted an analysis to broadly determine if adequate forage is being produced for domestic livestock grazing, wild ungulate grazing, and the needs of plant and watershed health on those lands deemed suitable for grazing (see table 313). The basic assumptions can be found in the project record, but essentially elk population estimates were converted to a density/acre estimate. This utilizes the assumption that by considering an even distribution across that landscape at all times, this would account for the number of elk that would be found on an allotment at any one time. An additional caveat is that only elk consumption was calculated, as they have the greatest dietary overlap with domestic livestock. Doubling the needs for elk to account for forage needs of other native ungulates, such as deer, which are more of a browser, would only result in a one percent change in the total percent utilization estimates displayed in table 313.

Table 313. Estimated forage needs of grazing ungulates by national forest and the percent of total forage represented by this use on suitable acres in active allotments

National Forest	Annual Forage Needs (million pounds)			Annual Production	
	Domestic Livestock	Elk	Total Needs	Total (million pounds)	Amount Utilized (%)
Malheur	103	2.2	105.2	558	19%
Umatilla	37	3.9	40.9	169	24%
Wallowa-Whitman	72	4.8	76.8	216	36%

In the focal species assessment modeling for alternative B, grazing was held constant. Small areas with high risk could occur for any alternative, but, according to Countryman and Swanson (2008 [revised 2010]), the overall trend for rangeland has been positive within the Blue Mountains, suggesting that the current level of grazing would not be considered high risk. According to Wales et al. (2011) this risk factor was not weighted heavily in the model for the Cassin's finch, and, overall, the departure in the amount of source habitat from the historical amount led to the fairly low viability outcomes for all three of these species.

Besides the desired conditions, which are the same for all but alternative A, there are standards and guidelines that provide management direction for some of the habitat attributes represented by these species. For example, standards and guidelines for shrub utilization would range between 25 percent for alternative C and 45 percent for alternative B, with alternatives E and F falling in between. Alternative D, however, does not have a standard or guideline for shrub utilization.

Summary for Focal Species

For the 23 species modeled for the existing condition within the Umatilla and Wallowa-Whitman National Forests (see table 300 and table 301), and the 22 species modeled for the Malheur National Forest (see table 299; the peregrine falcon was not modeled), the lack of open late old structure, especially in ponderosa pine, and the lack of early successional stages were identified as habitats of concern. Both have also been identified in the literature as concerns.

The six species analyzed in detail had a high level of concern for at least one alternative for at least one national forest. Although it is anticipated that all species would remain viable for any of the alternatives, some alternatives show a higher likelihood for improved species viability than others. Table 314 is intended to display the relative ranking of each alternative in addressing the viability concerns of the representative focal species.

Table 314. Relative ranking of alternatives (1-6 with 1 being the best) for habitat improvement and risk reduction for focal species identified with high or moderate-to-high level of concern for viability for each national forest

National Forest	Species/Risks	Potential Vegetation Group	Habitat	Alternative A	B	C	D	E	F
MAL	White-headed woodpecker	Dry forest	Large/medium trees	3	5	6	1	2	4
	Western bluebird	All forested types	Open forest	4	5	6	1	2	3
	Fox sparrow	All forested types	Open forest	6	4	5	1	2	3
	Lewis's woodpecker	Dry forest	Post fire	3	2	1	6	5	4
	Lewis's woodpecker	Dry forest	Open forest	3	5	6	1	2	4
	Source habitat improvement			4	5	6	1	2	3
	Vegetation management	Cold forest	Snags	1	2	3	6	5	4
		Cool/moist forest		1	2	3	6	5	4
		Dry forest		2	3	4	1	6	5
	Open motor vehicle route management	All	Snags	5	4	1	6	2	3
	Salvage logging	Post fire	Snags	4	3	6	5	1	2
	Grazing occurrence	All	Herbaceous	2	2	1	3	2	2
	Grazing intensity	All	Herbaceous	5	4	1	3	2	2
	Risk reduction			2	3	1	6	5	4
UMA	boreal owl	Cold forest	Boreal forest	1	3	2	6	5	4
	Cassin's finch	All forested types	Large/medium trees	3	5	6	1	2	4
	White-headed woodpecker	Dry forest	Large/medium trees	3	5	6	1	2	4
	western bluebird	All forested types	Open forest	4	5	6	1	2	3
	Lewis's woodpecker	Dry forest	Post fire	3	2	1	6	5	4
	Lewis's woodpecker	Dry forest	Open forest	3	5	6	1	2	4
	Source habitat improvement			2	5	6	1	3	4
	Vegetation management	Cold forest	Snags	1	2	4	6	5	3
		Cool/moist forest		2	1	6	3	5	4
		Dry forest		2	3	4	1	6	5
	Open motor vehicle route management	All	Snags	5	4	1	6	2	3
	Salvage logging	Post fire	Snags	3	2	5	6	4	1
	Grazing occurrence	All	Herbaceous	2	2	1	3	2	2
	Grazing intensity	All	Herbaceous	5	4	1	3	2	2
	Risk reduction			3	1	4	6	5	2
WAW	Cassin's finch	All forested types	Large/medium trees	3	5	6	1	2	4
	White-headed woodpecker	Dry forest	Large/medium trees	4	5	6	1	2	3
	Western bluebird	All forested types	Open forest	4	5	6	1	2	3
	Lewis's woodpecker	Dry forest	Post fire	2	1	4	6	5	3
	Lewis's woodpecker	Dry forest	Open forest	3	5	6	1	2	4
	Source habitat improvement			3	5	6	1	2	4

National Forest	Species/Risks	Potential Vegetation Group	Habitat	Alternative					
				A	B	C	D	E	F
	Vegetation management	Cold forest	Snags	4	2	1	6	5	3
		Cool/moist forest		6	4	2	1	5	3
		Dry forest		6	3	2	1	5	4
	Open motor vehicle route management	All	Snags	5	4	1	6	2	3
	Salvage logging	Post fire	Snags	2	4	5	6	3	1
	Grazing occurrence	All	Herbaceous	2	2	1	3	2	2
	Grazing intensity	All	Herbaceous	5	4	1	3	2	2
	Risk reduction			6	3	1	4	5	2

The quantity of source habitat alone may be interpreted as the upper limit of the potential to support a species (Raphael et al. 2001), and therefore reduction in habitat would be the first attribute to elevate the viability concern. Other factors, such as quality and distribution of habitat, as well as other risk factors, need to be evaluated to refine the ability of source habitat to meet the biological needs of a species (*ibid*).

Three of the species are associated with either early successional or more open habitats. Both of these habitat distributions are generally below what would be expected on the landscape. Swanson et al. (2010) called it the forgotten stage of forest succession and it has been identified by some as important in the conservation of bird species (DeGraaf and Yamasaki 2003, Fontaine et al. 2009). Both of these habitats would be created at higher levels for alternatives D and E. These same three species are also all affected by grazing associated changes in vegetative structure. The threat from grazing would be greatest from alternative D based on more acres being available for grazing, while the threat from the level of vegetative structure alteration would be greatest from alternatives A and B. It is uncertain if there is a level of upland grazing that would still allow adequate vegetative structure for these three species. For example, Saab et al. (1995) reported that Cassin's finch responded negatively to heavy grazing and showed no response to moderate grazing. They also reported that the fox sparrow responded negatively to heavy and variable grazing. The studies used for both species referred to riparian habitats. Holechek et al. (1999) found confusion exists, even among range professionals, as to what heavy and moderate grazing intensity mean and that heavy grazing, as reported in the stocking studies they reviewed, averaged 57 percent utilization of primary forage species and that moderate averaged 43 percent. But when using the best explanation of these terms [as given by Klipple and Bement, 1961] moderate grazing in coniferous forest rangelands was between 35 and 45 percent of forage (*ibid*).

Large snags are important to several species. The analysis does not indicate that risks associated with any alternative would lead to a reduction in existing snag levels. Past management may have led to a reduction of snags and it will take time to replace them on the landscape, but the mechanism to do so for Forest Service management activities is in place for all alternatives. Alternative D would not have a standard or guideline regarding retention of large snags, but the same desired condition for snags across the landscape exists for all action alternatives. Open motor vehicle route density was also considered a threat to snag retention, mostly associated with the harvest of snags for firewood. Currently, there is a restriction on the removal of large-diameter snags for personal firewood use. However, it is recognized that large-diameter snags near open motor vehicle routes would continue to be vulnerable to illegal firewood removal, resulting in a loss of current snags and of future large-diameter logs. The loss of this habitat component would be most prevalent in areas with high open motor vehicle route densities. As indicated previously, this threat is not really reduced to the level used in the model for any alternative.

Management direction designed to achieve desired vegetative conditions in the forest plan is intended to result in long-term terrestrial wildlife source habitat conditions within the predicted HRV. The rationale for using HRV for this purpose is that biodiversity is assumed to persist, albeit with fluctuations in populations, through centuries or millennia of disturbance and recovery (Aplet and Keeton 1999). Even with the predictions of climate change, HRV presents the greatest potential to respond to expected change. Approximating historical conditions for source habitats provide a management strategy likely to sustain diverse focal species, even for those about which we know little (Hunter et al. 1988, Landres et al. 1999, Swanson et al. 1994). Similarly, because of limited understanding about ecosystems, approximating past conditions offers one of the best means for predicting and reducing impacts to current ecosystems (Kaufmann et al. 1994). Therefore, if the amount and structure of source habitats are within their HRV, associated wildlife species will have a greater likelihood of sustainability than if the amount and structure of source habitats remain outside their HRV (Raphael et al. 2001, Spies et al. 2006).

Based on the analysis, it appears unlikely that changes in threats are of sufficient magnitude to override the importance of source habitat in determining species viability. Although there is a reduction in source habitat for all alternatives for the boreal owl, it is still within the range of HRV after the first two decades, which is believed to be sufficient to maintain viable populations for all alternatives. For the other four species, white-headed woodpecker, Cassin’s finch, fox sparrow, and western bluebird, viable populations would be expected for all alternatives. Although a slight reduction in source habitat for some of these species occurs, especially for alternatives A and C, by the end of the fifth decade, the trend in source habitat is either stable or upward. There is a large degree of uncertainty however, especially for the three open habitat species, and therefore all action alternatives should require monitoring of both habitat and risk factors over time. Since the white-headed woodpecker is a management indicator species, monitoring is required for this species.

Focal Species Not Modeled

Approximately half of the species modeled for current viability outcomes were not modeled for alternative B, since it was determined that a reliable way to project and quantify future changes did not exist (Wales et al. 2011). For example, several species were associated with very limited habitat on National Forest System lands (e.g., northern harrier) or habitats that had little active management within them (ash-throated flycatcher). There also was a group of species that were not modeled for existing conditions. Although it was not possible to model viability, a qualitative analysis of forest plan components (desired conditions and standards and guidelines) for the alternatives indicated they would be sufficient to reduce threats and improve habitat for most of these species, thereby improving the likelihood of continued viability for all of the alternatives.

For example species associated with riparian areas would receive protection based on the desired conditions for aquatic habitat and watershed function (see appendix A 1.1 Watershed Function), which describe a desire for continued improvement in abundance and quality of riparian areas. Standard and guidelines also would provide protection (for a complete list see Wales et al. 2011):

- Timber harvest and thinning should occur in riparian management areas only as necessary to maintain, restore or enhance conditions that are needed to support aquatic and riparian dependent resources (guideline MA 4B RMA-FOR-1).

- Where management activities occur within riparian habitat, the quantity, stature, and health of shrubs should not be reduced or degraded (guideline WLD-HAB-25).

Within MA 4B Riparian Management Areas, grazing utilization would be expected to comply with guideline MA 4B RMA-RNG-2 G-115 (see appendix A table 55a).

Detailed analysis of all these species for alternative B is available in Wales et al. (2011). None of the species in this group that initially had viability concerns would be expected to have increased concern because of implementing alternative B (Wales et al. 2011). Since none of the other alternatives differ substantially from alternative B regarding risk to or loss of habitat for these species, they have not been analyzed further, with the exception of bighorn sheep. Bighorn sheep were analyzed due to the risk posed by potential disease transmission from domestic sheep.

Bighorn Sheep

Bighorn sheep (BHS) in Oregon and Washington are of two different subspecies: the California and Rocky Mountain bighorn. Historically, California bighorn sheep occurred in central and southeastern Oregon, the eastern slope of the Cascade Range in Washington, northwestern Nevada, and the mountains of southwestern Idaho. The Rocky Mountain bighorn sheep historically occurred in northeastern Oregon, central Idaho, Montana, Wyoming, and northeastern Nevada (Wisdom et al. 2000). The current range represents an increase in occupied habitat since the 1930s as a result of a combination of reintroductions and protection of remnant populations. However, much of the historical range is still unoccupied. These species are not well distributed within the planning area but were chosen as a focal species to represent grass/shrub environment.

Bighorn Sheep Source Habitat – Bighorn sheep prefer open areas on rocky slopes, ridges, rimrocks, cliffs, and canyon walls adjacent to meadows or grasslands (Verts and Carraway 1998). Alpine and subalpine vegetation are typically summer range for this species. Risenhoover et al. (1988) suggested that the three major components of bighorn sheep habitat are visibility, escape terrain (cliffs, talus areas), and abundant continuous forage. They were chosen as a focal species for grass and shrublands. Wisdom et al. (2000) placed both the Rocky Mountain and California bighorn sheep in family group 22, which are residents of high elevation alpine and subalpine communities.

Source habitats are primarily alpine, subalpine, upland shrubland, and upland herbland community groups as described by Wisdom et al. (2000). They projected a downward change of 47 percent that would result from a decline in big sagebrush, mountain sagebrush, fescue-bunchgrass, interior ponderosa pine, native forbs, western larch, wheatgrass bunchgrass, whitebark pine-alpine larch, and whitebark pine. Wisdom et al. (2000) acknowledged that those trends in source habitats for bighorn sheep were derived without reference to the proximity of cliffs and talus and may not accurately represent changes in the more restricted subset of stands available to bighorn sheep. More recently the Forest Service developed a model for the Payette National Forest using escape terrain defined by Sappington et al. (2007) and combined with a horizontal visibility component (USDA Forest Service 2010) to define source habitat. This analysis utilizes a very similar model (details are available from the project record), with the exception of the vegetation data used. The Blue Mountains forest plan revision analysis utilized existing vegetation polygon and current vegetation survey stake point summaries (Countryman 2009). Only summer source habitat was modeled.

Source habitat by itself does not provide a meaningful metric for evaluating bighorn sheep viability. The distribution and abundance of bighorn sheep have been significantly reduced from pre Euro-American settlement conditions. Because disease epizootics are an integral factor in bighorn sheep persistence, analysis of bighorn sheep habitat needs to incorporate those factors that contribute to the potential risk of disease transmission. This was accomplished by addressing such things as the availability and connectivity of suitable bighorn sheep habitats, bighorn sheep behavior and movement patterns, proximity of bighorn sheep to domestic sheep, and the likelihood of contact between the species.

Bighorn Sheep Attraction and Disease Transmission – Bighorn sheep are attracted to domestic sheep and goats (Onderka et al. 1988, Schommer and Woolever 2001), and, although the mechanisms of respiratory disease in bighorn sheep are not well understood, the evidence that contact between domestic sheep and bighorn sheep leads to respiratory disease and die-offs in bighorn sheep is overwhelming (Clifford et al. 2009, Foreyt et al. 1994, Silflow et al. 1993). More than 327 bighorn sheep in a 30 square mile area in Hells Canyon died when exposed to *Pasteurella multocida* and *Mannheimia haemolytic*a that was most likely carried by a feral goat (Cassirer et al. 1998, Onderka et al. 1988, Schommer and Woolever 2001). Both *P. multocida* and *M. haemolytica* were isolated from this feral goat and a bighorn sheep found in close proximity to where the Hells Canyon (1995 and 1996) bighorn sheep pneumonia epizootic began (Cassirer et al. 1998, Dassanayake et al. 2008, Weiser et al. 2003). Several authors (Dassanayake et al. 2008, Silflow et al. 1993, Srikumaran et al. 2008, Weiser et al. 2003) have demonstrated that bighorn sheep are highly susceptible to *P. multocida* and *M. haemolytica* strains found in domestic sheep and goats.

As a result of die-offs and suppressed reproduction during the last century, the genetic diversity in bighorn sheep herds has been lost (Schommer and Woolever 2001). At the present time there are no vaccines to protect bighorn sheep from developing pneumonia (Clifford et al. 2009, Schommer and Woolever 2001, Srikumaran et al. 2007, Weiser et al. 2003). The only way to prevent a pneumonia outbreak in bighorn sheep herds is to keep bighorn sheep separated spatially from domestic sheep and goats (Clifford et al. 2009, Dassanayake et al. 2008, Onderka et al. 1988, Schommer and Woolever 2001).

Effects from Each Alternative to Bighorn Sheep – The separation, either spatially, temporally, or both, of bighorn sheep from domestic sheep has been recommended by leading bighorn sheep disease experts (Garde 2005, Schommer and Woolever 2001, Singer 2001). The Western Association of Fish and Wildlife Agencies defines effective separation as spatial and/or temporal separation between wild sheep and domestic sheep or goats resulting in, at most, minimal risk of potential association and subsequent transmission of respiratory disease between animal groups (WAFWA 2010). It is recommended that site-specific solutions for each bighorn sheep population and domestic sheep allotment be developed based on a management strategy appropriate for the complexity of the situation (Schommer and Woolever 2001). Each of the alternatives would take this approach; however, given the complexity of the issue in the Blue Mountains, each alternative would have pros and cons for minimizing the risk of contact between domestic and bighorn sheep.

Alternatives were evaluated on their merits for providing separation and minimizing likelihood of contact between domestic sheep and the 16 bighorn sheep populations within and adjacent to the Blue Mountains national forests (see table 315). Telemetry data was used for the Payette National Forest analysis for herds in Hells Canyon National Recreation Area (HCNRA) to develop Core Herd Home Ranges (CHHR), which are used in this analysis. For those herds outside of the HCNRA, herd home ranges identified by ODFW were used for analysis. Core home range is used in the remainder of the document to refer to either bighorn sheep home range.

Table 315. Crosswalk of bighorn sheep herd names from state agencies and the Payette National Forest analysis within the Blue Mountains forest plan revision analysis effort[1]

Bighorn sheep subspecies	Herd Name	State	Payette National Forest	National Forest
California	Aldrich Mountain	Oregon	NA	MAL
	Potamus Creek	Oregon	NA	UMA
	Burnt River	Oregon	NA	WAW
Rocky Mountain	Lostine	Oregon	Lostine	WAW
	Lower Imnaha	Oregon	Imnaha	WAW
	Bear/Minam	Oregon	Not modeled	WAW
	Wenaha	Oregon	Wenaha	UMA
	Upper Joseph Canyon	Oregon	Black Butte/Red Bird	WAW
	Upper Hells Canyon	Oregon	Upper Hells Canyon[2]	WAW
	Lower Hells Canyon	Oregon	Big Canyon/Muir/Myers	WAW
	Sheep Mountain	Oregon	Sheep Mountain	WAW
	Mountain View	Oregon	Mountain View	UMA
	Asotin	Washington	Asotin	UMA
	Tucanon	Washington	Not modeled	UMA
	Black Butte	Washington	Black Butte/Red Bird	WAW
	Red Bird	Idaho	Red Bird	WAW

1. The Canyon Creek herd identified in the Oregon bighorn sheep management plan is not addressed here based on correspondence that indicated this herd is no longer being monitored, managed, or recognized by ODFW and there are no plans to attempt to reestablish it (Raaf 2011 (11 March).
2. Referred to as McGraw herd initially in the Payette National Forest analysis.

Bighorn Sheep Source Habitat Analysis – Those alternatives that would provide the most summer source habitat in areas identified as unsuitable for domestic sheep grazing and the fewest acres of rangelands considered suited for domestic sheep grazing are considered the best options for bighorn sheep population persistence (see table 316). The Wallowa-Whitman and the Umatilla National Forests would have a large portion of habitat in areas identified as unsuitable for domestic sheep grazing for all alternatives. Although the table displays acres of rangelands suitable for domestic sheep grazing, not all of those acres are currently being or would be grazed by domestic sheep. Many of the acres that could be grazed by domestic sheep are currently in cattle allotments, and, although technically they could be grazed by sheep, it would require a change in the type of livestock permitted on the allotment.

Other considerations for managing to protect summer source habitats for bighorn sheep include the potential for overlap between core home ranges and domestic sheep allotments and distances between core home ranges and domestic sheep allotments. It is assumed that any overlap between bighorn sheep core home ranges and domestic sheep allotments will result in a disease transmission between the species. Only alternative A would have a small sliver of domestic sheep allotment that would overlap with currently occupied bighorn source habitat based on the CHHRs developed for the Hells Canyon herds or the herd home ranges identified by ODFW for the more southern bighorn sheep herds (see figure 33 on page 240).

Table 316. Relative ranking of alternatives by national forest based on proportion of bighorn sheep summer source habitats not available for domestic sheep grazing (protected) and rangelands remaining suited for domestic sheep grazing

National Forest	Alternative	Summer Source Habitat Protected		Rangeland Suitable for Domestic Sheep Grazing		Relative ranking for providing separation between domestic and bighorn sheep
		(percent)	(acres)	(percent)	(acres)	
MAL	A	0	0	100	1,451,000	3
	B	45	21,200	73	1,060,000	2
	C	93	44,900	24	348,000	1
	D	45	21,200	73	1,060,000	2
	E	45	21,200	73	1,060,000	2
	F	45	21,200	73	1,060,000	2
UMA	A	0	0	100	578,000	5
	B	70	158,400	35	205,000	2
	C	82	185,000	12	69,000	1
	D	68	154,500	38	222,000	4
	E	68	154,500	35	205,000	3
	F	68	154,500	35	205,000	3
WAW	A	0	0	100	754,000	5
	B	85	263,600	51	382,000	2
	C	91	282,200	35	266,000	1
	D	85	262,600	51	385,000	4
	E	85	262,600	51	382,000	3
	F	85	262,600	51	382,000	3

Distances from bighorn sheep core habitats to domestic sheep allotments were also evaluated, with the assumption being that the greater the distance between the species, the greater the probability for persistence of bighorn sheep herds. Table 317 displays distances between bighorn sheep core home ranges and domestic sheep allotments. Alternative C would provide the greatest separation between core home ranges and domestic sheep allotments, followed by alternative B, with alternatives A, D, E, and F providing the least amount of separation.

Bighorn Sheep Contact Model – Bighorn sheep, especially rams, make occasional long-distance movements beyond their core herd home range. On Bureau of Land Management (BLM) administered lands in Idaho, bighorn sheep were documented to have traveled nearly 50 miles, including through towns and across major rivers (Coggins 2002). Telemetry data has shown that desert bighorn sheep regularly cross the broad valleys that separate the majority of desert mountain ranges (Krausman et al. 1996, Schwartz et al. 1986). Singer et al. (2001) called this movement forays and defined them as any short-term movement of an animal away from and back to its herd’s core home range. Such behavior can put bighorn sheep at risk of contact with domestic sheep, even when domestic sheep use is outside of core herd home range areas. This is especially true where suitable habitats are well-connected and these connections overlap with domestic sheep use areas (Gross et al. 2000, Singer et al. 2000). The risk of contact between dispersing bighorn sheep and domestic sheep is related to the number of bighorn sheep in a herd, the proximity of domestic sheep use areas (allotments) to a bighorn sheep core herd home range, the distribution of bighorn sheep source habitats across the landscape, and the frequency and distance of bighorn sheep forays outside of the core herd home range. It is important to remember the following analysis does not capture the risk associated with wandering domestic sheep or goats.

Table 317. Distance in kilometers from bighorn sheep core herd home ranges to the nearest active domestic sheep allotment

Herd Name	State Herd Name	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F
Aldrich Mountain[1]	Aldrich Mountain	43	43	46	43	43	43
Potamus Creek[1]	Potamus Creek	30	30	35	30	30	30
Burnt River[1]	Burnt River	48	48	82	48	48	48
Lostine	Lostine	24	48	48	24	24	24
Imnaha	Lower Imnaha	30	93	97	30	30	30
Bear/Minam[1]	Bear/Minam	22	39	40	22	22	22
Wenaha	Wenaha	11	28	39	11	11	11
Black Butte	Upper Joseph Canyon Black Butte	12	68	72	12	12	12
Red Bird	Upper Joseph Canyon Black Butte Red Bird	31	91	98	31	31	31
Upper Hells Canyon	Upper Hells Canyon	54	99	99	54	54	54
Big Canyon	Lower Hells Canyon	54	118	121	54	54	54
Muir	Lower Hells Canyon	33	107	107	33	33	33
Myers	Lower Hells Canyon	51	117	120	51	51	51
Sheep Mountain	Sheep Mountain	88	115	115	88	88	88
Mountain View	Mountain View	18	46	57	18	18	18
Asotin	Asotin	43	71	83	43	43	43
Tucanon1	Tucanon	44	70	82	44	44	44

1. Core herd home range is based on information provided by states regarding home range.

Alternatives were ranked based on the frequency of interspecies contact as modeled using the core home range and foray analyses. The foray distances and probabilities are based on analysis of more than 50,000 telemetry points associated with bighorn sheep herds from Hells Canyon. This basically utilized the probability of a bighorn ram making a foray, the probability of a ram moving a certain distance from the core home range (in one kilometer rings), and then the probability of an animal that has made a foray and reached a ring that intersects an allotment. Table 318 on page 241 displays relative ranking of alternatives based on the number of contacts per year. It is assumed that the greater the likelihood of contact, the greater the potential for disease transmission and resulting disease outbreaks. Alternative C is the only alternative that would reduce interspecies contact to a level of almost zero.

The analysis demonstrates low yearly contact rates when interaction with all of the various herds is considered for all alternatives. Table 318 displays that there is relatively no risk to the California bighorn herds (Aldrich, Potamus, and Burnt River) that are adjacent to the national forest for all alternatives. Because much of the potential contact on National Forest System lands was dealt with in the establishment of the Hells Canyon National Recreation Area, there are some herds where there is no anticipated contact with domestic sheep. Some level of contact would be expected for the Wenaha bighorn sheep population for all alternatives except alternative C; however, it would be considered an extremely low contact rate.

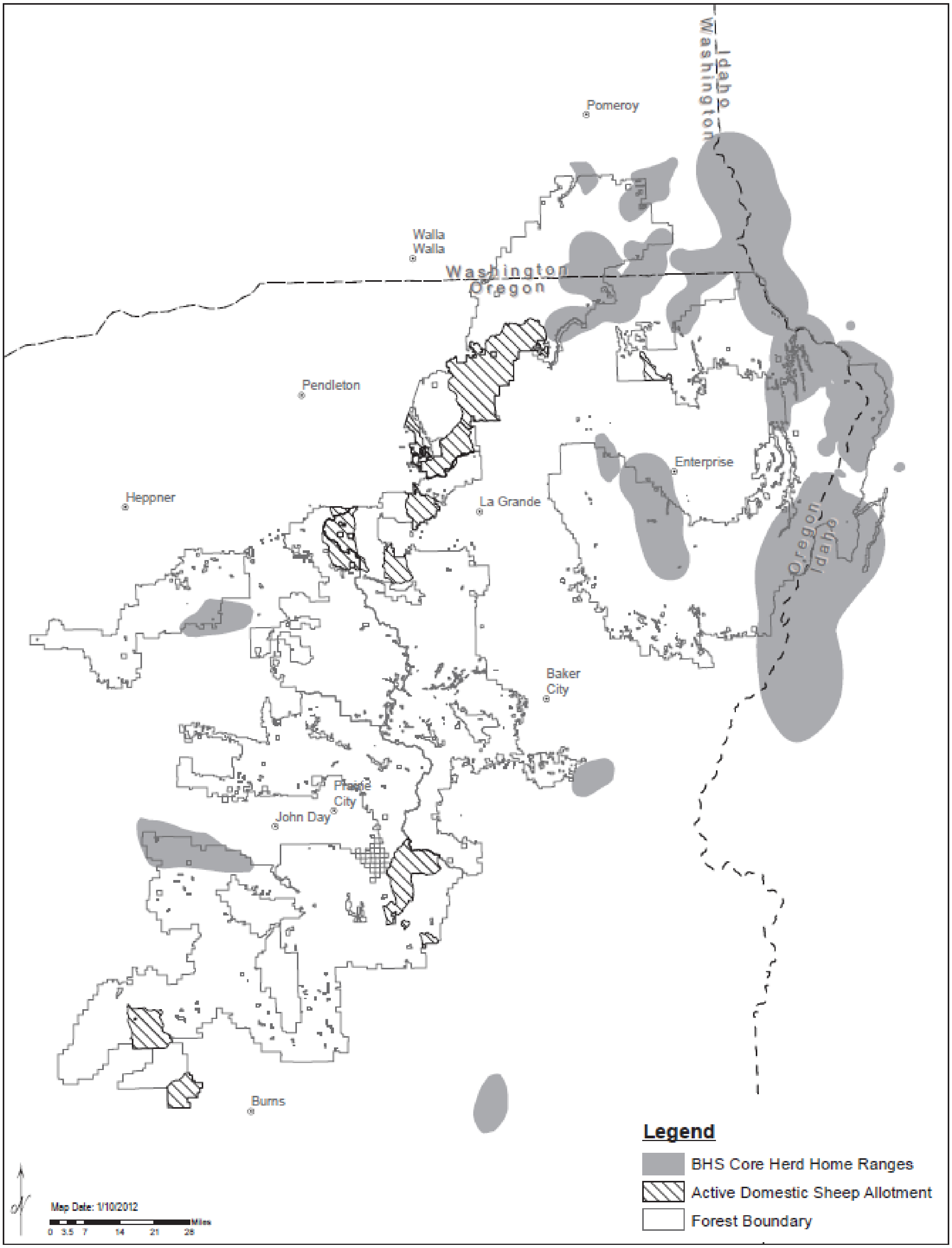

Figure 33. Bighorn sheep core herd home ranges for northeastern Oregon and southeastern Washington

Table 318. Annual contacts by herd and alternative based on modeled contact between bighorn sheep and domestic sheep allotments and relative ranking of alternatives

Herd Name	State Herd Name	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F
Aldrich Mountain	Aldrich Mountain	0	0	0	0	0	0
Potamus Creek	Potamus Creek	0*	0*	0	0*	0*	0*
Burnt River	Burnt River	0	0	0	0	0	0
Lostine	Lostine	0.0009	0	0	0.0009	0.0009	0.0009
Imnaha	Lower Imnaha	01	0	0	01	0	0
Bear/Minam	Bear/Minam	0.0009	0	0	0.0009	0.0009	0.0009
Wenaha	Wenaha	0.0331	0.0007	0	0.0094	0.0094	0.0094
Black Butte	Upper Joseph Canyon Black Butte	0.007	0	0	0.007	.007	0.007
Red Bird	Upper Joseph Canyon Black Butte Red Bird	0.0001	0	0	0.0001	0.0001	0.0001
Upper Hells Canyon	Upper Hells Canyon	0	0	0	0	0	0
Big Canyon	Lower Hells Canyon	0	0	0	0	0	0
Muir	Lower Hells Canyon	0*	0	0	0*	0*	0*
Myers	Lower Hells Canyon	0	0	0	0	0	0
Sheep Mountain	Sheep Mountain	0	0	0	0	0	0
Mountain View	Mountain View	0.0035	0	0	0.0017	0.0017	0.0017
Asotin	Asotin	0	0	0	0	0	0
Tucanon	Tucanon	0	0	0	0	0	0
Contacts per Year		0.0456	0.0007	0	0.0201	0.0201	0.0201
Relative ranking of alternatives for minimizing contact		4	2	1	3	3	3

* A slight risk of contact exists for these herds but it is so small as to be almost zero.

Alternative C would provide the greatest protection to bighorn sheep habitats, the greatest amount of physical separation, and the least likelihood of contact, which would result in the greatest likelihood of persistence for all bighorn sheep populations. Alternative B would have an extremely low contact rate and would provide a high degree of physical separation that would result in a very high likelihood that bighorn sheep would continue to persist. Alternatives D, E, and F would pose the greatest risk of contact to the Wenaha herd (0.0094 contacts/year), but even this contact rate would be considered extremely low.

The contact rates presented in table 318 are much lower than the lowest rate achieved for the Payette National Forest (USDA Forest Service 2010). Their lowest contact rate of 0.08 resulted in one contact every 11 years, and, even assuming a high probability that contact would result in a disease outbreak, it still resulted in a low likelihood of herd extirpation (USDA Forest Service 2010). The annual contact rate of 0.0201 for alternatives D, E, and F would be equivalent to approximately one contact every 48 years between domestic sheep and a member of one of the 16 bighorn sheep herds. On an individual herd basis, the contact risk for the Wenaha herd for example would be approximately one contact every 100 years. These contact rates combined with the standards and guidelines for all alternatives that would help maintain separation of bighorn sheep and domestic sheep indicate a high probability that bighorn herds would persist within the planning area for all alternatives. It should be kept in mind however, that as modeling completed by Clifford et al. (2009) demonstrated, even a minimal level of contact can have severe persistence implications for bighorn sheep populations. For one Sierra Nevada bighorn sheep population that they modeled, an estimated two percent annual risk of contact would result in a 50 percent probability of a catastrophic respiratory outbreak that would result in at least 40 percent mortality.

Compatibility with the Hells Canyon National Recreation Area Act – Several bighorn sheep herds utilize HCNRA and move freely back and forth to other National Forest System and BLM lands. Starting in 1994, a sample of bighorn sheep in the HCNRA were fitted with telemetry radio collars and monitored bi-weekly. Utilizing this information, the Payette National Forest completed a core herd home range analysis for each of the 16 herd populations. This analysis demonstrated the inter-connectivity between the herd units and the extent at which bighorn sheep currently move across the landscape. In consideration of the above information, the following determinations have been made regarding compatibility with the HCNRA Act and the HCNRA Comprehensive Management Plan (CMP) for the action alternatives analyzed.

None of the alternatives currently graze domestic sheep within 19 miles of the HCNRA and with the exception of alternative D, the action alternatives do not have domestic sheep grazing within 50 miles of the HCNRA. All alternatives therefore comply with the HCNR CMP by maintaining a separation between bighorn and domestic sheep that is likely to keep the two species apart at the current population levels.

Threatened, Endangered, Proposed, Candidate, and Sensitive Wildlife Species

Projects implemented under the forest plan collect more site-specific resource information for the project area. Biological evaluations and assessments that provide detailed analysis of potential effects from each project are required for threatened, endangered, proposed, and candidate species and those included on the Regional Forester's Sensitive Species List (collectively TEPCS). Historical conditions, current conditions and desired conditions are analyzed at a finer scale of resolution to better predict project outcomes. A determination of effects for TEPCS species would have to be made for any future project under the direction of the forest plan.

As indicated in the Focal Species section, a basic assumption is that the focal species represent ecological conditions that provide for viability of other species in the group and that focal species represent the species group (see table 298) such that, by providing for adequate amounts and distribution of habitat and managing risks for focal species, the ecological conditions needed to maintain viability of other associated species would be provided (USDA Forest Service 2010). Some TEPCS species were analyzed in detail as focal species in the viability assessment for alternative B (Wales et al. 2011). Although some of these focal species had low viability scores, there was no indication that implementing any of the alternatives would threaten the viability of any of those species to the extent that would cause a trend towards Federal listing.

What follows is a description of the broad potential effects at the national forest level for species currently listed in compliance with the Endangered Species Act or the Regional Forester's Sensitive Species List within the planning area. In some cases, standards and guidelines have been included to improve safeguards for certain habitat features of some species. All alternatives assume that direction given in FSM 2670 and FSH 2609 will be followed (e.g., FSH 2670.21 Threatened and Endangered Species 1. Manage National Forest System habitats and activities for threatened and endangered species to achieve recovery objectives so that special protection measures provided by the Endangered Species Act are no longer necessary. Or FSH 2670.22 Sensitive Species 1. Develop and implement management practices to ensure that species do not become threatened or endangered because of Forest Service actions.).

Canada Lynx

The Canada lynx was listed as a threatened species in March 2000 (USFWS 2000). Critical habitat was designated in November 2006, and then was revised in 2009 (USFWS 2009). A recovery plan has not been published; although a Recovery Outline (USDI 2005) was released in September of 2005 (Recovery Outlines carry no regulatory authority). This outline identified northeast Oregon/southeast Washington as peripheral areas defined as areas that contain few verified historical or recent records of lynx. Records are sporadic and usually associated with periods when there were unprecedented cyclic population highs in Canada, such as the early to mid-1960s and/or 1970s. There is no evidence of long-term presence or reproduction that might indicate colonization or sustained use of these areas by lynx. However, some of these peripheral areas may provide habitat enabling the successful dispersal of lynx between populations or subpopulations. At this time, we simply do not have enough information to clearly define the relative importance of secondary or peripheral areas to the persistence of lynx in the contiguous United States (USDI 2005).

Due to a lack of data, the historical and current status of resident lynx populations in the Blue Mountains is uncertain. Only nine museum specimens exist for Oregon- all from 1897-1927 (McKelvery et al. 2000). Although the USFWS Web site[7] indicates that there are "at least 247 bounty records of lynx from 12 counties in the state," ODFW indicated that the lynx is very rare and is known from only 17 verified specimens recorded between 1897 and 1993 and that ODFW records, maintained since 1922, show that four of these individuals were taken during trapping. Only three specimens are recorded for southeastern Washington; one from the Blue Mountains (1931) and two from arid grasslands in 1962 and 1963 (McKelvery et al. 2000). These most current specimens in the Blue Mountains were found in anomalous habitats within several years of peak lynx populations in western Canada (*ibid*)

In May 2005, the Forest Service and the USFWS revised the Canada Lynx Conservation Agreement (CA) that was initially established in 2000. The revised agreement included a commitment that both agencies would jointly refine the criteria for classifying Canada lynx occupied habitat. As a result of that commitment, the revised agreement was amended in May 2006 (USDA Forest Service 2006) to include a definition of occupied Canada lynx habitat. Table 1 of the amendment lists national forests as occupied or unoccupied by Canada lynx and the Blue Mountains national forests are listed as unoccupied based on the completion to protocol of the National Lynx Survey. The CA further states that the Forest Service agrees that forest plans in states where lynx are listed should include guidance to conserve lynx for those portions of administrative units identified as occupied lynx habitat. Direction included in an August 2006 memorandum (USFWS 2006) indicated that "…the lynx should not appear on species lists for proposed Federal actions on national forests determined to be unoccupied by lynx. Compliance with section 7 (a)(2) of the Endangered Species Act is not required for the lynx under this circumstance."

Effects from Each Alternative on Canada Lynx

Canada lynx were identified as a focal species representing boreal forests (USDA Forest Service 2010), but because of their rarity in the Blue Mountains were not used in that capacity for the plan revision effort. According to Witmer et al. (1998), the two issues identified for lynx in the Columbia Basin, were 1) conservation of appropriate mosaics of seral stages in boreal forest habitat, and 2) harvest and human disturbance.

[7] http://www.fws.gov/oregonfwo/Species/Data/CanadaLynx

Habitat

Lynx require early seral stage boreal forest habitats for foraging and relatively small patches of late-successional forest to provide for denning opportunities. Analysis for the two focal species for the cold forest (see table 298) resulted in decreasing the level of concern (boreal owl) or maintaining a low level of concern (water vole) regarding their viability (see table 299 through table 301). This would indicate that at the broad scale, habitat for the lynx is being maintained or moved towards HRV. This is also supported by the vegetation analysis (see figure 16 in the "Forested Vegetation, Timber Resource, and Wildland Fire" section) which indicates that the early seral stage is close to the low range of HRV and that the late successional stage of cold forest is above HRV for multi-storied stands. This coupled with the fact that there is little active timber harvest anticipated in the cold forest for any alternative (see table 341), should result in the maintenance of lynx habitat throughout the life of the plan.

Risks

Witmer et al. (1998) indicated that road density in lynx habitat should be 1 mile per square mile. Where lynx are legally protected, an increase in roads through lynx habitat increases human access and human lynx encounters, as lynx also use roads for hunting and travel (Koehler and Aubry 1994). Increased road density leads to increased poaching, road kills, and incidental mortality of lynx while increased snowmobile use may allow access by other, competing predators (McKelvery et al. 2000).

Currently more than half of the cold forest in the Blue Mountains is in areas that are roadless. Wales et al. (2011) estimated that 24 percent of the cold forest within the Malheur National Forest has less than 1 mile per square mile of open motor vehicle routes, whereas the Umatilla and Wallowa-Whitman National Forests would have 52 and 74 percent of the cold forest respectively with route density below 1 mile per square mile. As displayed in figure 35, alternatives vary in the risk of human interaction associated with open motor vehicle routes by forest. When compared to alternative B, alternatives C, E, and F would reduce the risk of encounters, whereas D would increase the risk. The Blue Mountains are considered unoccupied by resident lynx (USDA Forest Service 2006) and a change in suitable habitat on the fringe of lynx range would not be expected to have any impact on the lynx population, therefore implementing any of the alternatives would have no effect on the Canada lynx.

Gray Wolf

Second only to humans in adapting to climate extremes, gray wolves once ranged from coast to coast and from Alaska to Mexico in North America. Records indicate all wolves were eliminated from the Blue Mountains in the early 1900s after Euro-American settlement. In January 1995, wolves from Canada were transplanted to the Salmon River drainage in central Idaho. In the winter of 1998-99, a collared wolf from this population (B-45-F) moved into northeast Oregon, eventually being captured by the United States Fish and Wildlife Service in March 1999 near the Middle Fork of the John Day River and returned to Idaho (ODFW 2005 (updated 2010)). Another collared wolf, from the White Cloud pack in Idaho, was killed on the freeway just south of Baker City, Oregon in May 2000 (*ibid*). Wolves have successfully colonized portions of Idaho and more recently have become established in northeast Oregon, confirming that suitable wolf habitat exists in the Blue Mountains. ODFW is currently monitoring three wolf packs: the Imnaha, Wenaha, and Walla Walla. The Walla Walla pack is new and wildlife managers are still trying to determine their range, which could be primarily in Washington state.[8] Currently there are no known packs within the Malheur National Forest.

On April 2, 2009, the USFWS published a final rule establishing a Distinct Population Segment (DPS) of the gray wolf in the Northern Rocky Mountains. Gray wolves within the Northern Rocky Mountains DPS boundaries, except in Wyoming, were removed from the list of endangered and threatened wildlife (USFWS 2009a). The final rule became effective on May 4, 2009 but was vacated in 2010 by U.S. Federal District Court in Missoula, Montana (Defenders of Wildlife et al. v. Salazar, CV 09-77-M-DWM and Greater Yellowstone Coalition v. Salazar, CV 09-82-M-DWM). In 2011, the Department of Defense and Full-Year Appropriations Act carried a rider directing the U.S. Fish and Wildlife Service to reissue the 2009 rule that recognized the Northern Rocky Mountains DPS (USFWS 2011) as well as its 2009 status. The DPS includes that portion of Washington east of Highway 97 and Highway 17 north of Mesa and that portion of Washington east of Highway 395 south of Mesa. It includes that portion of Oregon east of Highway 395 and Highway 78 north of Burns Junction and that portion of Oregon east of Highway 95 south of Burns Junction. This has resulted in a rather unusual situation where wolves are no longer endangered in that area, but in surrounding areas that don't currently have wolves, Endangered Species Act protections are still in place. To address this situation, the U.S. Fish and Wildlife Service is initiating an assessment of the biological and conservation status of wolves in the Pacific Northwest to determine their appropriate listing classification, and when completed, they will evaluate a potential Pacific Northwest DPS in accordance with the agency's existing DPS policy and will reclassify this area through an additional rulemaking process.[9]

Currently gray wolves are considered as endangered west of highway 395 in the Blue Mountains and east of 395 they are included on the Regional Forester's Sensitive Species List (see figure 34) and managed under the wolf management plan for Oregon (ODFW 2005 [updated 2010]). For the Malheur National Forest, the wolf would be considered federally listed on 43 percent of National Forest System lands. For the Umatilla National Forest, the wolf would be considered federally listed on only 20 percent of National Forest System lands. The wolf would be included on the Regional Forester's Sensitive Species List throughout the Wallowa-Whitman National Forest.

Based on the Northern Rocky Mountains Wolf Recovery Plan (USDI 1987), three key wolf habitat components are necessary: 1) year-round prey base of ungulates and alternative prey, 2) secluded denning and rendezvous sites, and 3) open spaces with minimal exposure to humans. Wisdom et al. (2000) suggested four major challenges to wolf conservation within the Interior Columbia Basin: excessive mortality from humans, mortality related to roads, displacement from habitat by human activities, and population isolation. The Oregon wolf management plan recognized that "human tolerance has been and remains the primary limiting factor for wolf survival."

[8] ODFW Web site: Current status of wolves in Oregon (June 6, 2011) http://www.dfw.state.or.us/Wolves/index.asp
[9] http://www.fws.gov/oregonfwo/Species/Data/GrayWolf/default.asp

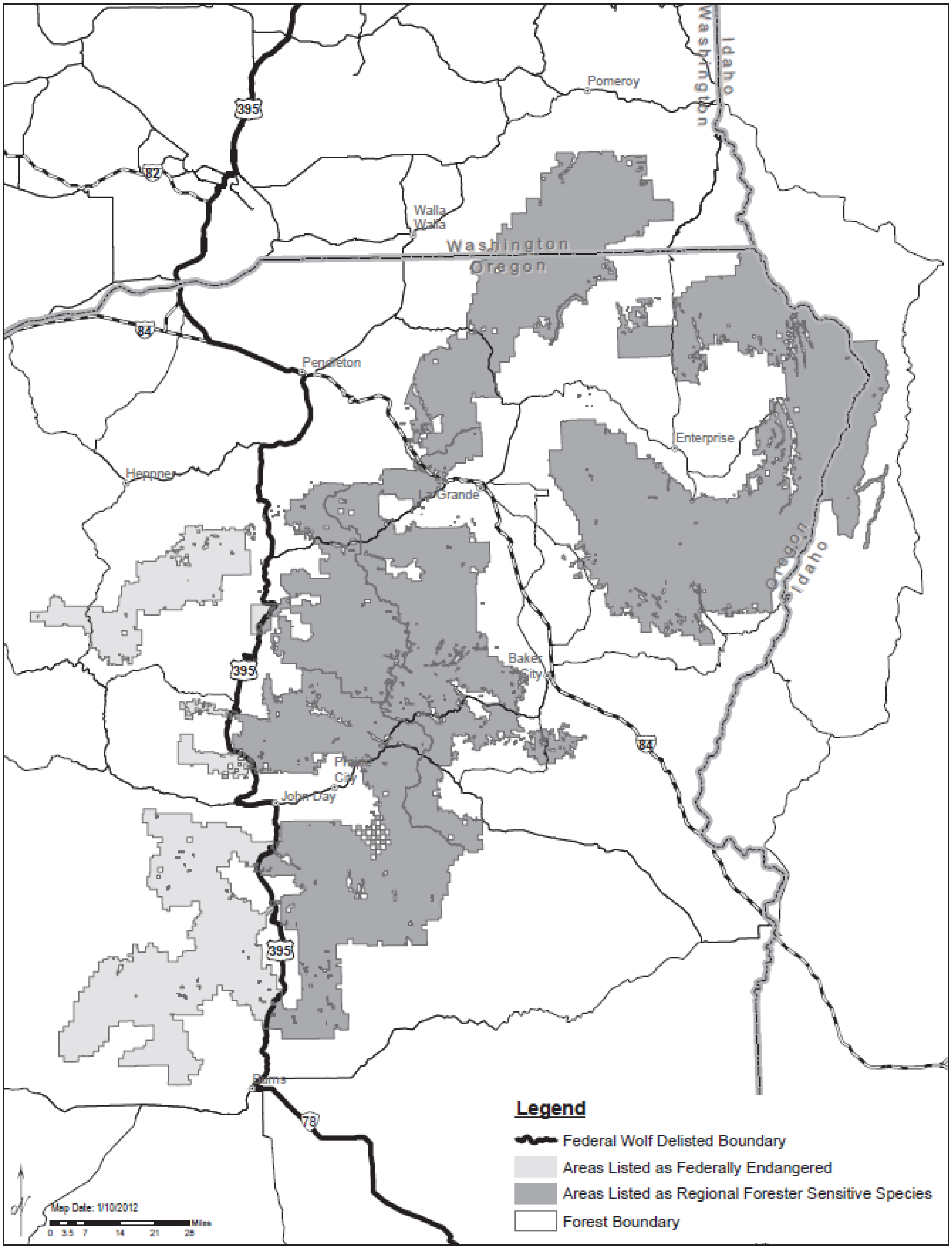

Figure 34. Status of the gray wolf in reference to the national forests within the Blue Mountains

Effects from Each Alternative on Gray Wolf

Humans have changed the landscape to great extent during the past 150 years. Wolves are habitat generalists and theoretically a wide range of Oregon ecosystems are capable of supporting wolves. Nevertheless, it is difficult to predict specific areas wolves will occupy and also difficult to predict where they will persist. The ability to persist will be determined largely by the degree of human tolerance for the species across the state's vast rural landscapes (ODFW 2005 [updated 2010]).

Because wolves are habitat generalists that hunt and den in a wide variety of vegetation types, the alternatives would have little effect on the amount and distribution of habitat used by wolves or their prey species (USFWS 2003). Gray wolf populations are primarily limited by nonhabitat factors, such as direct interaction with humans that cause mortality (Bangs et al. 1998) and to a lesser degree denning disturbance (ODFW 2005 [updated 2010]). In some areas, wolves are capable of occupying habitats with few conflicts that might be considered marginal based on human population densities and land management practices. However, most of the known wolf mortality that has occurred within the DPS has been in response to livestock depredations. Wolves that have a history of livestock depredations are lethally controlled by agents of USDA-APHIS Wildlife Services. Most of the depredation problems in Oregon have been within the Wallowa-Whitman National Forest.

Wolves are most vulnerable to disturbance while denning and rearing pups. Wolf interaction with humans is perhaps most influenced by human accessibility to remote habitats. Two measures have been used to assess disturbance impacts on wolves; miles of desired open motor vehicle routes and acres of management areas with limited motor vehicle access.

Exposure to humans varies for all alternatives due to desired conditions for density of open motor vehicle routes as well as the expanse of the various management areas. For example, although alternative C would have the same desired condition for density of open motor vehicle routes in MA 4A as alternatives B, E, and F, it would have less than half the acres in MA 4A. Figure 35 displays the difference in risk based on the composite of route density and acres in general forest (MA 4A) compared to the proposed action, because a single composite for the existing condition could not be generated.

Additional open motor vehicle routes would likely be obliterated or closed depending on protection and restoration needs and funding available from other resources, such as soil, water, fish and wildlife. The reduction in open motor vehicle routes would have the indirect effect of reducing the likelihood of adverse human interaction with wolves in the form of shooting, harassment, vehicle collisions, and other forms of threats. Open motor vehicle route reduction would likely continue over the long term in gradually diminishing amounts until the national forests have transportation systems that achieve a more desirable balance between access needs, resource impacts, and effective open motor vehicle route maintenance capability.

Another measure of solitude provided wolves would be acres of limited motor vehicle use and/or areas considered roadless or nonmotorized. Areas without open motor vehicle routes are generally represented by management allocations, such as MA 1A Congressionally Designated Wilderness Areas, MA 1B Preliminary Administratively Recommended Wilderness Areas, MA 2B Research Natural Areas and MA 3A Backcountry (nonmotorized use). These management areas are generally seen as providing secure areas for wildlife. Allocations to these management areas will vary between alternatives as displayed in figure 36. In comparison to the no-action alternative (A), all alternatives would have more acres allocated to management areas with the least amount of human disturbance. Of the action alternatives, alternative C would have the most acres allocated to such management areas followed by alternatives E, F, and B. Alternative D would have the least.

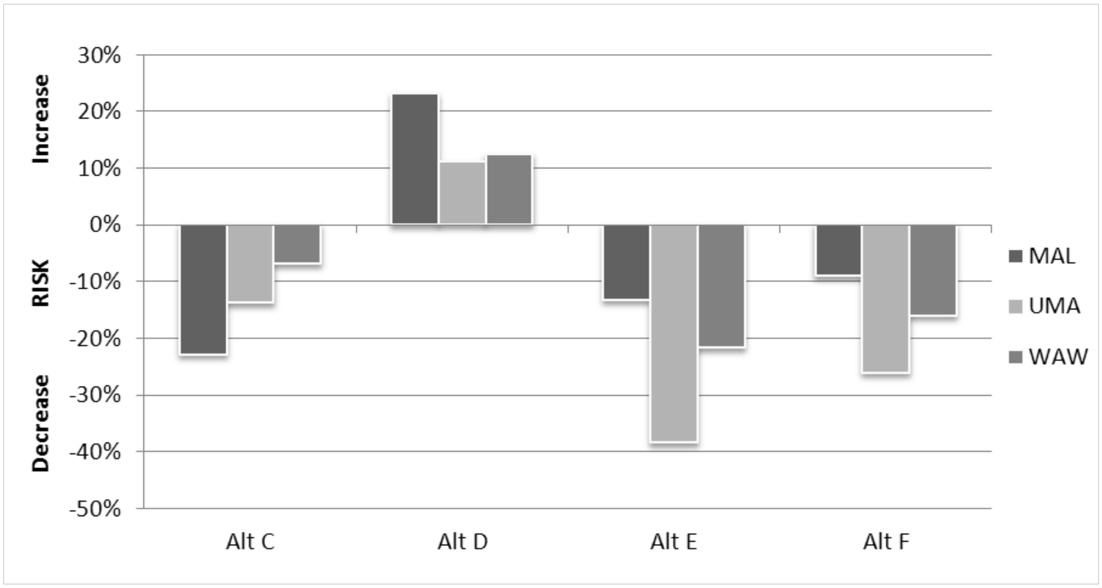

Figure 35. The change in risk of human interaction with the gray wolf for action alternatives in comparison to the proposed action based on desired open motor vehicle route density for each national forest

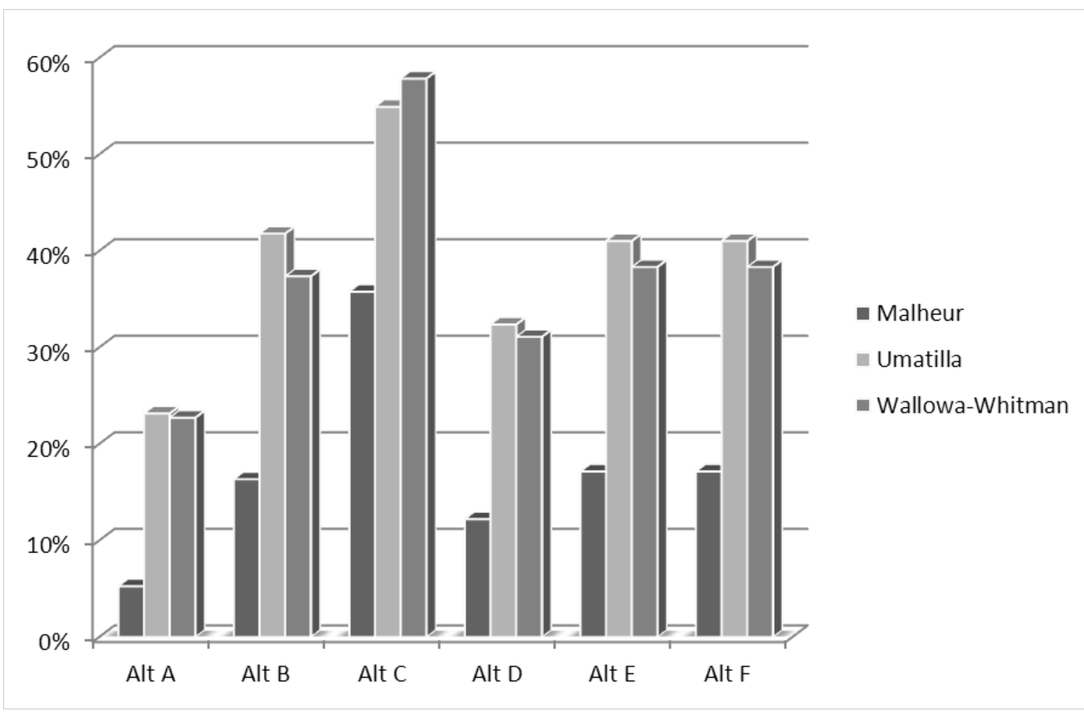

Figure 36. Percent of each national forest that would be considered secure areas for wildlife for each alternative

Malheur National Forest – Depending on location, the wolf is either federally listed as endangered or is included on the Regional Forester's Sensitive Species List. There are no known packs within the Malheur National Forest, although young wolves are beginning to explore more of eastern and central Oregon. Because the Malheur National Forest is unoccupied, individual wolfs would not be affected by implementing any of the management alternatives. Alternative C would reduce the risk of encounters between wolves and humans the most, as it would have the most acres in backcountry management areas (see figure 36) effectively reducing the total open motor vehicle route density within the national forest (see figure 35). Because of the desired condition for road density in bull trout and anadromous fish watersheds, alternatives E and F reduce the risk to wolves based on road density compared to the proposed action. The detailed assumptions for calculating how these standards would be applied during the life of the plan can be found in the project record, but basically the estimated number of watersheds and acres based on projected active management treatments (MA 4A) that would either be in bull trout or anadromous watersheds was used to reduce the amount of MA 4A that would have an open motor vehicle route density of 2.4 miles per square mile.

It is assumed that through implementation of the 2005 Travel Management Rule (36 CFR 212), the Malheur National Forest will limit cross-country travel, except for over-the-snow motor vehicles. Although Creel et al. (2002) found that stress-hormone levels of wolves increase with snowmobile use, it was not clear if it resulted in changes to population dynamics. Alternative C reduces over-the-snow motor vehicle impacts within the Malheur National Forest (see table 319), mostly due to the incorporation of MA 3C, which limits over-the-snow motor vehicle travel to designated routes. None of the alternatives are anticipated to reduce prey abundance for wolves and even though alternative C would provide the greatest reduction in potential human interaction with wolves; the management direction of any of the alternatives would continue to contribute to the viability and persistence of the wolf within the Malheur National Forest during the expected life of the forest plan. All alternatives incorporate standard WLD-HAB-6 S-1, which prohibits management activities near denning sites.

Table 319. Percent of each national forest that is suitable for winter motor vehicle use by alternative

National Forest	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F
MAL	92	91	64	95	92	92
UMA	75	72	46	78	71	71
WAW	78	74	40	76	70	70

Umatilla National Forest – Similar to the Malheur National Forest, the wolf is federally endangered within a portion of the Umatilla National Forest, but a sensitive species on more than 80 percent of the national forest. Currently the national forest is occupied by at least one pack, and most of the known locations of wolves have been in that portion of the national forest where the wolf would be considered a sensitive species. The potential impacts of roads to wolves would be similar to the Malheur National Forest (summer cross-country travel has been restricted); however, because of the prevalence of anadromous watersheds, impacts by alternatives would be different (see figure 35). Alternative C has more acres in MA 3C than either E or F however, the combination of MA 3C with anadromous watersheds indicates that alternative E reduces the risk from open motor vehicle route density the most followed by F and then C. Risk from over-the-snow motor vehicles use is also different, with a noticeable reduction in alternatives C, E and F, although the reductions are more substantial in alternative C. Again, there is no anticipated reduction in prey availability for the wolf and all alternatives incorporate standard WLD-HAB-6, which prohibits management activities near denning sites. As indicated, the portion of the Umatilla National Forest currently known to be occupied by wolves is that portion where the wolf would be considered a sensitive species. Forest plans do not directly implement activities that could cause disturbance to individual wolves. However, the probability exists that at least one project implemented in compliance with the forest plan could disturb an individual wolf. Using this premise, implementing the plan might affect individuals but implementing the management direction for any of the alternatives would result in the continued viability and persistence of the wolf within the Umatilla National Forest during the life expectancy of the plan.

Wallowa-Whitman National Forest – The Wallowa-Whitman National Forest is occupied by at least one pack and the entire national forest is within the area where the wolf was delisted; as such, the wolf is considered a sensitive species for the national forest. Similar to the Umatilla National Forest, alternative E does the best at reducing the potential for human/wolf conflict based on open motor vehicle route density (see figure 35) followed by F and then C. Alternative C has the most acres in back country management areas that minimize motor vehicle access (see figure 36) and reduce areas for over-the-snow motor vehicle use (see table 319), which may be of a greater benefit as the change in road density is not as dramatic as within the Umatilla National Forest. It is also assumed the Wallowa-Whitman National Forest will restrict cross-country summer motor vehicle use in the near future. There is no anticipated reduction in prey availability for the wolf and all alternatives incorporate standard WLD-HAB-6 S-1, which prohibits management activities near denning sites. The Wallowa-Whitman National Forest is currently known to be occupied by wolves and although Forest plans do not directly implement activities that could cause disturbance to individual wolves, the probability exists that at least one project implemented in compliance with the forest plan could disturb an individual wolf. Using this premise, implementing the plan might affect individuals but implementing the management direction for any of the alternatives would continue to provide for the viability and persistence of the wolf within the Wallowa-Whitman National Forest during the plan period.

Wolverine (Candidate Species)

The North American wolverine became a Federal candidate species December 14, 2010. The wolverine was evaluated as a focal species for the habitat generalist group which included the gray wolf and the peregrine falcon. It is sensitive to risk factors that can cause disturbance (Copeland et al. 2007, Gaines et al. 2003, Krebs et al. 2007) as are the other species in this group.

Wolverines are considered habitat generalists, and their home ranges are so large that they are usually measured in hundreds of square miles rather than thousands of acres. Recent radio telemetry studies of wolverines in the Rocky Mountains of British Columbia (Krebs et al. 2007) and the United States (Copeland 1996, Copeland et al. 2007, Squires et al. 2007) indicate that wolverines are wide-ranging, inhabit remote areas near timberline, and are sensitive to human disturbance at natal and maternal den sites. Interestingly, Aubry et al. (2007), in their historical review of wolverine distribution in the west, concluded that wolverines detected in Oregon in recent decades “probably represent extreme dispersal events that were not representative of self-sustaining populations” because “there is no evidence of wolverine occurrence in eastern Washington or Oregon currently.” Edelmann and Copeland (1999) indicated that of the 150 sightings for Oregon, at least some of them occurred in the Wallowa Mountains. Using remote cameras and bait stations Magoun et al. (2011) recently documented at least three individuals in the Eagle Cap Wilderness Area of the Wallowa-Whitman National Forest. It is still uncertain, however, if breeding takes place in the Blue Mountains planning area.

Suitable wolverine habitat in Oregon is considered to be the high-elevation forests of the Cascade Range, the Blue Mountains, the Wallowa Mountains, and the Ochoco Mountains. Habitat areas for wolverines are usually isolated and described as patchy, often separated by large areas of unsuitable habitat. The assessment model (Wales et al. 2011) identified source habitat as the cool moist and cold dry (including white-bark pine) potential vegetation groups above 4,000 feet in elevation. Alpine cirques with boulder fell fields offer the primary denning habitat for wolverines in Idaho, and may also do so in Oregon (Magoun and Copeland 1998). Montane coniferous forests, suitable for winter foraging and summer kit rearing, may only be useful if connected with subalpine cirque habitats required for natal denning, security areas, and summer foraging (Copeland 1996).

Similar to other large mammalian carnivores in the Rocky Mountains (e.g., *Ursus arctos*, *Canis lupus*), the current distribution of wolverines may be determined more by intensity of human settlement than by biophysical factors such as vegetation type or topography (Banci 1994, Carroll et al. 2001, Kelsall 1981). Thus, specific habitat needs are not as important as reducing human disturbance, particularly in natal den sites (subalpine talus cirques) during the denning period.

Effects from Each Alternative on Wolverine

Malheur National Forest – The wolverine is listed as suspected within the Malheur National Forest. Wales et al. (2011) found the vast majority (96 percent) of watersheds within the Malheur National Forest had zero to low (1 to 600 acres) amounts of denning habitat (see table 320), with only 4 having moderate amounts. There were no watersheds with high amounts (greater than 1,400 acres). This suggests that a breeding population of wolverines would be unlikely to occur on the Malheur National Forest and that occurrence on this national forest would most likely represent extreme dispersal events that are not representative of self-sustaining populations as suggested by Aubry et al. (2007).

Table 320. Percent of watersheds by national forest having zero, low (1 to 600 acres), moderate (601 to 1,400 acres) and high (greater than 1,400 acres) amounts of wolverine denning habitat

National Forest	Zero	Low	Moderate	High
MAL	75	21	4	0
UMA	87	9	4	0
WAW	58	15	18	10

All alternatives incorporate standard WLD-HAB-6 S-1, which prohibits management activities near denning sites; however, it is unlikely that management actions would occur in the area during the time of denning. Magoun and Copeland (1998) speculated that deep, persistent spring snow cover was an obligate component of wolverine reproductive denning habitat, possibly because it aides in the survival of young by providing a thermal advantage (Pulliainen 1968) and refuge from predators (Persson et al. 2003, Pulliainen 1968). Reproductive denning begins in late February to mid-March, and post weaning den abandonment occurs in late April and May (Magoun and Copeland 1998, Persson et al. 2003), which for the most part is prior to when field activities associated with the plan would begin. Winter recreation then becomes the largest risk for disturbance of denning wolverines (Copeland 1996, Goldberg 2010). Recent advances in snowmobile technology capabilities has raised concerns about their ability to access previously isolated areas (Wisdom et al. 2000) where natal denning may be occurring. Wales et al. (2011) assessed winter habitat effectiveness by calculating the density of designated winter routes in wolverine habitat and determined that these routes have little effect on wolverine habitat, but recognized this did not account for cross-country winter use. As displayed in table 319, only alternative C measurably reduces the amount of national forest open to cross-country snowmobile use, whereas the other alternatives vary less than four percent between them.

In montane habitats in the southern latitudes, wolverines remain at high elevation throughout the year, avoiding lower elevation habitats with xeric conditions (Copeland et al. 2010). Several authors have attributed this to human influence (Carroll et al. 2001, May et al. 2006, Rowland et al. 2003). Carroll et al. (2001) found areas with road densities less than 1 mile per square mile to be strongly correlated with the presence of wolverine. Rowland et al. (2003), in a test of the Raphael et al. (2001) model, found that road density was a better predictor of wolverine abundance than amount of habitat when applied at the watershed scale. As displayed in figure 37, alternative C does the most for reducing the risk of encounters between wolverines and humans, since it has the most area in backcountry management areas. Additionally, alternative C establishes MA 3C which is intended to be managed for linkages between large blocks of back country. Both alternatives E and F have a desired condition to reduce hydrological connectivity of roads which was assumed to result in a roadbed density below one mile per square mile in bull trout watersheds. Based on assumptions regarding activity acres and percent that could occur in bull trout watersheds, alternative E could implement this standard on an additional 67,000 acres and alternative F would implement it on an additional 44,000 acres. It is not possible to determine how many acres of source habitat would be impacted.

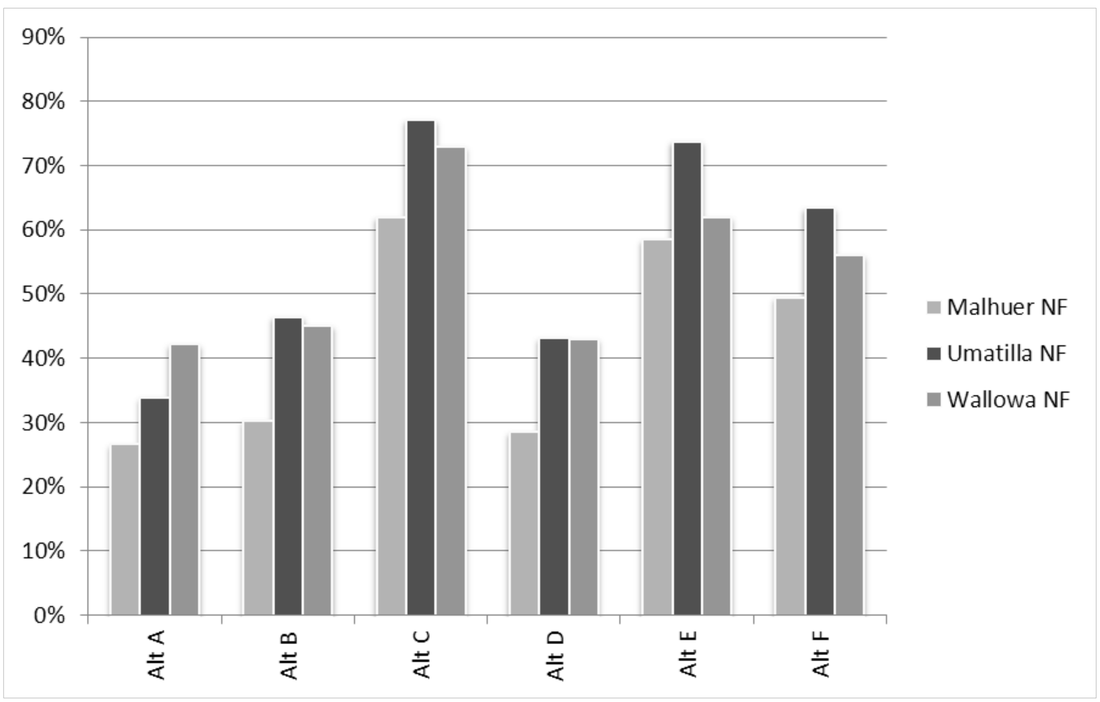

Figure 37. Percent of source habitat for the North American wolverine by alternative and by forest that occurs in Management Areas with an open motor vehicle route density of less than 1.5 mile per square mile

Because the Malheur National Forest is not occupied, it is not expected that individual wolverines would be affected by implementing any of the management alternatives. Although there is a high level of concern for source habitat with all alternatives for the Malheur National Forest (see table

299), all alternatives would provide direction to manage habitats towards HRV. As mentioned for the Canada lynx, the cold forest is relatively close to what occurred historically. Currently, the overall ability to move through the planning area for wolverine was rated as moderate to high, meaning in all likelihood wolverine mobility is not restricted (Wales et al. 2011). There is potential for wolverines from the Rocky Mountain population to enter Oregon from Idaho, Wyoming, or Montana. Although individuals may be impacted, overall management direction of any of the alternatives would contribute to habitat conditions for viability and persistence of this species.

Umatilla National Forest – The wolverine is listed as suspected within the Umatilla National Forest. Similar to the Malheur National Forest (see table 320), 96 percent of Umatilla National Forest watersheds had zero to low (1 to 600 acres) amounts of denning habitat (Wales et al. 2011) with only 4 percent having moderate amounts and there were no watersheds with high amounts (greater than 1,400 acres). Unlike the Malheur National Forest, 87 percent of the watersheds within the Umatilla National Forest have no denning habitat. This would suggest that it would be unlikely that the Umatilla National Forest would support a breeding population of wolverines and that occurrence on this national forest would probably represent extreme dispersal events that are not representative of self-sustaining populations as suggested by Aubry et al. (2007).

All alternatives incorporate standard WLD-HAB-6 S-1, which prohibits management activities near denning sites; however, it is extremely unlikely that management actions would occur in the area and during the time of denning (see discussion for the Malheur National Forest). There is a wider spread between alternatives in reducing over-the-snow travel within the Umatilla National Forest and overall there is less area on the forest open to OSVs (see table 319). Still, alternative C reduces OSV suitability the most, with alternatives E and F, ranking second for improving winter habitat effectiveness for the wolverine. Although there is a high to moderate level of concern for all alternatives for the Umatilla National Forest (see table 300) and individuals may be impacted, overall management direction of any of the alternatives would contribute to habitat conditions for viability and persistence of this species.

Wallowa-Whitman National Forest – The wolverine was most recently documented within the Wallowa-Whitman National Forest in the winter of 2011 (Magoun et al. 2011). Unlike the Malheur and Umatilla National Forests, the Wallowa-Whitman National Forest has watersheds that were categorized as having high amounts of denning habitat (see table 320). Wales et al. (2011) determined that 18 percent of the watersheds had moderate amounts of denning habitat while at least 10 percent had high amounts (greater than 1,400 acres). Less than 58 percent of the watersheds had no denning habitat. As suggested by Magoun et al. (2011), it is possible that the Wallowa-Whitman National Forest supports a small breeding population of wolverines and that their occurrence on this national forest may not represent extreme dispersal events as suggested by Aubry et al. (2007). Wales et al. (2011) determined that the watersheds with the greatest amount of potential denning habitat are all in the Wallowa Mountains (Eagle Creek, Upper Wallowa Creek, Upper Imnaha River, and the Minam River) which would align with the recent documentation of wolverines within the Wallowa-Whitman National Forest (Magoun et al. 2011)

All alternatives incorporate standard WLD-HAB-6 S-1, which prohibits management activities near denning sites; however, it is extremely unlikely that management actions would occur in the area and during the time of denning (see discussion for the Malheur National Forest). There is a wider spread between alternatives in reducing over-the-snow travel within the Wallowa-Whitman National Forest and overall there is less area on the forest open to OSVs (see table 319). Still, alternative C reduces OSV suitability the most, with alternatives E and F, being the next best for improving winter habitat effectiveness for the wolverine. Although there is a high to moderate level of concern for all alternatives for the Wallowa-Whitman National Forest (see table 301) and individuals may be impacted, overall management direction of any of the alternatives would contribute to habitat conditions for viability and persistence of this species.

Sage-grouse (Candidate Species)

In March 2010, the USFWS determined that the greater sage-grouse warrants the protection of the Endangered Species Act but that listing the species at this time is precluded by the need to address higher priority species first. Sage-grouse are considered a sagebrush obligate species as virtually all studies of sage-grouse have identified the bird's dependence on large, woody sagebrushes (*Artemisia* spp.) for food and cover during all periods of the year (Dalke et al. 1963, Connelly et al. 2000, Connelly et al. 2004). Sage-grouse breed on sites called leks (strutting grounds) which are typically used year after year. Breeding habitats are normally sage-brush dominated shrub-steppe, consisting of large, relatively contiguous stands of sage-brush (Connelly et al. 2011). Much of the original sage-grouse habitat has been permanently lost to agricultural development and urban areas (Leu and Hanser 2011, Pyke 2011) and the remaining habitat ranges from high quality to no longer adequate.

Source Habitat Description

According to Schroeder et al. (1999), sage-grouse use a wide mosaic of sagebrush habitats throughout the west that include:

- Tall sagebrush types such as big sagebrush (*Artemisia tridentata*), three-tip sagebrush (*A. tripartita*), and silver sagebrush (*A. cana*)
- Low sagebrush types, such as low sagebrush (*A. arbuscula*) and lack sagebrush (*A. nova*)
- Mixes of low and tall sagebrush with abundant forbs
- Riparian and wet meadows
- Steppe dominated by native forbs and bunchgrasses,
- Scrub-willow (*Salix* spp.)
- Sagebrush/woodland mixes with juniper (*Juniperus* spp.), ponderosa pine (*Pinus ponderosa*), or quaking aspen (*Popululs tremuloides*)

Call and Maser (1985) summarized characteristics of quality sage-grouse habitat in Oregon as sagebrush steppe between 4,000 and 8,000 feet with annual precipitation of 10 to 16 inches and rolling topography. Within this landscape, sage-grouse need key habitat elements for reproduction and survival. In Oregon, nesting habitat consists of sagebrush plants (*A. tridentata* and *A. arbuscula*) with a strong native herbaceous understory (Hagen et al. 2007).

Sage thrashers were chosen as the focal species to represent species, including the sage-grouse, associated with the Shrub-steppe Group in the Woodland/Grass/Shrub Family (Wales et al. 2011). It was felt that sage thrasher represents the full range of habitats and risks associated with this group, including loss, fragmentation, and degradation of sagebrush (*Artemisia* spp.) habitats. Modeling for the sage thrasher indicated that habitat is only moderately departed from HRV, and the influence of open motor vehicle route is low. As a result, there is a moderate level of concern for the viability of the sage thrasher (see table 299 through table 301), and therefore the group, for all three national forests.

Habitat for the group represented by the sage thrasher was never highly abundant on National Forest System lands in the Blue Mountains. Species of sagebrush vary by elevation and soils but include low sagebrush, silver sagebrush, rigid sagebrush, basin big sagebrush, Wyoming big sagebrush, mountain big sagebrush, threetip sagebrush, bitterbrush, and rabbitbrush (Johnson and Clausnitzer 1992), all of which make up the sagebrush shrubland habitat. Sage-grouse habitat is a subset of the sagebrush shrubland habitat and as indicated by Hagen (2011) is found on less that 0.7 percent of National Forest System lands in Oregon. The habitat mapping effort for greater sage-grouse in Oregon (Hagen 2011) utilizes the concept of core areas as presented by Doherty et al. (2011) with some modifications, explained in detail by Hagen (2011). For Oregon the core area goal is to identify habitats necessary to conserve 90 percent of Oregon's greater sage-grouse population with emphasis on the highest density and important use areas which provide for breeding, wintering and connectivity. In addition, low density areas are to be identified that provides breeding, summer and migratory habitats for the statewide population.

In 2012, the U.S. Fish and Wildlife Service created a Conservation Objective Team (COT) of state and FWS representatives to develop conservation objectives for the sage-grouse. The final report (COT 2013) identifies key habitats necessary for sage-grouse conservation range-wide and has termed these habitats as priority areas for conservation (PACs). These PACs were developed using maps created by individual states and therefore the PACs in their report coincide with the core areas identified by Oregon and displayed in figure 38. The BLM's National Technical Team identified Priority Primary Habitat (BLM 2011) which is the same as core areas and PACs in Oregon. Sage-grouse habitat on the Blue Mountains National Forests actually falls into two different management zones (figure 38), the Snake River Plains and the Northern Great Basin (COT 2013). According to COT (2013), the Malheur National Forest would encompass both management zones and two populations: the central Oregon population, which is considered at risk (C2) or potentially at risk (C3), and the northern great basin population, which is potentially at risk (C3). The Wallowa-Whitman is only in one management zone and encompasses only the Baker population which is considered at risk (C2).

Effects from Each Alternative on Sage-Grouse

The greater sage-grouse is not expected to occur within the Umatilla National Forest (see table 321). Sagebrush habitats were estimated to occur on less than 1 percent of the Forest, none of which were mapped as greater sage-grouse habitat by Hagen (2011). Because the forest is not occupied and there is no known occupied habitat in either Oregon (Hagen 2011) or Washington (Hays et al. 1998) immediately adjacent to the forest, it will not be addressed further.

Malheur National Forest – Sagebrush steppe habitat was estimated to occur on approximately 6 percent of the landscape within the Malheur National Forest; however, not all of this is considered sage-grouse habitat. Habitat mapping completed by ODFW (figure 38) indicates that only 41,600 acres is considered greater sage-grouse habitat, and of this, 30,000 has been mapped as core habitat, and the remainder as low density habitat. Habitat on National Forest System lands is not contiguous, with the largest block within the Malheur National Forest being slightly more than 24,000 acres of Core Area Habitat (PAC) occurring in the Snake River Plains Management Zone and associated with the Northern Great Basin population. The Northern Great Basin population is a large population in Oregon, Idaho, Nevada, and Utah. In Oregon, PACs and low density (nonpriority but managed) habitat combined capture all but three percent of known summer, one percent of known breeding, and one percent of known wintering habitat. Oregon PACs also considered the need to maintain a network of connected habitats. Overall, this part of the population is potentially at risk (C3). Habitat within the Malheur National Forest represents 0.6 percent of sage-grouse habitat in Oregon within this management zone.

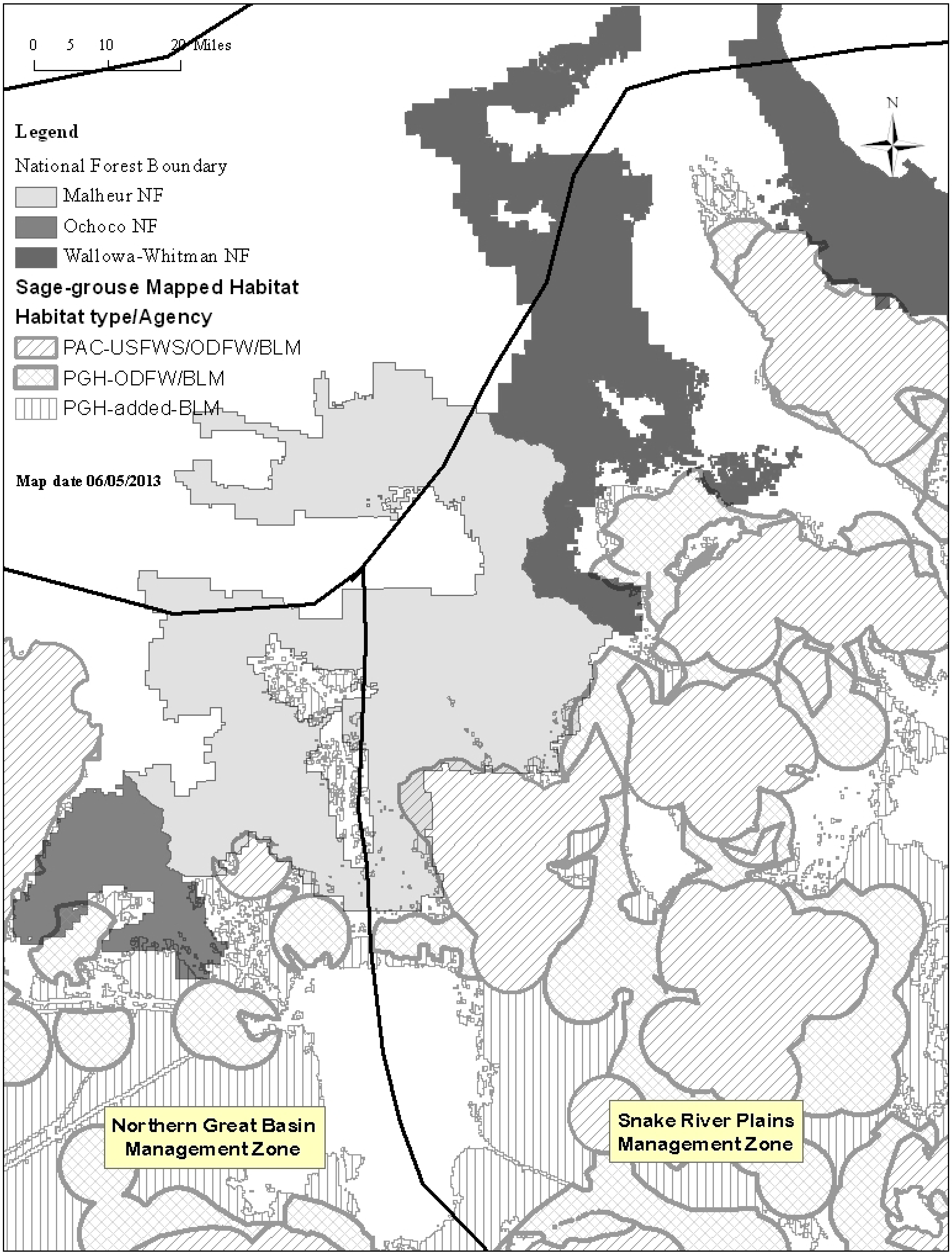

Figure 38. Greater sage-grouse habitat within and adjacent to the Blue Mountain National Forests

The eastern portion of the Malheur is in the Northern Great Basin Management Zone and is associated with the Central Oregon population. This population is estimated to have only 53 percent of historical sagebrush habitat, having lost more historical habitat than any other sage-grouse administrative unit in Oregon. The area also has more privately owned sage-grouse habitat (48 percent) than most other sage-grouse management zone populations in Oregon. Priority areas for conservation and low density (nonpriority but managed) habitat combined capture all but three percent of known summer, one percent of known breeding, and one percent of known wintering habitat. Although a lot of the known habitat is mapped, it is recommended to retain all PACs in Central Oregon. Less than 14,000 acres of habitat occur within the Malheur National Forest and less than half of this is considered PACs. This represents 0.2 percent of sage-grouse habitat within this management zone in Oregon.

All alternatives include a desired condition to restore habitats including the sagebrush steppe. Sagebrush steppe is identified as a special habitat for all alternatives (see appendix A 1.13 Special Habitats), with a desire of no net loss and at least 70 percent having an understory of native species, resulting in conditions that are sustainable and resilient to disturbance. In other words they are capable of recovering to their potential community without intervention after a disturbance. The other 30 percent of the landscape would include areas of juniper encroachment, non-sagebrush shrub lands, annual grasslands, and nonnative perennial grasslands that potentially could be rehabilitated and enhanced as sagebrush habitat. This would be true no matter which action alternative is being evaluated.

Management activities likely to occur in sage-grouse source habitats are primarily grazing, invasive plant species control, and fire suppression, all of which are discussed below as threats/risks to habitat. Alternatives E and F also identify objectives to reduce juniper encroachment on 800 acres and to reduce sagebrush density on 700 acres in areas where it currently exceeds 25 percent canopy cover during the life of the plan. This represents only a modest gain in habitat, which in all likelihood would not lead to a detectable change in the sage-grouse population.

Threats and Risks

Sage-grouse populations in these two management zones face a wide suite of threats, including juniper encroachment, renewable energy development (both wind and geothermal), energy transmission, roads, OHV recreation, mining development, and residential development. Despite efforts to manage wildfire risks, wildfires and invasive species have continued to reduce the quality of habitat in portions of this area (COT 2013).

Livestock grazing is the most wide-spread use of sage-grouse habitats in the west. There is no doubt that historical grazing had significant impacts on sagebrush habitats throughout the west (Crawford et al. 2004) due to season-long use and stocking levels that far exceeded the carrying capacity of the land. Current livestock grazing, however, can be positive, negative or neutral and will vary with timing, intensity of use and a host of environmental factors (Hagen et al. 2011). Grazing may improve brood use of habitat (Dahlgren et al. 2006), reduce nesting success due to loss of vegetation for cover (Beck and Mitchell 2000, Connelly and Braun 1997), or remain neutral by maintaining perennial bunchgrasses with moderate levels of livestock utilization (Stohlgren et al. 1999). Beck and Mitchell (2000) summarized potential effects of livestock grazing on sage-grouse habitats, and cited only four references that provide empirical evidence of direct negative effects of livestock grazing on sage-grouse, as follow: Of 161 nests examined in Utah, two were trampled by livestock (one sheep, one cattle) and five were deserted due to disturbance by livestock (Rasmussen and Griner 1938). As previously discussed for focal species, data for both uplands and riparian areas indicate an improvement in overall rangeland condition under current management. Although recognized that some of the true rangeland sites are strongly or highly departed from their historical condition (see table 85 in the “Livestock Grazing and

Rangeland Vegetation" section), the cause may not be current livestock grazing but rather historical grazing or invasion of nonnative annuals due to fire. Within sage-grouse source habitat, 77 percent of CVS plots were classified as phase C or better; meaning that a large portion of habitat can be restored through proper management. It is assumed that livestock grazing would be managed to achieve the expressed desired conditions of the plan (see appendix A 1.2 Species Diversity, 1.5 Invasive Species, 1.6 Structural Stages, 1.7 Plant Species Composition, 1.8 Stand Density, and 1.13 Special Habitats), which would result in an improvement of rangeland phases. Alternative C reduces the amount of the national forest considered suitable for livestock grazing by almost 28 percent, eliminating grazing on approximately 400 acres of sage-grouse core habitat and 700 acres of low-density habitat. As previously discussed, stocking rates and utilization levels (residual biomass) have more to do with successful range improvement than anything else. As displayed in table 313, the current forage needs of domestic livestock and wild ungulates is below what has been cited as acceptable use and still see rangeland improvement (Holecheck 1988); however, it is also recognized that small areas of overuse can occur. Because of this, alternative C would lead to the most improved sage-grouse habitat, followed by alternatives E and F, based on exposure to domestic livestock grazing and utilization levels within the uplands (RNG-5 and RNG-6).

Open motor vehicle route density was also identified as a risk factor for the sagebrush group (Wales et al. 2011). Ingelfinger and Anderson (2004) found density of sagebrush obligate birds decreased 39 to 60 percent within a 100-meter buffer of roads with low traffic volumes associated with natural gas extraction in Wyoming. Although the direct effects of recreational activity on sage-grouse is unknown, there are negative correlations between sage-grouse populations and increased human activity (Connelly et al. 2004). Wales et al. (2011) found road density generally to be low in source habitat for the sagebrush group, which is probably true for sage-grouse habitat as well. Neither road density nor distances to nearest roads were significant factors in the long term persistence of sage-grouse throughout its range (Aldridge et al. 2008); however, negative effects to habitat use and productivity, such as abandonment of leks during the breeding season, may occur locally from proximity of roads (Aldridge and Boyce 2007, Lyon and Anderson 2003). All alternatives include standard WLD-HAB-6 S-1, which prohibits activities that would disturb nesting activity within 1,200 feet of these sites. Alternatives E and F, however, improve upon this protection measure by restricting open motor vehicle routes within two miles of a lek during the breeding season (WLD-HAB-14). In general, sage-grouse habitats are within MA 4A, which has an open motor vehicle route desired condition of 2.4 miles per square mile or less. It is assumed that motor vehicle travel will be limited to open designated routes with cross-country travel generally not allowed.

Wildfire, both managed and unmanaged, is considered one of the key threats to sage-grouse habitats (Crawford et al. 2004). As with grazing, fire can be positive, negative or neutral in its effects on sage-grouse. The length of the fire cycle has changed, being more frequent in low elevations and less frequent at higher elevations, resulting in invasion of exotic grasses at lower elevations and woodland expansion at higher elevations (Miller et al. 2011). As previously noted, all alternatives would desire plant communities as well as disturbance regimes (i.e., fire) to be within HRV, which should preclude the use of fire as a management tool in the sagebrush community where the risk of exotic grass invasion is high. Alternatives E and F provide added management emphasis with standards and guidelines (FIRE-4, FIRE-5, and WLD-HAB-22) to call attention to this risk. Additionally there are standards that address the spread of noxious weeds (NOX-3) and that guide restoration (NOX-2).

Energy development on the landscape has been identified as a significant threat within the range of this species (Doherty et al. 2011). This has mostly been associated with oil and gas exploration, but more recently wind farms have become a concern. Although there is little indication that viable energy sources for development exist within the planning area, alternatives E and F do have plan components (WLD-HAB-15, WLD-HAB-16, and WLD-HAB-17) that would consider habitat adjacent to the national forest as well as within the national forest.

Although the Malheur National Forest constitutes relatively little of the overall sage-grouse habitat in Oregon (0.3 percent) and individual sage-grouse may be impacted, overall management direction of any of the alternatives would contribute to habitat conditions for viability and persistence of this species.

Wallowa-Whitman National Forest – Sagebrush steppe habitat was estimated to occur on less than 1 percent of the landscape for the Wallowa-Whitman National Forest, but according to ODFW (see figure 38) a little more than 3,000 acres within the Wallowa-Whitman National Forest would be considered sage-grouse habitat, most of which is mapped as core habitat. Habitat within the Wallowa-Whitman occurs in the Snake River Plains Management Zone and represents 0.07 of a percent of the habitat found in this management zone. And although this management zone supports the largest population of sage-grouse outside of the Wyoming Basin, habitat within the Wallowa-Whitman is only associated with the Baker population, which is thought to have little connectivity with other populations due to habitat and topography. Most (68 percent) of the sage-grouse habitat for the Baker population is in private ownership and 31 percent is administered by BLM (Hagen 2011). Overall, this population is considered at risk (C2). Most of the area used by this population has been mapped as priority habitat of which less than one percent occurs within the Wallowa-Whitman.

The Baker population is more at risk and probably less resilient as connectivity to other populations appears limited. However, recent telemetry information suggests that at least some birds may move between the Weiser population in Idaho and the Baker population (COT 2013). There is no redundancy in this population as everything occurs in one general area. Also, the quality of habitat is more similar to habitat of extirpated populations than extant ones (Wisdom et al. 2011).

As discussed for the Malheur National Forest, all alternatives include a desired condition to restore habitats including the sagebrush steppe. Sagebrush steppe is identified as a special habitat for all alternatives, with a desire of no net loss. Management activities likely to occur in sage-grouse source habitats are primarily grazing, invasive plant species control, and fire suppression, all of which were discussed in detail as threats/risks to habitat for the Malheur National Forest. All of the standards and guidelines discussed for the Malheur National Forest would also apply to the Wallowa-Whitman National Forest. Although less than 0.05 percent of sage-grouse habitat in Oregon occurs within the Wallowa-Whitman National Forest, overall management direction of any of the alternatives would contribute to habitat conditions for viability and persistence of this species even though individual sage-grouse may be impacted.

Forest Service Sensitive Terrestrial Wildlife Species

Sensitive species are defined as those plant and animal species identified by the regional forester for which population viability is a concern, as evidenced by significant current or predicted downward trends in population numbers or density and habitat capability that would reduce a species' existing distribution (FSM 2670.5). Management of sensitive species "must not result in a loss of species viability or create significant trends toward Federal listing" (FSM 2670.32). The regional forester is responsible for identifying sensitive species and shall coordinate with Federal and state agencies and other sources, as appropriate, in order to focus conservation management strategies and to avert the need for Federal or state listing as a result of national forest management activities.

Terrestrial wildlife species that are included on the Regional Forester's Sensitive Species List as occurring within the planning area are displayed in table 321. Selected sensitive species associated with specific habitats are discussed below, but detailed analysis of individual species is documented in the biological evaluation available from the project record.

Table 321. Special status species for the Blue Mountains (from the 2011 Regional Forester's Sensitive Species List), their associated focal species with their level of concern for viability, and effects determination for special status species

Common Name	Status[1]	Focal Species	Level of Concern Outcome[2]		Effects determination[4] special status species		
			Current	Change[3]	MAL	UMA	WAW
Tri-colored blackbird	OR-SEN	Marsh wren	L	=	NI	NA	NA
Grasshopper sparrow	OR-SEN	Northern harrier	L	=	MIIH	NA	NA
Upland sandpiper	SEN	Upland sandpiper	FS	FS	MIIH	MIIH	MIIH
Bufflehead	OR-SEN	Bald eagle	L to M	=	NI	NI	NI
Greater sage-grouse	FC/SEN	Sage thrasher	M	=	MIIH	NA	MIIH
Black swift	OR-SEN	None	FS	FS	NA	NA	NI
Bobolink	SEN	Wilson's snipe	L	=	MIIH	NA	NA
Gray flycatcher	WA-SEN	Ash-throated flycatcher	H	=	NA	NI	NA
American peregrine falcon	SEN	American peregrine falcon	L/M	=	MIIH	MIIH	MIIH
Bald eagle	SEN	Bald eagle	L or M	=	MIIH	MIIH	MIIH
Harlequin duck	SEN	Bald eagle	L to M	=	NA	NA	MIIH
Black rosy finch	OR-SEN	Gray-crowned rosy finch	FS	FS	NA	NA	MIIH
Wallowa rosy finch (subspecies of gray-crowned rosy finch)	OR-SEN	Gray-crowned rosy finch	FS	FS	MIIH	NA	MIIH
Lewis's woodpecker	SEN	Lewis's woodpecker	M/H to M	= MAL - WAW - UMA	MIIH	MIIH	MIIH
White-headed woodpecker	SEN	White-headed woodpecker	H	=	MIIH	MIIH	MIIH
Ash-throated woodpecker	WA-SEN	Ash-throated flycatcher	H	+	NA	NI	NA
Mountain quail	WA-SEN	Macgillivray's warbler	M	=	NA	MIIH	NA
Green-tailed towhee	WA-SEN	Ash-throated flycatcher	H	+	NA	MIIH	NA
Great gray owl	WA-SEN	Northern	L	=	NA	MIIH	NA

Common Name	Status[1]	Focal Species	Level of Concern Outcome[2]		Effects determination[4] special status species		
			Current	Change[3]	MAL	UMA	WAW
		goshawk					
Columbian sharp-tailed grouse	OR-SEN	Northern harrier	L	=	NA	NA	NI
Inland tailed frog	SEN	Inland tailed frog	L to M	=	NA	MIIH	MIIH
Columbia spotted frog	OR-SEN	Columbia spotted frog	L to M	=	MIIH	MIIH	MIIH
Painted turtle	OR-SEN	Columbia spotted frog	L to M	=	NA	MIIH	NA
Striped whipsnake	WA-SEN	Lark sparrow	L	=	NA	NI	NA
Canada lynx	FT	Boreal owl	H to M	+ MAL = WAW = UMA	NE	NE	NE
Gray wolf	FE/SEN	Gray wolf	FS	FS	NLAA MIIH	NLAA MIIH	MIIH
Pallid bat	SEN	Lark sparrow	L	=	MIIH	NA	NA
Pygmy rabbit	OR-SEN	Sage thrasher	M	=	MIIH	NA	NA
Townsend's big-eared bat	SEN	Townsend's big-eared bat	FS	FS	MIIH	MIIH	MIIH
Spotted bat	OR-SEN	Lark sparrow	L	=	NA	NA	MIIH
Fringed myotis	OR-SEN	Western bluebird	H to M/H	=	MIIH	NA	MIIH
North American wolverine	FC/SEN	North American wolverine	H to M/H	=	MIIH	MIIH	MIIH
Preble's shrew	WA-SEN	Northern harrier	L	=	NA	MIIH	NA
Mountain goat	WA-SEN	Northern harrier	L	=	NA	MIIH	NA
Western Bumblebee	OR-SEN	None	FS	FS	NA	NA	MIIH
Intermountain Sulphur	OR-SEN	None	FS	FS	NA	MIIH	MIIH
Lustrous Copper	WA-SEN	None	FS	FS	NA	MIIH	NA
Humped coin	WA-SEN	None	FS	FS	NA	MIIH	NA
Yuma Skipper	OR-SEN	None	FS	FS	NA	MIIH	MIIH
Salmon coil	WA-SEN	None	FS	FS	NA	MIIH	NA
Shiny tightcoil	WA-SEN	None	FS	FS	NA	MIIH	NA
Fir pinwheel	SEN	None	FS	FS	NA	MIIH	MIIH
Meadow fritillary	WA-SEN	None	FS	FS	NA	MIIH	NA
Silver-bordered fritillary	OR-SEN	None	FS	FS	MIIH	NA	MIIH
Barry's hairstreak	WA-SEN	Ash-throated	H	+	NA	MIIH	NA

Common Name	Status[1]	Focal Species	Level of Concern Outcome[2]		Effects determination[4] special status species		
			Current	Change[3]	MAL	UMA	WAW
		flycatcher					
Johnson’s hairstreak	SEN	None	FS	FS	MIIH	MIIH	MIIH
Great Basin fritillary	WA-SEN	None	FS	FS	NA	MIIH	NA

1 SEN: sensitive in both Oregon and Washington
OR-SEN: sensitive only in Oregon
WA-SEN: sensitive only in Washington
FE: federally listed as endangered
FT: federally listed as threatened
FC: federal candidate species

2 Level of concern outcomes are described earlier in this section. In general terms, they range from low level of concern (suitable environments are either broadly distributed or of high abundance compared to their historical distribution) to high level of concern (suitable environments are highly isolated and exist at very low abundance). FS indicates species whose habitats are too limited or specialized to assess at the broad scale of the forest using a focal species assessment model.

3 Stable
- downward trend
+ upward trend

4 For ESA and sensitive species, effects determinations are made only for the Federal action (the preferred alternative). The effects determinations are documented in the biological assessment/biological evaluation (BA/BE), included in the planning record.
MIIH: may impact individuals or habitat, but is not likely to contribute to a trend toward federal listing or cause a loss of viability to the population or species.
NLAA: may affect, not likely to adversely affect.
NE: no effect.
NA: not applicable.

Effects from Each Alternative on Sensitive Species

As indicated in tables table 298 and table 321, many of the Regional Forester’s Sensitive Species were either analyzed in detail as a focal species or were in a focal species group that was analyzed in detail. For example, the bald eagle was analyzed in detail by Wales et al. (2011) and found to have a low level of concern for viability on the Malheur and the Umatilla National Forests and a moderate level of concern for viability on the Wallowa-Whitman National Forest (table 301). There was no increase in the level of concern between the existing condition and any of the alternatives indicating that although individual bald eagles may be impacted by implementing the alternatives, none would cause a trend toward Federal listing. Another example would be the tri-colored blackbird which was represented by the marsh wren, or the pygmy rabbit represented by the sage thrasher. Both of the focal species had either a low or moderate concern for viability which was not increased in any of the alternatives, indicating that although individuals of a species may be impacted, none of the alternatives would cause a trend toward Federal listing. It is assumed that species in family/groups (table 298) where there is no increase in the level of concern for viability of the representative focal species (table 299 through table 301) would not trend towards federal listing or loss of population viability. Detailed discussions for these species or their representative focal species can be found in Wales et al. (2011). Those species identified as “fine scale” species (FS in table 321) usually have very limited occupied habitat or are locally endemic and are most appropriately addressed at the project level, where the finer scale of analysis allows appropriate identification of their habitats. For example, the shiny tightcoil is only sensitive in Washington, which represents 22 percent of the analysis area, over half of which is in areas not identified for active management. And although associated with ponderosa pine and Douglas-fir vegetation types, it is the talus slopes within these forest types to which they are most closely associated, resulting in a portion of the landscape that cannot be mapped at the forest scale. Such habitats are identified as Special Habitats (1.13) and management would be towards the desired condition, which is that they remain on the landscape and provide high quality habitat for associated species.

Limited Habitats

The gray-crowned rosy-finch is an example of a sensitive species with extremely limited and disjunct habitat on the national forests (Wisdom et al. 2000). The subspecies that occurs in the Blue Mountains is the Wallowa rosy finch (Macdougall-Shackleton et al. 2000). Wallowa rosy finch forage for insects along the edge of snow-fields (Johnson 1965). Breeding and nesting habitat occurs in alpine habitat associations within the plan revision area (Johnson 1975, Miller 1939, Wisdom et al. 2000). Only two isolated patches of breeding and nesting habitat occur within the planning area. One patch is centered in the Eagle Cap Wilderness Area (Wallowa-Whitman National Forest) and the other in the Strawberry Wilderness Area (Malheur National Forest). Although identified as a focal species, an assessment model was not developed for the species due to this limited habitat on National Forest System lands.

Wisdom et al. (2000) placed both the gray-crowned and black rosy-finches (*Leucosticte atrata*) in the same family group (summer residents of high elevation alpine communities) and so it is assumed that the analysis for gray-crowned will be representative of both species.

Grazing and recreation would be the major management actions that may impact habitat for the gray-crowned rosy-finch. The upland rangeland condition has improved from the early 1950s but has stabilized in the last decade (see Livestock Grazing and Grazing Land Vegetation section). For the gray-crowned rosy-finch the amount of source habitat has not changed from the historical situation. However, as Hann et al. (1997) pointed out, while the overall trend may not be changing, site specific instances of loss of habitat quality from past excessive domestic sheep grazing may have already occurred. Current risks would be overgrazing by domestic sheep and human recreational activities in alpine tundra (Lehmkuhl et al. 1997). The amount of source habitat subjected to domestic sheep grazing varies (table 322) from zero within the Wallowa-Whitman National Forest to 15 percent within the Malheur National Forest. This estimate of source habitat is all cold upland/herbland (UH) potential vegetation group found within the range of the species as given by Marcot et al. (2003) and not just the known occupied habitat, although both the gray-crowned and black rosy finches are documented within the Wallowa-Whitman National Forest, with the gray-crowned being suspected within the Malheur National Forest (table 322).

Table 322. Estimated acres of gray-crowned rosy-finch source habitat by national forest and the percent in active grazing allotments subject to domestic sheep grazing and within designated wilderness areas

National Forest	Acres of Source Habitat	Percent Active Allotments	Percent Domestic Sheep Grazing	Percent Designated Wilderness Areas
MAL	1,500	38%	15%	66%
UMA	3,900	13%	8%	45%
WAW	39,000	38%	0%	53%

Only alternative C reduces the amount of source habitat that is subject to domestic sheep grazing: zero within the Malheur National Forest and just slightly more than one percent within both the Umatilla and Wallowa-Whitman National Forests. Although alternatives A, B, E, and F have the same amount of source habitat within active allotments, alternatives E and F should have the least impact due to a lower utilization level, followed by alternative A (table 79 in volume 1) and then alternative B (see livestock grazing discussion for focal species).

Although there are slight differences in the amount of overall backcountry between alternatives, the increase in the amount of source habitat for the gray-crowned rosy finch included in backcountry areas would be negligible. There is little anticipated change in recreation between alternatives and current wilderness area use levels are low. Because of the location of habitats for the gray-crowned rosy-finch (alpine), the change in access (open motor vehicle routes) between alternatives would probably not alter the amount of recreation occurring in their habitat.

The black rosy-finch is considered imperiled in Oregon but apparently secure within its range in the United States (NatureServe 2011). Recent literature has not recognized the nominal subspecies of the gray-crowned rosy-finch (*ibid*) so the species is considered vulnerable (breeding) in Oregon. The nonbreeding status is possibly imperiled, but is considered secure within its range in the United States. Because the majority of the habitat for this species is not grazed by domestic sheep and recreation use levels within higher elevations are considered low, it is assumed that although individuals or habitat may be impacted, implementing any of the alternatives will not cause a trend toward Federal listing nor cause a loss of viability to the population or species.

Limited Distribution

The upland sandpiper is an example of a sensitive species that has extremely limited distribution on the national forests of Oregon and is considered rare and disjunct from the eastern and mid-western U.S. populations. This long-distance migrant winters in South America and rarely farther north, arriving at its nesting grounds in March-May. The upland sandpiper is distributed sparingly west of the Rocky Mountains in high-altitude meadows of Washington, Oregon and Idaho (Houston and Bowen 2001). The main range for the upland sandpiper is the north central portion of the United States east of the Rocky Mountains (Houston and Bowen 2001) with sparse and often isolated populations breeding west of the main range in North America (Dechant et al. 1999 (revised 2002)), including scattered locations in southwest Union, southern Umatilla, southern Grant, and western Lake Counties in central and eastern Oregon (Gilligan et al. 1994). Logan Valley and Bear Valley are the main strongholds for this species in Oregon, and Bear Valley, for the most part is private land (ODFW 2006). Because Oregon is a minor portion of the sandpiper's range, the majority of research available on this species has been conducted east of the Rocky Mountains. Though it is identified as a focal species, an assessment model was not developed due to this limited distribution.

Upland sandpipers seem to prefer large (100 hectares or more) grassland-associated landscapes that offer a mix of vegetation heights, including short grass areas for courtship displays as well as taller grasses for nesting cover on breeding grounds (Vickery et al. 2010). They use a variety of habitats, from natural grasslands to cultivated or grazed fields during migration and on nonbreeding grounds (*ibid*). Upland sandpipers nest in open flats consisting of native grasses and forbs (Akenson 1991). Two key components of upland sandpiper habitat are nesting cover and availability of insects for young sandpipers (Akenson and Schommer 1992).

Grazing and recreation are the major management actions that could impact habitat for this species. The upland rangeland condition in general has improved from the early 1950s but has stabilized in the last decade (see Livestock Grazing and Grazing Land Vegetation section). Since most studies report only the presence of upland sandpipers and not how they use grazed areas, it is difficult to give a general statement on the effects of grazing to upland sandpipers (Vickery et al. 2010). Basically, sandpipers have been found using grazed areas for nesting, foraging, and brood rearing (Bowen and Kruse 1993, Dechant et al. 1999 (revised 2002), Houston and Bowen 2001). Within mixed-grass and tall grass prairie in South Dakota, nest densities did not differ between idle sites and sites that were grazed in May where 20 to 80 percent of the current year's growth was removed (Kaiser 1979). Fourteen nests were found within a 256-ha fragment of moderately grazed prairie in South Dakota (Lokemoen and Duebbert 1974). Kirsch and Higgins (1976) reported that mean nest productivity was lowest on tilled areas (where no nests were observed), higher on grazed and idle areas, and highest on burned areas. Nest loss occasionally occurs as a result of trampling by cattle (Ailes 1980, Bowen and Kruse 1993). Current grazing assessed at the forestwide scale appears to allow sufficient residual cover to satisfy the needs for nesting and foraging habitat for this species. Although small areas exist that do not allow sufficient residual cover, these would be addressed at the project level.

None of the alternatives propose activities that would attract or reduce the amount of recreation other than restricting motor vehicle access. Assuming that a reduction in motor vehicle access would reduce the amount of recreation, then disturbance to upland sandpiper by alternative would be similar to figure 35, where alternatives E and F would provide the least disturbance and alternative D would have the greatest likelihood of disturbing sandpipers. Because domestic livestock grazing is proposed to be moderate for most alternatives (table 312 and table 313) and should be managed to achieve the desired conditions stated in appendix A, it is unlikely, other than the potential for the trampling of a nest, that grazing would be detrimental to the breeding population of this species.

Species occupying the periphery of their range are often found in less favorable habitats and exhibit lower and more variable densities (Brown 1984, Brown et al. 1995, Gaston 1990). This probably accounts for upland sandpiper's ranking as critically imperiled for Oregon, because nationwide the upland sandpiper is considered to be secure. Since moderate grazing does not appear to be detrimental and recreation uses remain level or decrease, it is assumed that although individuals or habitat may be impacted, implementing any of the alternatives will not cause a trend toward Federal listing nor cause a loss of viability to the population or species.

In addition, several other species have limited distribution in the planning area as they are considered sensitive only in Washington, which represents a very small portion of the planning area. One example is the Barry's hairstreak, a butterfly associated with juniper (Fleckenstein 2006). Juniper accounts for less than one percent of the vegetation within the Umatilla National Forest (see table 231 in the "Forested Vegetation, Timber Resources, and Wildland Fire" section). This would indicate an extremely limited distribution of habitat where this species would be considered sensitive within the Umatilla National Forest and even more limited when compared to the amount of juniper in Washington. The intent of the plan is to restore or maintain terrestrial vegetation, which would include juniper, and large-scale treatment within this vegetation type is not anticipated. Therefore, there is no indication that implementing any of the alternatives would cause a trend toward Federal listing nor cause a loss of viability to the population or species.

Riparian Habitats

Several species are associated with riparian habitats, such as the Lewis's woodpecker, bald eagle, inland tailed frog, Columbia spotted frog, fir pinwheel, and the fritillary butterflies. When considering existing conditions, the bald eagle had a low level of concern for viability for the Blue Mountains. Human activities within or adjacent to riparian habitat was the major concern for the bald eagle. None of the alternatives would cause this to worsen, so it is assumed that the level of concern would remain low.

Both the inland tailed and the Columbia spotted frog had a low viability score for existing conditions. Riparian areas, lakes, and wetlands are protected for all management direction and

Executive Order 11190 (Carter 1977) limits the loss or conversion of this type of habitat. The desired condition for all alternatives is to maintain or increase the extent and diversity of wetlands within the Blue Mountains (1.1.3 Wetland function). Outside the national forests, much of these frogs' habitat is in private ownership. Many historical wetlands occurred on private lands that were converted to agricultural uses. Both species had risk factors of grazing, roads, invasive species, and disease. Invasive species and disease are, for the most part, outside the control of plan components. None of the alternatives envision new road construction unless a commensurate level of decommissioning occurs (KW-1 S-15). All action alternatives envision a reduction of roads open to the public compared to existing conditions, except alternative D which maintains the existing condition. All alternatives establish Riparian Management Areas that have several other standard and guidelines that should alleviate some of the risks posed to each of these species. Monitoring conducted as part of PACFISH/INFISH (Archer et al. 2009) has indicated, at least on a broad scale, that there has been recovery in several parameters most closely associated with livestock grazing effects. Analysis of PACFISH-INFISH Biological Opinion PIBO data for the three national forests also indicates a favorable trend in many of the parameters important to both of these frogs.

In general, alternative C should see the greatest improvement and the most rapid recovery of riparian and wetland areas due to the reduced area subjected to domestic livestock grazing and the stricter utilization levels within those areas that are grazed. Additionally, alternative C establishes the most acres within riparian management areas (RMAs) and with the widest buffer zone. Alternative D would be the least favorable towards riparian species in that more acres are proposed for domestic livestock grazing and the riparian management area is the narrowest of all of the alternatives. Alternatives A and B would be similar in impacts as the amount of area dedicated to domestic livestock grazing is the similar and the RMA widths are the same. Because alternative F has lower utilization levels in anadromous fish and bull trout watersheds (see Table 323) it would have slightly more effect than alternative C, but would greatly reduce impacts when compared to the remaining alternatives. There are several standards and guidelines for RMAs that apply to most alternatives, which also will provide for recovery.

Table 323. Maximum utilization and residual stubble height within riparian sites. The minimum residual stubble height (applies at the greenline) for all alternatives is 4 to 6 inches. The maximum bank alteration for all alternatives is 20 percent.

Measure	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F
Maximum percent utilization of woody vegetation	40%	25%	40%	25% within bull trout spawning and rearing reaches and 40% for all watercourses including anadromous fish reaches	25% in bull trout spawning and rearing habitat, 35% in anadromous fish reaches within the Umatilla and Wallowa-Whitman National Forests, and 40% in all other water courses
Maximum percent utilization of herbaceous vegetation	40%	10%	40%	25% within bull trout spawning and rearing reaches and 40% for all watercourses including anadromous fish reaches	25% in bull trout spawning and rearing habitat, 35% in anadromous fish reaches within the Umatilla and Wallowa-Whitman National Forests, and 40% in all other water courses

Based on the desired conditions for each alternative and the standards and guidelines for riparian/aquatic habitats, implementing any of the alternatives may impact individuals of those species associated with riparian habitats, but would not cause a trend toward Federal listing nor cause a loss of viability to populations or species.

Special Habitats

Several sensitive species are associated with specialized habitats for which disturbance can be an issue. One broad category of special habitats is nest, roost and denning sites. All alternatives include the standard WLD-HAB-6 S-1, which prohibits disturbance within 1,200 feet of such areas (bald eagle, Lewis' woodpecker). Bat maternity and roost sites (Townsend's big-eared bat, fringed myotis) are not to be disturbed (WLD-HAB-18 G-7). Trees with nest cavities and large snags are also provided protection (WLD-HAB-10 G-11, WLD-HAB-12 S-7, and WLD-HAB-21 G-6).

The forest plan revision identifies a number of desired conditions, objectives, and standard and guidelines for the management of the numerous plant association/seral stages occurring within the planning area specifically developed for the restoration and maintenance of terrestrial vegetation communities. Restoring and maintaining terrestrial vegetation conditions has been identified as one of the top management priorities within the Blue Mountains. Several terrestrial invertebrate species occur primarily in talus slopes associated with dry ponderosa pine or Douglas-fir and the plan provides information for the conservation of special habitats, such as talus slopes (see appendix A, 1.13 Special Habitats).

Cumulative Effects

Focal Species

Boreal owl habitat was estimated by Wisdom et al. (2000) to have decreased by 61 percent within the Columbia River Basin, but only by 3 percent in the Blue Mountains Ecological Reporting Unit (ERU) compared to historical conditions, resulting in a stable trend for the species in the Blue Mountains. Much of their preferred habitat in the Blue Mountains is within National Forest System lands, and therefore few cumulative effects are anticipated from lands under private, state, or other Federal administration. At the broad scale, Nature Serve ranks the boreal owl as apparently secure (N4) in the United States. The effects of climate change, although uncertain, indicate that a reduction in habitat for this species will probably occur during the next 50 to 100 years within the Blue Mountains.

Cassin's finch is distributed from British Columbia southward and into Mexico during winter. Throughout the conifer belts of North America's western interior mountains, Cassin's finch can be one of the most common and conspicuous breeding birds (Hahn 1996).This finch is considered a year round resident in Oregon and regionally they are commonly found breeding throughout the mountainous west. Wisdom et al. (2000) did not address this species but rather the Hammonds flycatcher which was placed in the same group as this finch (USDA Forest Service 2010). Wisdom et al. (2000) estimated a 42 percent decrease in source habitat within the Columbia River Basin, and a 34 percent decrease in the Blue Mountains ERU compared to historical conditions for the Hammond's flycatcher. At the broad scale, Nature Serve ranks the Cassin's finch as secure (N5) in the United States and apparently secure (S4) in Oregon. Although the Cassin's finch is associated with open forested stands, which may be more abundant on private lands, they are associated with larger trees, which may not be more abundant on private lands (see Old Forest section). No information exists to indicate that management of lands under private, state, or other Federal administration would change; therefore, if the downward trend in habitat within the Blue

Mountains as given by Wisdom et al. (2000)is a result of management off-forest, then this continued cumulative effect would be expected.

Western bluebirds breed throughout much of the western United States, Mexico, and southwestern Canada. Apparent declines in numbers of this species in the Pacific Northwest and British Columbia, especially in regions west of the Cascade Range, have generated concern. This was one of the species modeled by Raphael et al. (2001) for the SDEIS for the Interior Columbia Basin, which resulted in an outcome of C currently for National Forest System and BLM administered lands but changed to a B outcome for 2 of the alternatives in 100 years and remained the same for one alternative. At the broad scale Nature Serve ranks the western bluebird as secure (N5) in the United States and apparently secure (S4) in Oregon. Western bluebirds respond positively to artificially constructed nest boxes (Brawn and Balda 1988) and bluebird enthusiasts in Washington, Oregon, and British Columbia have established trails of nest boxes in an effort to reestablish local breeding populations. Cassidy and Grue (2000) estimated that in Washington, more than 57 percent of population occurs on private as opposed to public lands. Continued expansion of residential/industrial areas and changes in agricultural practices could continue to impact suitable areas for breeding and foraging. Some western bluebirds migrate to California and Baja California in winter (DeGraaf et al. 1991) and conditions on these wintering grounds if similar to the above, could affect the status of populations.

Fox sparrows are one of North America’s most geographically variable birds with 18 subspecies divided into 3 or 4 distinct groups with equally variable life-history characteristics across its range (Weckstein et al. 2002). Because of its preference for shrubby habitats, fox sparrow probably responds well to the more intensive timber management that occurs on private land, so in this sense the cumulative impacts would be positive. There is no indication that management of lands under private, state, or other Federal administration would change appreciably from current; therefore, few cumulative effects are expected. At the broad scale, Nature Serve ranks the fox sparrow as secure (N5) in the United States and apparently secure (S4) in Oregon. The fox sparrow is migratory, and as such is more likely to be affected by changes in climate, which may result in a phenology mismatch as described by Jones and Cresswell (2009).

Lewis’s woodpecker is found throughout ponderosa pine forests in the western United States. The species is migratory within the northern portion of its breeding range with most individuals leaving summer areas during winter. Migratory movements to areas outside of breeding range probably occur annually but vary considerably in magnitude from year to year (Tobalske 1997). Species may winter outside of the breeding range in large numbers one year, but may be almost completely absent from the same areas the next. No data on distances and routes for marked individuals exists. Relatively short-distance migrations (0 to 20 km) occur within the breeding range (Bock 1970, Tashiro-Vierling 1994) and longer-distance migrations (100 to 1,000 km or more) probably occur for individuals breeding in the northern portion of the range. Exact distances are largely unknown due to their irregular movements as breeding and wintering habitat varies and the species is opportunistic in its foraging habits (Bock 1970). Wisdom et al. (2000) in evaluating the migratory population within the Columbia Basin found that source habitat for this species had the largest negative relative change of any of the species they analyzed. Wisdom et al. (2000) evaluated what is termed secondary source habitat in this analysis, and attributed the decline primarily to a basin-wide change from old-forest ponderosa pine to mid-seral structural stages. They also recognized the loss of cottonwood/willow old forest structure due to a change in the historical hydrological regime. The current direction on federally administered lands would be to manage towards more old-forest within ponderosa pine, but much of the low elevation dry forest is on private lands (ODFW 2006) and is most likely to remain in non-old forest conditions.

The vast majority of the cottonwood/willow habitat also occurs on private lands and will probably continue to be managed at an earlier seral structure than preferred by this species. Climate change may actually provide a short term benefit to this species because of the predicted increase in individual tree mortality due to stress (van Mantgem et al. 2009) as well as a warmer climate that has already lead to more frequent and severe fires in the western United States (Westerling et al. 2006), increasing the primary habitat for this species. Association with agricultural settings likely exposes Lewis's woodpecker to herbicides and insecticides (Abele et al. 2004, Tashiro-Vierling 1994), which could have potential negative effects.

Because habitats on a whole are projected to increase in the Blue Mountains for all alternatives, public lands should contribute to viability within the region. The effects of climate change, although uncertain, indicate that a change in habitat for terrestrial species will occur during the next 50 to 100 years within the Blue Mountains. If the anticipated increase in fire severity and frequency due to drier conditions occurs, this could lead to an improvement, at least in the short term, in habitat for the western bluebird and fox sparrow, while reducing habitat for the boreal owl.

Bighorn sheep are native to western North America, from British Columbia to Mexico. Within this range, several sub-species occur. Populations have been greatly reduced throughout its range from a once very common abundance. It has been estimated that half the bighorn sheep habitat within the Columbia River Basin, is currently unoccupied (Wisdom et al. 2000). Disease transmission between domestic sheep and wild sheep is considered the greatest threat to wild sheep populations. There are private lands where domestic sheep currently graze immediately adjacent to public lands. Additionally, domestic sheep are a common 4-H project, which may also place them within foray distances of existing and/or future wild sheep range increasing the risk of disease spreading to wild sheep populations.

Threatened, Endangered, Proposed, and Candidate Species

The gray wolf has circumpolar distribution in the northern latitudes. It occurs in Europe, Asia and North America. In North America, it is considered common in Alaska and most of Canada. Within the recovery areas of the U.S., populations have been increasing, with the largest populations in Minnesota, Michigan, and Wisconsin. Eastern Oregon has recently been colonized by wolves thought to have originated in Idaho. Gray wolf populations are increasing in eastern Oregon and this trend is likely to continue during the short term due to high prey populations, decreasing open motor vehicle route density across the Blue Mountains and management direction to protect denning wolves. As populations increase wolves will continue to disperse into new areas, eventually increasing contact with human populations and activities. Habitat does not appear to be limiting, and therefore the greatest threat is mortality due to interaction with humans. The legal and illegal killing of individuals, both on and off of public lands is of concern. Hunting in Idaho could potentially pressure more individuals to relocate to Oregon. Increased livestock depredation and interaction with humans could lead to lethal removal of individuals by the state game department as well as the illegal shooting of individuals, which has already occurred. Over the long term, human social pressures will likely restrict the distribution of wolves to areas of limited human occupation and away from concentrated domestic livestock production. In the end, the cumulative effect of human tolerance and persecution will have to change to achieve long-term successful recovery.

The wolverine has circumboreal distribution. In North America, it extends across Canada and Alaska, and uses forested and nonforested environments. In the western U.S., wolverine are known to occur in Washington, Idaho, Montana and Wyoming. Wisdom et al. (2000) estimated a

14 percent increase in source habitat within the Columbia River Basin with more than 80 percent of the watersheds in the Blue Mountains ecological reporting unit (ERU) (6) showing an increase of more than 100 percent in source habitat compared to historical conditions. Raphael et al. (2001) evaluated wolverine habitat across the Columbia Basin and showed that likely habitat for wolverine occurred more in the northern Blue Mountains than the southern parts (e.g., Malheur National Forest).

Since most wolverine habitat is found on remote, high-elevation National Forest System lands, few cumulative effects are expected from lands under private, state, or other federally administered lands. Probably the greatest threat to wolverines is the ever-increasing disturbance from activities such as snowmobiling, heli-skiing, cross-country skiing, and snowshoeing. Recent advances in snowmobile technology capabilities has raised concerns about their ability to access previously isolated areas (Wisdom et al. 2000) where natal denning may be occurring. Although none of the alternatives attempts to expand this type of recreation in the future, it is anticipated that expansion of such activities will occur.

As with most species that inhabit high elevation habitats of the Blue Mountains, climate change is of concern, but more so with the wolverine. Spring snow cover, which has been shown to strongly correlate with wolverine denning locations and year-round movement, is also correlated to dispersal pathways across the landscape (Copeland et al. 2010, Schwartz et al. 2009). This bioclimatic niche (Copeland et al. 2010) is likely to continue to be strongly impacted by global climate change (Mote et al. 2005), threatening wolverine throughout their geographic distribution as spring snow cover may decrease.

The vast majority of greater sage-grouse habitat in Oregon does not occur on National Forest System lands, but on lands administered by BLM (71 percent) and private lands (21 percent). The BLM is reviewing their management with the intention of enhancing greater sage-grouse conservation. The Baker Population of greater sage-grouse (Wallowa-Whitman National Forest) occurs mostly on private lands where there are limited regulatory mechanisms making it uncertain as to whether state-recommended conservation measures and practices will be applied on the majority of lands supporting this population. It is assumed that ODFW, in cooperation with USFWS and NRCS, will continue to provide incentives to private landowners for the conservation of sage-grouse habitat. Hunting will continue to be a cumulative impact, but at the current level is not considered to be a threat to the breeding population (Hagen 2011).

Climate change will have an important influence on sage-grouse habitats, as the various scenarios predict increasing temperature, atmospheric carbon dioxide, and severe weather events all of which favor cheat grass expansion and increased wildfire activity (Miller et al. 2011). Increase temperature predictions suggest that sagebrush habitats could be replaced with other woody vegetation causing further decline in sage-grouse habitats (Bradley 2010, North American Bird Conservation Initiative (NABCI) 2010).

Forest Service Sensitive Species

Many sensitive species of birds, especially those that are migratory, have ranges that encompass landscapes outside of the national forest. As such they are exposed to threats beyond the control of the Forest Service. For example, the use of insecticides and other agrochemicals associated with cultivation practices has been identified as one of the main threats to the upland sandpipers on their wintering grounds in South America (Vickery et al. 2010). Many of the riparian associated species have been impacted by loss of habitat to agriculture, especially in the lower valley bottoms. ODFW in cooperation with other government agencies has developed programs and strategies to improve riparian habitats on non-federally administered land (ODFW 2006). Some species, such as buffleheads and Harlequin duck are migratory and can be legally hunted throughout the flyway.

Wormworth and Mallon (2006) suggest that projected changes in vegetation shifts caused by climate change could affect bird species. They project that alpine vegetation communities within the arctic would likely be reduced. Although there is a high degree of uncertainty, this same projected change would likely occur within the Blue Mountains resulting in the loss and fragmentation of habitat.

Affected Environment – Management Indicator Species

Species are generally selected as management indicator species in order to estimate the effects of each alternative on fish and wildlife populations. The planning rule states that certain vertebrate and/or invertebrate species present in the area shall be identified and selected as management indicator species and the reasons for their selection will be stated. These species shall be selected because their population changes are believed to indicate the effects of management activities (CFR 219.19(a)(1)). Management indicator species can be chosen from five categories of species:

- Endangered and threatened plant and animal species identified on state and Federal lists
- Species commonly hunted, fished, or trapped
- Nongame species of special interest
- Species with special habitat needs that may be influenced significantly by planned management programs
- Additional plant or animal species selected because their population changes are believed to indicate the impacts of management activities on other species of selected major biological communities or on water quality

The terrestrial management indicator species selected during the last plan revision effort (1990) in the Blue Mountains were selected because their habitat requirements encompassed a broad range of conditions. For the 1990 forest plans, the Forest Service identified 24 different species or groups of species as management indicator species. It was anticipated that by selecting and managing for these species the needs of all of the other fish and wildlife species would be adequately met. In the 1990 forest plans, there was one general objective for management indicator species: to provide for the habitat requirements of the selected management indicator species and maintain viable populations of management indicator species. However, the 1982 NFMA regulations do not make a direct link between management indicator species and viability. Attempts to do so in individual plans have been problematic. Simply stated, population trends of management indicator species are not expected to mirror trends of other species.

Within the context of this planning process, management indicator species are used for the purpose of assessing the impacts of the alternatives on wildlife populations as directed in CFR 219.19(a) (1) and (2). The no-action alternative (no change in current management) will be evaluated in terms of the management indicator species listed in the 1990 forest plans.

Detailed rationale for selecting those management indicator species identified for alternatives other than the no-action alternative is found in the project record. What follows is a description of the management indicator species for the no-action alternative, the management indicator species that are common to all alternatives, and the management indicator species common only to action alternatives. Table 324 is a listing of management indicator species selected for analysis by forest and by alternatives.

According to 36 CFR 219.19(a) (1) management indicator species are selected "in order to estimate the effects of each alternative on fish and wildlife populations." Section 219.19(a) (2) requires that "planning alternatives shall be stated and evaluated in terms of both amount and quality of habitat and of animal population trends of the management indicator species," and refers to forest plans. Indicators should be chosen for specific habitats identified as being at risk, where there is a high level of management actions anticipated, and where there is reasonable certainty that management indicator species population changes can be monitored and attributed to Forest Service activities (Hayward et al. 2004).

Table 324. Management indicator species selected for each national forest by alternative

National Forest	Management Indicator Species	Alt. A	Alts. B, C, D, E, and F (action alternatives)
Malheur	American marten	X	
	Northern three-toed woodpecker	X	
	Primary excavators	X	
	Pileated woodpecker	X	X
	Rocky Mountain elk	X	
	White-headed woodpecker		X
	Mule deer		X
Umatilla	American marten	X	
	Northern three-toed woodpecker	X	
	Primary excavators	X	
	Pileated woodpecker	X	X
	Rocky Mountain elk	X	X
	White-headed woodpecker		X
Wallowa-Whitman	American marten	X	
	Northern three-toed woodpecker	X	
	Primary excavators	X	
	Northern goshawk	X	
	Pileated woodpecker	X	X
	Rocky Mountain elk	X	X
	White-headed woodpecker		X

Estimating the population density, let alone population trend, for most any vertebrate species is at best problematic (Bart et al. 2004). Animals often are difficult to capture or observe, they are harmed in the process, or the associated costs and effort of making absolute counts or censuses are prohibitive (Gibbs 2000). Failure to detect a species' presence in an occupied habitat patch is a common sampling problem when the population size is small, individuals are difficult to sample, or sampling effort is limited (Gu and Swihart 2004). Because accurately estimating absolute population size is difficult, ecologists frequently rely on indices of population size that they monitor over time as a surrogate for monitoring changes in actual population size (Gibbs et al. 1998).

Few long-term data sets exist for the analysis area. Monitoring of wildlife populations and habitats has been lacking or poorly implemented on national forests due largely to the lack of capacity or commitment to fund data collection, management, and analysis (Manley et al. 2006). Population estimates for some of the hunted species, such as elk and mule deer, are available through the state wildlife agencies. Breeding Bird Surveys (BBS) and Christmas Bird Counts (CBC) represent the only long-term data available to assess broad scale trends in most bird species. Breeding Bird Surveys provide some information regarding status of bird species and the Data is categorized into three credibility ratings. Altman (2000) indicated that a total of 31 routes were at least partially located within the Blue Mountains of Oregon and Washington. Although the BBS provides a huge amount of information about regional population change for many species, there are a variety of possible problems with estimates of population change from BBS data. Limitations of both methods for discerning population trends have been addressed (Sauer et al. 2008). For example, the year-to-year variation in abundance at any one locale may not indicate overall population decline but simply reflect a lack of detection on the part of the surveyor (Sauer et al. 1994) or abandonment on the part of the birds of one location for another.

The Christmas Bird Count data referred to in this document was generated using the number of birds reported per party hour; a measure of the amount of time spent searching for birds or the amount of effort expended. This is one way to standardize Christmas Bird Count data over time. Some years, there may have been many people counting birds, while other years there may have been fewer participants in the field. As CBC participation fluctuates (and as the number of CBC Count Circles increases), raw count numbers may also fluctuate (more counters can often lead to more birds reported). This is one method for correcting the differences in effort over time.

A combination of factors, including experience with implementing forest plans during the last decade, court rulings, scientific discourse concerning management indicator species (Andelman and Fagan 2000, Landres et al. 1988, Niemi et al. 1997, Roberge and Angelstam 2004, Wiens et al. 2008), and better understanding of the role of management indicator species have refined how management indicator species are viewed in planning. Management indicator species have always been defined as useful in assessing management effects, but the array of species actually selected often was driven by a desire to have a representative of each habitat that occurred on the national forest and not to assessing management effects (Hayward et al. 2004). Some of the confusion surrounding management indicator species results from the misperception that management indicator species is a special designation, resulting in more protection for the species. The reality is that management indicator species are simply yardsticks to measure the impact to habitats at risk in the alternative phase of planning and then to measure how well the land management plan is accomplishing what it said it would accomplish and to verify that the chosen management indicator species are responding in the manner predicted. With the focus on management issues, not every habitat will nor should be represented by a species on the management indicator species list.

CFR 219.35(a) and (b) has directed the Forest Service to utilize the best available scientific information during forest land management planning. As such the following analysis will try to incorporate new scientific information into the analysis of Management Indicator Species, especially the concept that they are meant to be measures of how well the forest plan is meeting its desired conditions by focusing management direction developed in the alternatives, providing a means to analyze effects on biological diversity, and serving as a reliable feedback mechanism during forest plan implementation (Hayward et al. 2004).

Environmental Consequences – Management Indicator Species

Management Indicator Species Only for Alternative A

American Marten for All Three National Forests

The American marten (*Martes americana*) is broadly distributed, extending from the spruce-fir forests of northern New Mexico to the northern limit of trees in arctic Alaska and Canada (Buskirk and Ruggiero 1994). The American marten was considered a focal species in several of the subbasin plans completed within the Blue Mountains and is a focal species for the forest plan revision effort. The Interior Columbia Basin Ecosystem Management Project included the American marten in Family 2 (broad elevation old forest)/Group 5(late-seral, montane forests). Wisdom et al. (2000) reported a moderately or strongly declining trend of American marten habitat within the Columbia Basin. In the Blue Mountains ecological reporting unit (ERU), approximately 40 percent of the watersheds had strongly declining trends for American marten habitat. Review of the maps developed by Wisdom et al. (2000), indicate that the watersheds with the greatest increase of American marten habitat are located in the southern portion of the Blue Mountains ERU.

The American marten was identified as a management indicator species for all three national forests. Although detail differs between the 1990 forest plans, it was selected to represent mature/old forest structure. It was also identified as having a viability concern and Forest Service Region 6 habitat direction was developed. Minimum habitat patches were to include:

- Mature/old growth patches larger than 160 acres with canopy covers of 50 percent or greater
- 1.5 snags greater than 20 inches d.b.h. per 10 acres
- 1.8 snags greater than 12 inches d.b.h. per acre
- 6 down logs per acre

Management was to provide this structure in blocks 160 acres or larger for every 4,000 to 5,000 acres. None of the 1990 forest plans defined habitat any further than forested ecosystems. This leads to the assumption that the forested landscape was anticipated to have 3 to 5 percent of the landscape in marten habitat. This direction was prior to the 1994 Eastside Screens amendment that indicated mature/old forest structure should be managed towards HRV.

Both the Wallowa-Whitman and Umatilla National Forests predicted a decline in marten populations based on implementing the1990 forest plans. The Malheur National Forest did not predict a population trend but rather estimated providing habitat that would support 125 pairs based on the assumptions at that time.

American Marten Habitat - The American marten is closely associated with late-successional stands of mesic conifers, especially those with complex physical structure near the ground (Buskirk and Powell 1994). Bull et al. (2005) concluded that American marten showed a strong preference for old-structure, unlogged stands in subalpine fir and spruce forests with canopy covers greater than or equal to 50 percent, and a high density of dead trees and logs. Resting and denning sites for marten are important habitat components as they provide protection from predators, weather, and thermal stress. Bull and Heater (2000) found that in northeastern Oregon, 43 percent of the marten resting sites were in trees with natural platforms; about 23 percent were in trees with cavities: about 23 percent were under the snow; and, 10 percent were in hollow logs, slash piles or underground. In the same study, they found that 40 percent of the marten dens were in tree cavities: 37 percent were in hollow logs; 17 percent were underground; and, 6 percent in slash piles.

As displayed in table 298, the American marten was chosen as a focal species and a model was developed to assess source habitats and threats to this species. For the purpose of the following analysis, source habitat for both current and historical conditions was considered to be cold moist and cold dry forests with multi-stories, large-tree structure (greater than 20 inches d.b.h.), and closed canopies (i.e., greater than 60 percent). Other factors that were considered in the evaluation of habitat for this species included open motor vehicle route density, openness of habitat, patch size and riparian habitat (Wales et al. 2011). Patch size has been described by several authors (Baldwin and Bender 2008, Chapin et al. 1998, Hargis et al. 1999, Kirk and Zielinski 2009, Potvin et al. 2000, Slauson et al. 2007, Snyder and Bissonette 1987) with a suggestion by Potvin et al. (2000) of managing for patch sizes greater than 250 acres. The 160 acres found in the original plan is within the range given by the various authors, but is less than the minimum of 200 acres given by Slauson et al. (2007).

Effects from Alternative A on American Marten – Using the data initially found in all three 1990 forest plans, it was predicted that marten habitat would occur on approximately 3 to 4 percent of the landscape. Figure 39 compares what percent of each national forest is marten habitat based on the potential vegetation groups analyzed in Wales et al. (2011), and then projects it forward. These results indicate that all three 1990 forest plans exceed what was originally projected to be in marten habitat, but only the Umatilla National Forest meets or exceeds the desired conditions of the Eastside Screens amendment. The Malheur National Forest would be on a trajectory to reach that desired condition in decade three, whereas the Wallowa-Whitman National Forest would be within the margin of error for the first decade, and maybe the second, but is on a downward trajectory for alternative A.

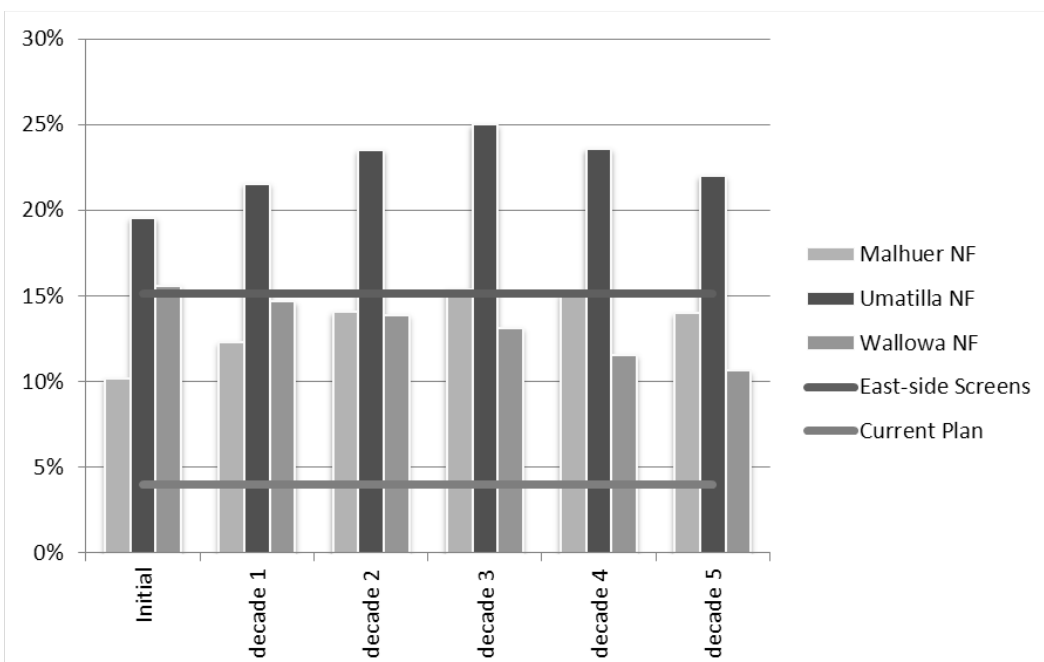

Figure 39. Percent source habitat for the American marten during the first five decades (compared to desired conditions of 1990 forest plans as amended by the Eastside Screens)

American Marten Population Trend – The Umatilla and Wallowa-Whitman National Forests originally predicted a downward trend for American marten populations based on the habitat reduction predicted in the original forest plan. Because of the Eastside Screens amendment, this predicted decline should not have occurred. Indeed, the Malheur National Forest 1990 forest plan predicted providing habitat for 125 martens by the end of the first decade. After two decades of implementation, using the same assumptions as the original forest plan analysis indicates sufficient habitat for 157 martens.

Using the habitat data displayed in figure 39 one could assume that populations of American marten would be stable within the Umatilla and Wallowa-Whitman National Forests, at least for the first two decades, with an increasing trend in the Malheur National Forest. Carnivores are extremely difficult to survey, especially on large geographic areas (Gompper et al. 2006) and population trends within the Blue Mountains are unknown. A method of gaining insight into abundance (and certainly distribution) of a species is examination of harvest and trapping records (Gese 2001). The best information available to help assess trends would be the trapping data (Hiller 2010) collected by the state game agencies. The data is reported per 100 trap nights in an attempt to correct for the difference in effort, but can still only be used to provide a very coarse look at trends (see figure 40). It appears from figure 40 that a slight downward trend may be occurring; however, trapping data is subject to many variables, such as experience of the trapper, pelt prices, differential harvest methods, and environmental and social factors all of which can influence harvest rates (Gese 2001, Gompper et al. 2006, Smith et al. 1984).

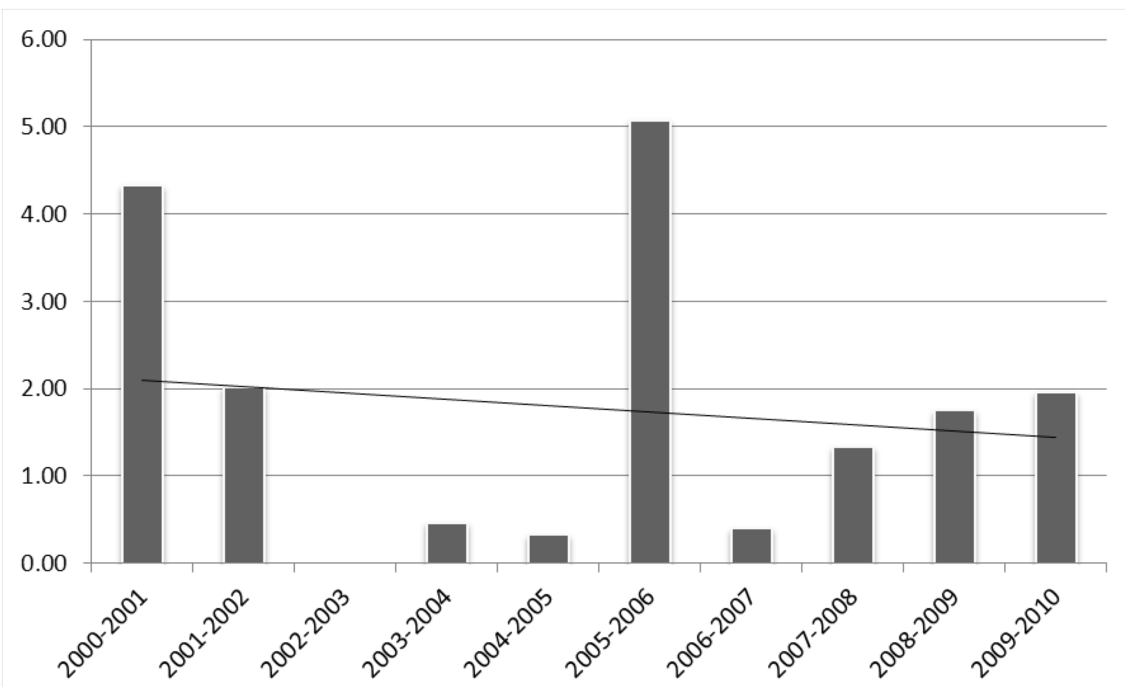

Figure 40. American marten harvested per 100 trap nights in eastern Oregon during the last decade

Primary Cavity Excavators for All Three National Forests

Primary cavity excavators include:

- Northern three-toed woodpecker
- Lewis' woodpecker

- Red-naped sapsucker
- Williamson's sapsucker
- Downy woodpecker
- Hairy woodpecker
- White-headed woodpecker
- Black-backed woodpecker

All three national forests identified primary cavity excavators as management indicator species. The Malheur National Forest provided a list in the forest plan and the Wallowa-Whitman National Forest listed the species it considered as primary cavity excavators in appendix G of the FEIS (USDA Forest Service 1990b). Both the Malheur and the Wallowa-Whitman National Forests included the yellow-bellied and red-breasted sapsuckers in their list. Yellow-bellied, red-naped, and red-breasted sapsuckers form a closely related complex and there has been confusion regarding whether or not they are separate species. Walters et al. (2002) provides this explanation:

> Red-breasted and red-naped sapsuckers, together with the yellow-bellied sapsucker (*Sphyrapicus varius*), form a superspecies. These three species have, for the most part, separate distributions but were long treated as forms of a single species—the yellow-bellied Sapsucker—until 1983, when systematic studies showed distinctions sufficient to warrant taxonomic treatment as separate species. Most of the early literature and research on this complex refer to yellow-bellied sapsuckers of eastern North America (found generally east of the Rocky Mountains). Limited, but more recent, work has focused on populations of the red-naped sapsucker of the Rocky Mountain trench region from central British Columbia to Arizona and populations of the red-breasted sapsucker with coastal distribution from northern British Columbia to California. The biology of these three species appears to be quite similar.

It would appear that neither the red-breasted nor the yellow-bellied sapsuckers occur within the planning area, indicating that the 1990 forest plans were referring to the red-naped sapsucker.

Even though the Malheur and Wallowa-Whitman National Forests actually listed individual primary cavity excavators, management direction was for primary cavity excavators in general. In those areas that were subject to management, the desire was to maintain snags at a level that would maintain at least 60 to 65 percent of the potential population, which relates to appendix 23 in Thomas (1979). Table 325 is based on appendix 23.

Table 325. Snags per 100 acres needed to meet the needs of primary excavators at the 60 percent population level based on Thomas (1979)

d.b.h. (inches)	Juniper	Aspen	Riparian	Ponderosa Pine	Mixed Conifer	White/ Grand Fir	Lodgepole/ Subalpine Fir
≥ zero				8.0	8.0	8.0	
≥ 12	2.3	2.3	6.0	8.2	8.2	8.2	3.5
≥ 10		6.7	3.0	4.5	4.5	1.8	7.3
≥ 6		9.0	9.0				
Totals	2.3	18.0	18.0	13.5	13.5	10.8	10.8

Eastside Screens modified the snag requirements by requiring that all sale activities (including intermediate and regeneration harvest in both even-aged and uneven-aged systems, and salvage) will maintain snags and green replacement trees of 21 inches or greater d.b.h. (or whatever is the representative d.b.h. of the overstory layer if it is less than 21 inches), at 100 percent potential population levels of primary cavity excavators. This plan amendment also states this should be determined using the best available scientific information on species requirements as applied through current snag models or other documented procedures.

The 1990 forest plan snag and down wood standards were based on wildlife species models (e.g., biological potential for snags) and tools that were developed in the 1970s and 1980s. Rose et al. (2001; page 602) determined from monitoring results that the biological potential models are a flawed technique for meeting the needs of primary excavators. DecAID (Mellen-McLean et al. 2009), which was developed to collect and synthesize the best available scientific information on wildlife relationships with dead wood, has demonstrated not only the variability of use between species but also the variability of dead wood distribution across the landscape.

Effects from Alternative A to Primary Cavity Excavators – The following analysis is based on a review of information from DecAID and Marshall et al. (2003). The analysis is only for green forests and compares wildlife species-specific data from DecAID with landscape data from Mason and Countryman (2010). Again, rather than conduct the analysis using the percent of potential population levels, snag levels will be assessed regarding their distribution across the landscape in comparison to what would have been expected for historical conditions. The concept of tolerance levels for individual species of wildlife from DecAID is utilized in this analysis. A tolerance level is the specific value at the edge of a tolerance interval. For example, a 30 percent tolerance level for a wildlife species of 2.5 snags/acre greater than 10 inches d.b.h. means that 30 percent of the population (at least in the population studied) use areas which contain densities of snags up to 2.5/acre. An 80 percent tolerance level of 30 snags/acre greater than 10 inches d.b.h. means that 80 percent of the population use areas which contain densities of up to 30/acre of 10 inch snags. Data was not available in DecAID for Hairy woodpecker, Lewis’s woodpecker, northern flicker, northern three-toed woodpecker and red-naped sapsucker.

Mason and Countryman (2010) conducted a snag analysis using CVS plots and made comparisons with the results from the DecAID landscape analysis and then condensed snag distribution into fewer categories. The results in tables 8 and 9 in Mason and Countryman (2010) are based on these categories. What this means for example is that a density of 2.5 snags per acre for snags 20 inches d.b.h. in ponderosa pine would be in the category of 2-4 trees per acre in DecAID, but will be in the 2 to 6 trees per acre using Mason and Countryman (2010). There is a caution for those areas where species tolerance levels were identified as being zero snags per acre (see table 326) and where the values given for current and historical landscape levels (see table 327 and table 328) start with zero. It is unlikely that a large area of the landscape was devoid of snags due to the various disturbance regimes (fire and insects and disease) that historically were at work. It follows then that where 75 percent of the landscape is identified as being in the range of zero to 2 snags per acre in Mason and Countryman (2010), this should not be interpreted as 75 percent of the landscape had zero snags, but rather that snags existed in low numbers.

Table 326. Snag density per acre for 30, 50, and 80 percent tolerance levels at nest and roost sites (10 and 20 inch snags) by species of primary cavity excavator within the Blue Mountains national forests based on data from DecAID (Mellen-McLean et al. 2009)

Species	Potential Vegetation Group Associations	Snag density/acre for 30, 50, and 80 percent tolerance levels: 10 inches d.b.h. or greater (green)			Snag density/acre for 30, 50, and 80 percent tolerance levels: 20 inches d.b.h. or greater (green)		
		30%	50%	80%	30%	50%	80%
Black-backed woodpecker	Ponderosa pine/Douglas-fir	2.5	13.6	29.2	0.0	1.4	5.7
	Eastside mixed conifer	2.5	13.6	29.2	0.0	1.4	5.7
White-headed woodpecker	Ponderosa pine/Douglas-fir	0.5	1.9	4.0	0.5	1.8	3.8
	Eastside mixed conifer	0.3	1.9	4.0	0.5	1.8	3.8
Williamson's sapsucker	Ponderosa pine/Douglas-fir	14.0	28.4	49.7	3.0	8.4	16.3
	Eastside mixed conifer	14.0	28.4	49.7	3.3	8.6	16.6

Table 327. Percent of the landscape that historically met the snag density (10 and 20 inches) tolerance levels for primary cavity excavators based on tables 8 and 9 of Mason and Countryman (2010)

Species	Potential Vegetation Group Associations	Snag density/acre for 30, 50, and 80 percent tolerance levels: 10 inches d.b.h. or greater (green)			Snag density/acre for 30, 50, and 80 percent tolerance levels: 20 inches d.b.h. or greater (green)		
		30%	50%	80%	30%	50%	80%
Black-backed woodpecker	Ponderosa pine/Douglas-fir	64.3	7.2	4.6	78.5	78.5	14.5
	Eastside mixed conifer	34.0	14.8	12.0	62.1	62.1	20.1
White-headed woodpecker	Ponderosa pine/Douglas-fir	64.3	64.3	19.5	78.5	14.5	14.5
	Eastside mixed conifer	34.0	34.0	24.9	62.1	62.1	20.1
Williamson's sapsucker	Ponderosa pine/Douglas-fir	7.2	4.6	2.7	14.5	1.7	1.2
	Eastside mixed conifer	24.9	12.0	8.0	20.1	3.6	3.9

Table 328. Percent of the landscape that currently meets the snag density (10 and 20 inches) tolerance levels for primary cavity excavators based on tables 14 and 15 of Mason and Countryman (2010)

Species	Potential Vegetation Group Associations	Snag density/acre for 30, 50, and 80 percent tolerance levels: 10 inches d.b.h. or greater (green)			Snag density/acre for 30, 50, and 80 percent tolerance levels: 20 inches d.b.h. or greater (green)		
		30%	50%	80%	30%	50%	80%
Black-backed woodpecker	Ponderosa pine/Douglas-fir	66.4	4.1	6.0	80.6	80.6	13.1
	Eastside mixed conifer	35.1	13.7	11.9	61.2	61.2	20.4
White-headed woodpecker	Ponderosa pine/Douglas-fir	66.4	66.4	19.3	80.6	80.6	13.1
	Eastside mixed conifer	36.4	36.4	24.3	61.2	61.2	20.4
Williamson's sapsucker	Ponderosa pine/Douglas-fir	4.1	6.0	2.6	13.1	1.6	1.1
	Eastside mixed conifer	13.7	11.9	9.6	20.4	3.8	4.2

As displayed in table 328, in some cases snag levels are within the expected historical range for a given species and outside in other cases (usually less than is needed). It should be pointed out that for both table 327 and table 328, the percentages for the 30, 50, and 80 percent species tolerance levels do not add up to 100 percent because of the overlap between categories. For example, the 30 and 50 percent tolerance levels for 20 inch plus snags for the white-headed woodpecker are 0.5 and 1.8 (see table 326) both of which fall in the zero to 2 trees per acre of tables 8 and 15 of Mason and Countryman (2010). One of the assumptions being made is that an increase in older forests would result in a commensurate increase in snag levels. It must be recognized that it will take time to observe densities of large snags increasing, but the 1990 forest plans as amended are directed to provide for high levels of primary cavity excavators. Granted, threats continue to exist for retention of snags on the landscape (see focal species discussion), but in general because of the direction for snag management with the Eastside Screens Amendment, management of dead wood on National Forest System lands for the current alternative would continue to improve.

The zero values in table 326 and the tables from Mason and Countryman (2010) make it difficult to compare the existing versus the historical condition for the 30 and 50 percent tolerance levels. Comparing the 80 percent tolerance level also is problematic, since the tolerance level for the black-backed woodpecker is at the upper end of the category given by Mason and Countryman (2010) and the white-headed woodpecker would be in the middle. Given this, the existing condition of the category containing the 80 percent tolerance level for all three species analyzed is close to what would be expected across the landscape historically.

Primary Cavity Excavators' Population Trend – Population trends were not predicted per se in the 1990 forest plans, but rather the plan's ability to provide snag densities for a percent of the total population as described by Thomas et al. (1979). This was based on determining how many snags per acre were needed to support a nesting pair of primary cavity excavators and then providing a percentage of that total to achieve what was considered the biological potential. The methodology/models that supported this perspective are no longer considered appropriate (Rose et al. 2001). Rather than a one-size-fits-all approach, the focus is to use HRV for reference conditions and attempt to mimic natural levels and distributions of snags on the landscape. For example, the landscape historically only provided snag levels on five percent of the landscape that would coincide with where 80 percent of the observations of black-backed woodpecker have been documented. Because of the Eastside Screens amendment, population trends of primary cavity excavators for this alternative would be expected to continue to improve or remain stable.

Northern (American) Three-toed Woodpecker: Malheur and Umatilla National Forests

The three-toed woodpecker (*Picoides dorsalis*) is similar to the black-backed woodpecker (*P. arcticus*) in having three toes (versus four) and an absence of red in all plumages. The distribution of the three-toed woodpecker often coincides with that of spruce (*Picea* spp.) forests; the black-backed woodpecker occurs in spruce as well as in other coniferous forests, a habitat difference reflected in the distributions of these closely related species (Leonard 2001). The Interior Columbia Basin Ecosystem Management Project (ICBEMP) included the three-toed woodpecker in Family 2 (broad elevation, old forest)/Group 11 (late seral sub-alpine, montane forests). Wisdom et al. (2000) reported that source habitats were likely distributed throughout most of the mountainous regions of the basin but generally occupied less than 25 percent of any given watershed. The Blue Mountains ERU supports significant amounts of habitat for the group and had moderately or strongly increasing trends in more than 60 percent of watersheds.

The three-toed woodpecker (*Picoides dorsalis*) was identified as a management indicator species for all three national forests. The Malheur and Umatilla National Forests specifically name this species whereas the Wallowa-Whitman National Forest included it in a list of the species it considered primary excavators. Although details differ between the 1990 forest plans, the Malheur and Umatilla National Forests selected it to represent mature old forest. It was also identified as having a viability concern and Forest Service Region 6 direction was developed for habitat. Minimum habitat patches should include:

- Mature old forest patches greater than 75 acres with canopy covers of 50 percent or greater
- 6 snags greater than 12 inches d.b.h. per 10 acres
- 1.4 snags greater than 10 inches d.b.h. per acre

Such habitat patches should occur at a minimum of 1 per 2,000 to 2,500 acres.

Effects from Alternative A to the Northern (American) Three-toed Woodpecker – Using the above description of habitat, all three 1990 forest plans predicted that northern three-toed habitat would occur on approximately 3 to 4 percent of the landscape. Using the dry forest and cool moist forest potential vegetation groups, figure 41 displays what percent of each national forest is three-toed habitat, and then projects it forward. These results indicate that all three 1990 forest plans exceed what was originally projected. The reason for a different eastside screens level for the Malheur National Forest is that it was assumed that closed canopy was important to this species and therefore only closed canopied mature forests were summarized as habitat. Historically the Malheur National Forest was dominated more by open canopied old forest in comparison to the Umatilla and the Wallowa-Whitman National Forests. In any case, it would appear that habitat for this species is abundant on the three national forests and is projected to increase.

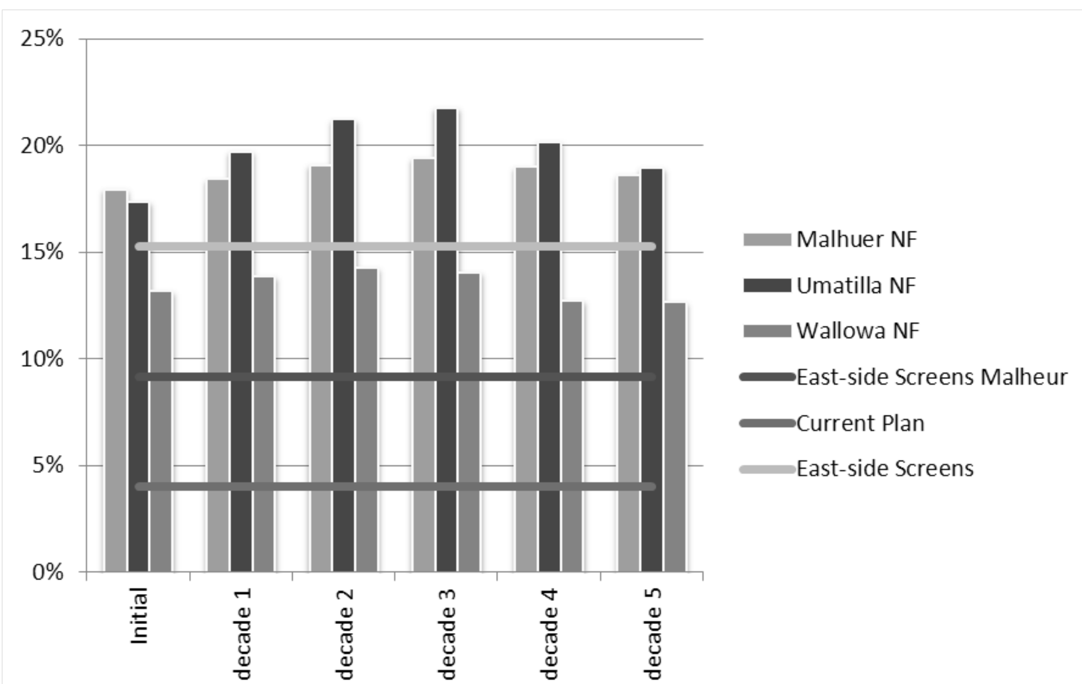

Figure 41. Percent source habitat for northern three-toed woodpecker projected for the next 5 decades (compared to original desired conditions of 1990 forest plans and as amended by Eastside Screens)

Northern (American) Three-toed Woodpecker Population Trend – American three-toed woodpeckers (*Picoides dorsalis*) are not federally listed in the United States or Canada and according to the PIF database (see table 329) there is not a regional concern for this species. Because of the species' low abundance and retiring habits, it is not well sampled with range-wide population sampling efforts such as bird breeding surveys (BBS) and consequently, data on which to assess population trends of American three-toed woodpeckers is lacking at the regional and range-wide scales (Wiggins 2004).

All three 1990 forest plans predicted a decline in old growth habitat, which would indicate an anticipated decline in populations. Only the Umatilla National Forest actually indicated a decline in population for this species, based on their original plan. For the 1990 forest plans as amended, it would be expected that population trends would be stable or increasing.

Table 329. Population trends of some primary cavity excavators from large-scale data sets based on data from Mellen-McLean (2011)

Species	Breeding Bird Surveys[1]				Partners in Flight Database[2]	
	OR	Reliability	WA	Reliability	BCR 9	BCR 10
Black-backed woodpecker	stable	yellow			15	14
Hairy woodpecker	stable	blue	stable	yellow	11	10
Northern flicker					13	13
Northern three-toed woodpecker					12	13
Red-naped sapsucker	no trend	red	no trend	red	16	17
White-headed woodpecker	no trend	red	no trend	red	18	18
Williamson's sapsucker	stable	yellow			18	17

1 Breeding Bird Survey (Sauer et al. 2008)
(http://www.mbr-pwrc.usgs.gov/bbs/cred.html).
Increase: significant (p less than 0.05) increase from 1966-2005.
Decrease: significant (p less than 0.05) decrease from 1966-2005.
Stable: yellow or blue reliability and no significant increase or decrease.
No trend: red reliability and no significant increase or decrease.

2 Partners in Flight (PIF) Database (http://www.rmbo.org/pif/scores/scores.html).
Regional combined scores can range from 5 to 25. Regional combined score greater than 13 may be a species of regional concern (Panjabi 2005).
BCR 9: Great Basin.
BCR 10: Northern Rockies

Northern Goshawk: Wallowa-Whitman National Forest (Focal Species Group: Forested Communities, Forested Mosaic)

In North America, the northern goshawk (*Accipiter gentiles*) nesting range includes the boreal forests of central Alaska and northern Canada, the Sierra Nevada, Rocky Mountains, northern Mexico, northern Minnesota, Wisconsin, central Michigan, New York, Pennsylvania, and southern New England. Northern goshawks have extended (or reoccupied) their breeding range south into the Appalachian Mountains and probably into the Great Smoky Mountains as far south as North Carolina following the return to maturity of forests that were logged in the 1800s (Marshall 1992). The goshawk was identified as a focal species in several of the subbasin plans completed within the Columbia Basin and is considered a focal species for the Blue Mountains plan revision effort. ICBEMP placed the northern goshawk in two separate habitat families: broad-elevation old forest (summer habitat) and forests, woodlands and montane shrubs (winter habitat). Within these families the goshawk was assigned to groups 5 and 25. Group 5 pertains to summer habitat (broad-elevation old forest) and includes the flammulated owl, American marten, and fisher. Group 25 (forests, woodlands, and montane shrubs) deals with winter habitat and includes only the northern goshawk. As noted for the American marten, a strong declining trend in source habitat was reported for the Blue Mountains. A similar trend was also reported for northern goshawk winter habitat in the Blue Mountains.

The northern goshawk was identified as a management indicator species for the Wallowa-Whitman National Forest. It was selected to represent another indicator of the abundance of mature/old forest patches and was considered associated with dense-canopied mixed conifer, white fir, and lodgepole pine associations. As indicated in table 301, the northern goshawk was chosen as a focal species and a focal species assessment model was developed to assess source habitats and threats to this species.

The northern goshawk uses a complex mosaic of landscape conditions to meet various life history requirements for nesting, post fledgling, and foraging (Reynolds 1992). Goshawk nesting habitat in eastern Washington and Oregon is generally composed of mature and older forests (McGrath et al. 2003). Typical nest stands are composed of large trees with high canopy cover (greater than 50 percent), multiple canopy layers, and a relatively high number of snags and downed wood (McGrath et al. 2003). Substantial disagreement regarding the habitat needs of this species occurs in the literature (Beier et al. 2008, Capan 1996, Greenwald et al. 2005, Reynolds et al. 2001, Reynolds 2004, Reynolds et al. 2008). Because of the importance of late-successional forests in many of the life history stages of the goshawk, Wales et al. (2011) mapped late-successional forests as a factor that influenced the quality of source habitat using the following variables:

- Potential vegetation types: dry ponderosa pine, dry Douglas-fir, dry grand fir, cool moist, cold dry
- Tree size: greater than 20 inches d.b.h.
- Layers: single/multistory
- Canopy cover: greater than 40 percent dry types, greater than 60 percent cool moist, cold dry

The results of this analysis indicated that suitable habitat for this species was broadly distributed and of high abundance within each national forest.

Effects from Alternative A to the Northern Goshawk – As a management indicator species for the Wallowa-Whitman National Forest 1990 forest plan, the habitat that it was to represent was much narrower and did not include the dry ponderosa pine. As with the other species associated with older forests, habitat was predicted to decline over time based on the initial plan. Figure 42 displays the projection for habitat in this analysis in relation to the 1990 forest plan original desired conditions as well as the desired conditions of the plan as amended. The eastside screens specifically mentioned the northern goshawk and provided some management direction for this species.

Northern Goshawk Population Trend – Data needed to assess population trends of the northern goshawk is lacking at the national forest, regional, and range scales. Based on the amount of habitat displayed in figure 42, it would appear that populations would be stable for at least the first three decades, after which habitat would begin to decline, which may or may not lead to a downward trend in populations.

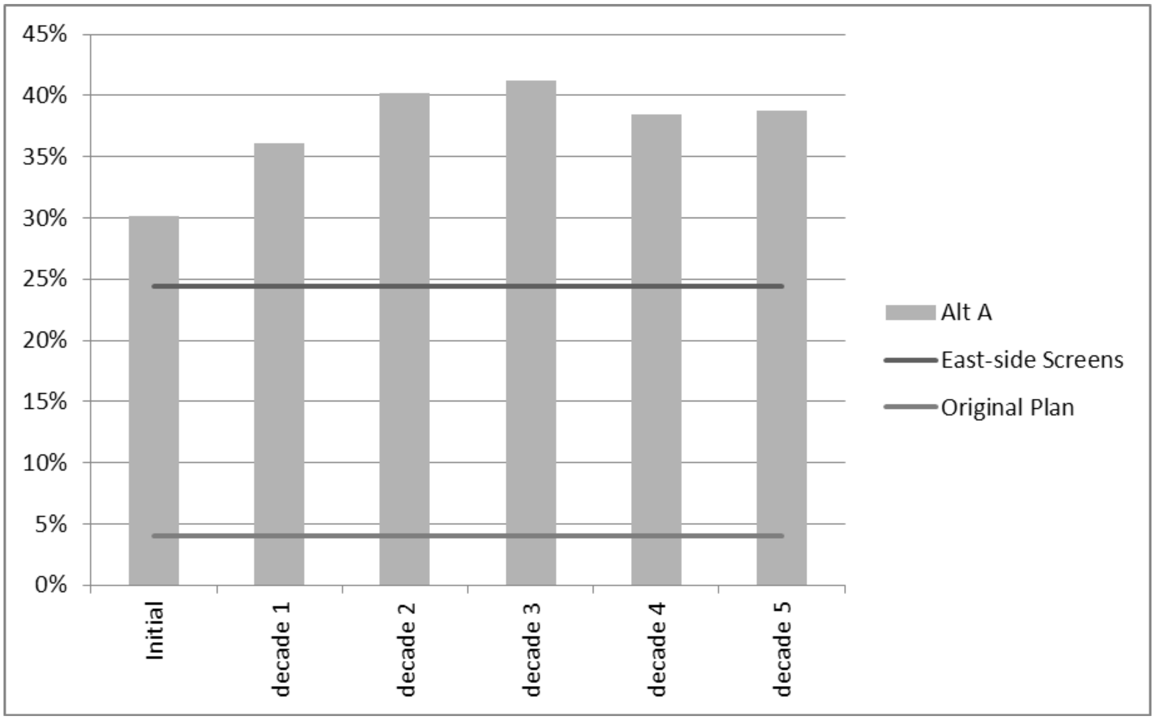

Figure 42. Percent source habitat for the northern goshawk within the Wallowa-Whitman National Forest projected for the next five decades (compared to original desired conditions of 1990 forest plans and as amended by the Eastside Screens)

Management Indicator Species Common to All Alternatives

Pileated Woodpecker

Other than the ivory-billed woodpecker (*Campephilus principalis*), the pileated woodpecker (*Dryocopus pileatus*) is the largest woodpecker species in the United States. It has been identified as a sensitive species and a strategy species for the Blue Mountains by Oregon (ODFW 2006) and is a state candidate for listing within Washington (WDFW 2005). The U.S. Fish and Wildlife Service identified the pileated woodpecker as a species of concern. The pileated woodpecker was considered as a focal species in several of the subbasin plans completed for the Northwest Power and Conservation Council within the Columbia Basin and is considered a focal species for the Blue Mountains plan revision effort. ICBEMP included the pileated in late-seral, multi-stratum forests (Family 2/Group 6). Wisdom et al. (2000) indicated that source habitats basin-wide have declined moderately or strongly in more than 50 percent of watersheds containing appropriate habitat types for this species. The Blue Mountains Ecological Unit showed a balanced mix of increases and decreases of habitat within watersheds (ibid).

Habitat

The pileated woodpecker prefers late seral stages of coniferous or deciduous forest, but will also use younger forests that have scattered, dead trees (Bull and Jackson 1995). In northeast Oregon, the pileated woodpecker selects unlogged stands of old-growth grand fir with closed canopies (Bull and Holthausen 1993) and in some cases open stands with high densities of large snags and logs (Bull et al. 2007). Pileated woodpeckers are rarely found in pure ponderosa pine stands. The association with late seral stages stems from the need for large diameter snags or living trees with some decay for nest sites, roosts and foraging (Bull 1987, Bull et al. 1992, Bull 2001).

The availability of snag habitat is an important feature within source habitat for pileated woodpeckers (Bull et al. 1986, Bull et al. 1992, Raphael and White 1984). Snags used for roosting and nesting in Eastern Oregon normally are greater than 25 inches in diameter (Bull 1987, Nielsen-Pincus 2005, Nielsen-Pincus and Garton 2007). In northwest Montana, nest trees were large western larch (*Larix occidenatalis*) and averaged 74.9 cm d.b.h. (McClelland 1979).

Risks and Threats

Snag density – Timber harvest has the most significant effect on habitat for this woodpecker (Bull 2003, Bull et al. 2007). Removal of large-diameter live and dead trees, of down woody material, and of canopy eliminates nest and roost sites, foraging habitat, and protective cover. In addition, prescribed fire may eliminate or reduce the number of snags, logs, and cover (Bull 2003). Predation is reported to be one of the main causes of mortality for the pileated woodpecker. Bull and Jackson (1995) suggest that fragmentation of forested habitat may lead to reduced population densities and increased vulnerability to predation. Bull et al. (2005a) found that pileated woodpecker foraging activity was highest in untreated forested stands, intermediate in stands that had been thinned, and lowest in stands that were prescribed burned.

Open Motor Vehicle Route Density – In addition to snag densities, the model uses road density as a variable to account for the probable reduced snag densities along roads. Bate et al. (2007), found that snag numbers were lower adjacent to roads due to safety considerations, firewood cutters, and other management activities. Other literature has also indicated the potential for reduced snag abundance along roads (Wisdom et al. 2000). The loss of snags due to firewood gathering was acknowledged in all three 1990 forest plans.

Alternative A (No Action)

The pileated woodpecker was identified as a management indicator species for all three 1990 forest plans. Although details differ between the 1990 forest plans, it was selected to represent mature/old forest structure. It was also identified as having a viability concern and Forest Service Region 6 direction was developed for habitat. Minimum habitat patches should include:

- Mature/old growth patches greater than 300 acres
- 1.5 snags greater than 20 inches d.b.h. per 10 acres
- 1.8 snags greater than 12 inches d.b.h. per acre

Such habitat patches should occur at a minimum of 1 per 12,000 to 13,000 acres. Although the preference is to have 300 continuous acres, if this is not possible, habitats could be arranged in 50 acre blocks no more than one-quarter mile apart.

Effects from Alternative A to the Pileated Woodpecker

It is difficult to assess how well the 1990 forest plans met their intended desires for several reasons. One is that each plan assessed old growth somewhat differently. For example, the Umatilla National Forest provided a table of acres, but only for areas outside of wilderness areas. The Wallowa-Whitman National Forest on the other hand included all lands. Additionally, it is unclear whether the figures for old growth include all vegetation types.

Using the specifications developed at the regional level that required 300-acre areas be managed for pileated woodpeckers within every 12,000-13,000 acres of habitat, all three 1990 forest plans predicted that pileated woodpecker habitat would occur on approximately 2.5percent of the landscape. Using the habitat types that were modeled in Wales et al. (2011), all three 1990 forest plans greatly exceed their initial predictions and both the Umatilla and Malheur National Forests exceed their 1990 forest plan desired conditions as amended (see figure 43). The Wallowa-Whitman National Forest is slightly below desired conditions, and as implemented, alternative A appears to reduce habitat for this management indicator species over time. The first two decades show only a slight reduction in source habitat (less than 4 percent), which could easily be within the accuracy error of modeling.

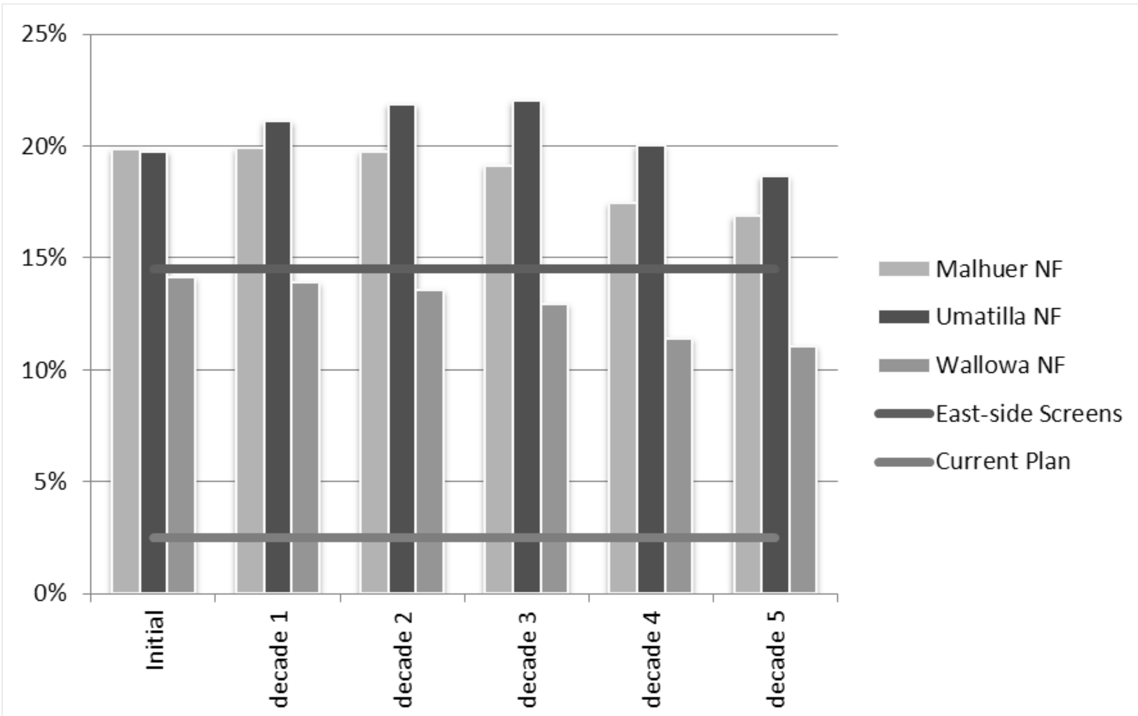

Figure 43. Percent source habitat for the pileated woodpecker projected for the next five decades (compared to original desired conditions of 1990 forest plans and as amended by the Eastside Screens)

Large snags were recognized as important in the initial planning effort, and although the method of analysis is different (see primary excavators discussion), this habitat attribute is still important. The following discussion is applicable to all alternatives and so will not be repeated within the discussion of the action alternatives.

Table 330 displays the tolerance levels for snag densities associated with the pileated woodpecker, derived from DecAID (Mellen-McLean et al. 2009) and the historical and current densities on the landscape as calculated by Mason and Countryman (2010). Based on the data displayed in table 330, it would appear that snag densities meeting the pileated woodpeckers tolerance levels are within what would have been expected historically. This could be the result of implementing the Eastside Screens amendment beginning early in the 1990s. Alternative A would continue to implement the standards that would protect all live trees 21 inches d.b.h. and greater thereby protecting existing and future snags and providing for future recruitment trees. Additionally, for alternative A, snag levels would still have to meet 2.25/acre for snags 21 inches d.b.h. and greater after all post sale activities.

Table 330. Snag density greater than 20 inches d.b.h. per acre for 30, 50, and 80 percent tolerance levels found at pileated woodpecker nest and roost sites in the eastside mixed conifer forest, larger trees vegetation condition class and what percent of the landscape would be expected to meet these levels and what percent of the landscape meets these levels based on Mason and Countryman (2010)

Species tolerance levels from DecAID table EMC_S/L.sp-22			Percent of landscape that historically met species tolerance levels (snags per acre)				Percent of landscape that currently meets species tolerance levels (snags per acre)			
30%	50%	80%	30% or less (0-3)	30-50% (3-8)	50-80% (8-18)	80% or more (> 18)	< 30% (0-3)	30-50% (3-8)	50-80% (8-18)	80% or more (> 18)
3.5	7.8	18.4	62%	15%	15%	3%	15%	4%	15%	4%

Population Trend – Data needed to assess population trends of the pileated woodpecker are lacking at the national forest, region, and range scales. The breeding bird surveys for Oregon appear to be stable (Sauer et al. 2008); however, the accuracy is considered to be very imprecise (Red) and would not be able to detect a five percent per year change over the long term. The Christmas Bird Counts have a similar pattern to the BBS for Oregon, but again the precision of this data is uncertain. Huff and Brown (2006) found low annual variation in abundance of pileated woodpeckers between 1994-2001in the Blue Mountains and found a stable or slightly upward trend in abundance. Populations of pileated woodpeckers are considered secure (N5) in the United States and apparently secure (S4) in both Oregon and Washington (NatureServe 2011).

The Malheur National Forest (USDA Forest Service 1990) estimated approximately 200 potential pairs for the selected alternative but did not indicate whether or not this was an increase or decline in populations. Both the Umatilla (USDA Forest Service 1990a) and the Wallowa-Whitman National Forests (USDA Forest Service 1990b) predicted a decline in this species for all alternatives. Based on habitat alone, figure 44 would indicate that expected populations of pileated would not only be greater than what the original forest plans envisioned, but would also exceed the expectations of the Eastside Screens for the Malheur and the Umatilla National Forests.

Alternatives B, C, D, E, and F

For the plan revision effort, the pileated woodpecker was chosen as a management indicator species to represent the cool/moist forest source habitat. As indicated in table 298, the pileated woodpecker was also chosen as a focal species and a model was developed to assess source habitats and threats to this species. Source habitats were defined to include:

- Potential vegetation: dry Douglas-fir, dry grand fir, moist, and cold forests
- Tree size greater than or equal to 20 inches d.b.h.
- Canopy greater than or equal to 40 percent in dry forests and greater than 60 percent in cool/moist and cold/dry forests
- Snags greater than 20 inches d.b.h. in the following density categories:
    - ♦ Low: less than 0.5 per acre
    - ♦ Moderate: 0.5 to 2.5 per acre
    - ♦ High: 2.5 to 7.5 per acre
    - ♦ Very high: more than 7.5 per acre

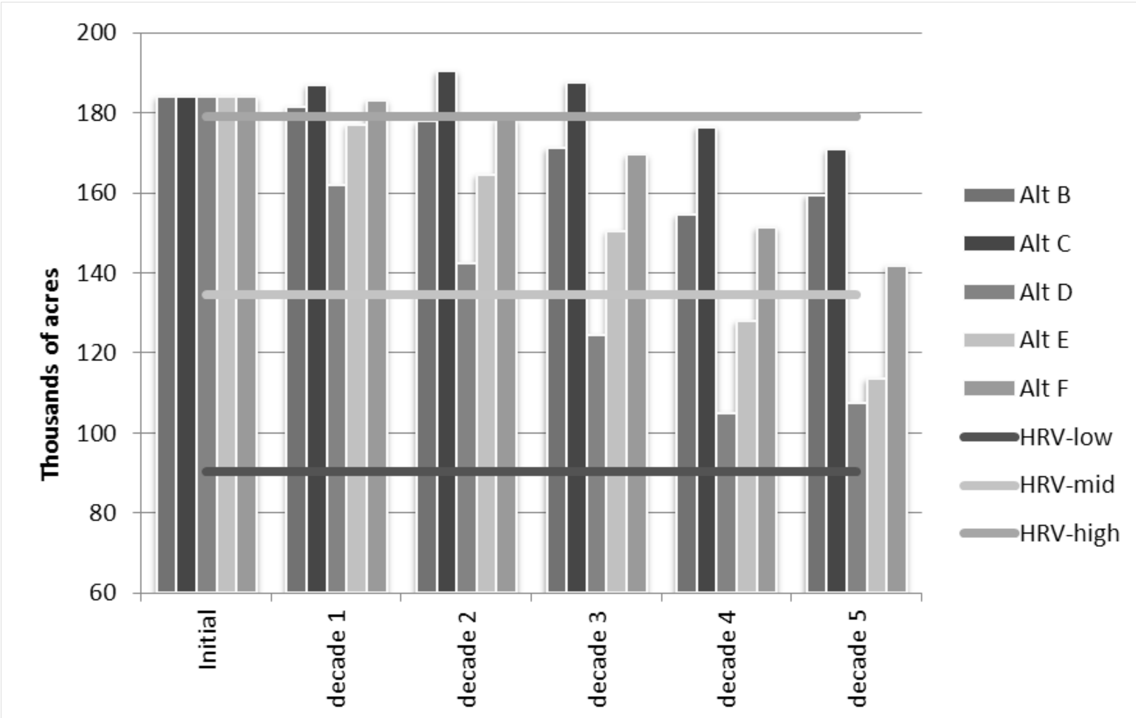

Figure 44. Malheur National Forest pileated woodpecker source habitat in relation to HRV displayed for each alternative for the first five decades

Effects from Alternatives B, C, D, E, and F to the Pileated Woodpecker

This species is well distributed within the planning area year round and was chosen as a focal species (USDA Forest Service 2010) to represent medium/large trees in the cool/moist forest. As a management indicator species, it was chosen to represent large trees in the late seral stage of cool/moist forest with its corresponding conditions for snags and coarse woody debris. The analysis that follows uses the habitat types as modeled in Wales et al. (2011). The potential vegetation group grouping of cool/moist forest as used in the plan analysis does not include all of the habitat types modeled in Wales et al. (2011) and therefore as a management indicator species for the action alternatives the habitats represented by the pileated would include the cool/moist and cold dry potential vegetation groups, as well as the dry grand fir and Douglas-fir from the dry potential vegetation group. Although ponderosa pine is a preferred nest tree, pileated rarely select nest sites in pure ponderosa pine stands, possibly due to such stands lack the abundance of snags and downed wood necessary for foraging habitat for pileated woodpeckers (Bull et al. 1986, Bull 1987).

Bull and Holthausen (1993) found that density of large snags (20 inches d.b.h. or greater) was the best predictor of density of pileated woodpeckers. Certain management activities that pose potential risks for snag retention on the landscape were previously discussed for focal species so will not be discussed here. Based on the data displayed in table 330, it would appear that current levels of snags 20 inches d.b.h. or greater are what would be expected to meet the need of this species.

Effects to Pileated Woodpeckers in the Malheur National Forest – As displayed in figure 44, during the first two decades all alternatives maintain source habitat within the range of HRV, although habitat is reduced over time for all alternatives. Alternative C does the most in regards to maintaining source habitat and alternative D does the least. It was assumed that increases in source habitat would result in increases in large snag density. Only alternative C actually shows an increase in source habitat, therefore suggesting that for all of the other alternatives, snag density would remain stable or decrease. In all likelihood, snag density would not be reduced in any alternative other than D due to safeguards (WLD-HAB-12 S-7) within each alternative to protect large snags. All alternatives include the same desired condition for snags on the landscape that was based on HRV; therefore, if met, the desired condition should provide adequate levels of this habitat attribute.

Effects Specific to the Umatilla National Forest – As displayed in figure 45, all alternatives would maintain source habitat above the mid-point range of HRV during the first two decades, although over time a reduction in habitat would occur for all alternatives. For the first decade, all alternatives would have an increase in source habitat. It is not until the third decade that source habitat would begin to decrease to less than the existing condition. Although the first decade shows slight differences between alternatives, it is so slight as to be in the range of error. The trend, however, is similar to what is evident from the other forests in that alternative C shows the largest benefit to the pileated and alternative D demonstrates the least benefit. Because all alternatives show an increase in source habitat during the first decade, it would be assumed that a commensurate increase in large snags would also occur.

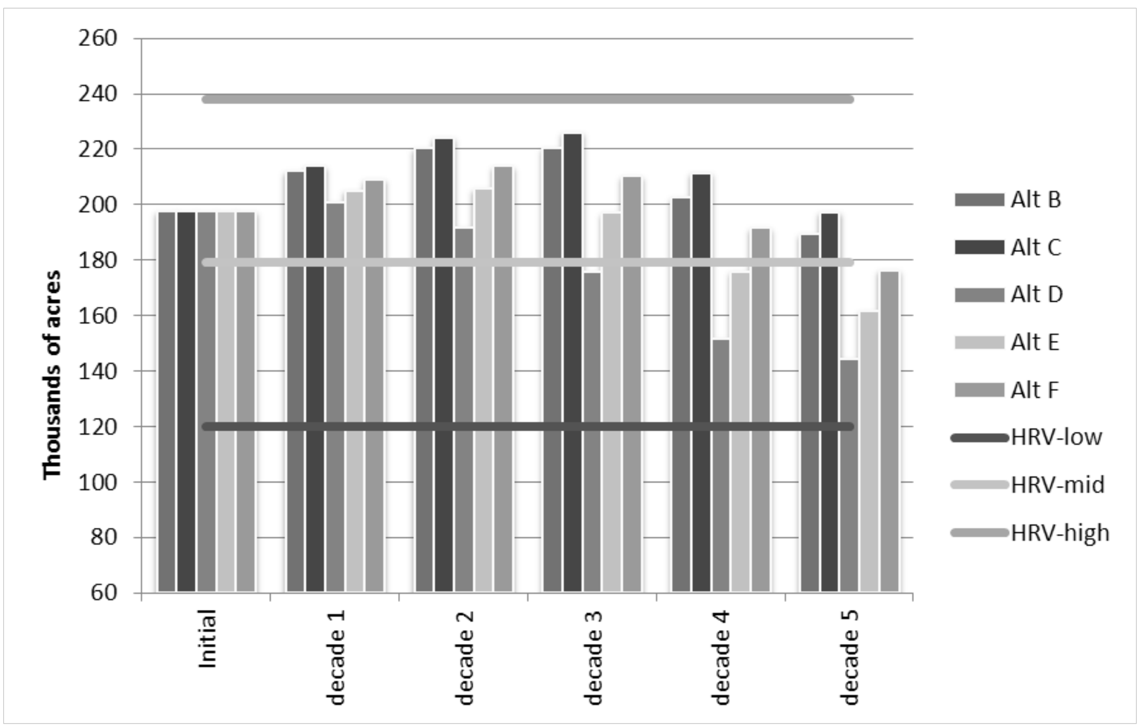

Figure 45. Umatilla National Forest pileated woodpecker source habitat in relation to HRV displayed for each alternative for the first five decades

Effects Specific to the Wallowa-Whitman National Forest – As displayed in figure 46, all alternatives maintain source habitat above the low range of HRV during the first decade, although all alternatives show at least a slight reduction in habitat. All alternatives show a decrease in source habitat over time, with alternative D dipping below the estimated low value for HRV by the second decade. Alternative C shows only a slightly better outcome than alternatives B or F for the first decade. Alternatives B and C remain relatively the same during the first three decades, and are the only alternatives that maintain source habitat within the estimated range of HRV for the Wallowa-Whitman National Forest through the first three decades.

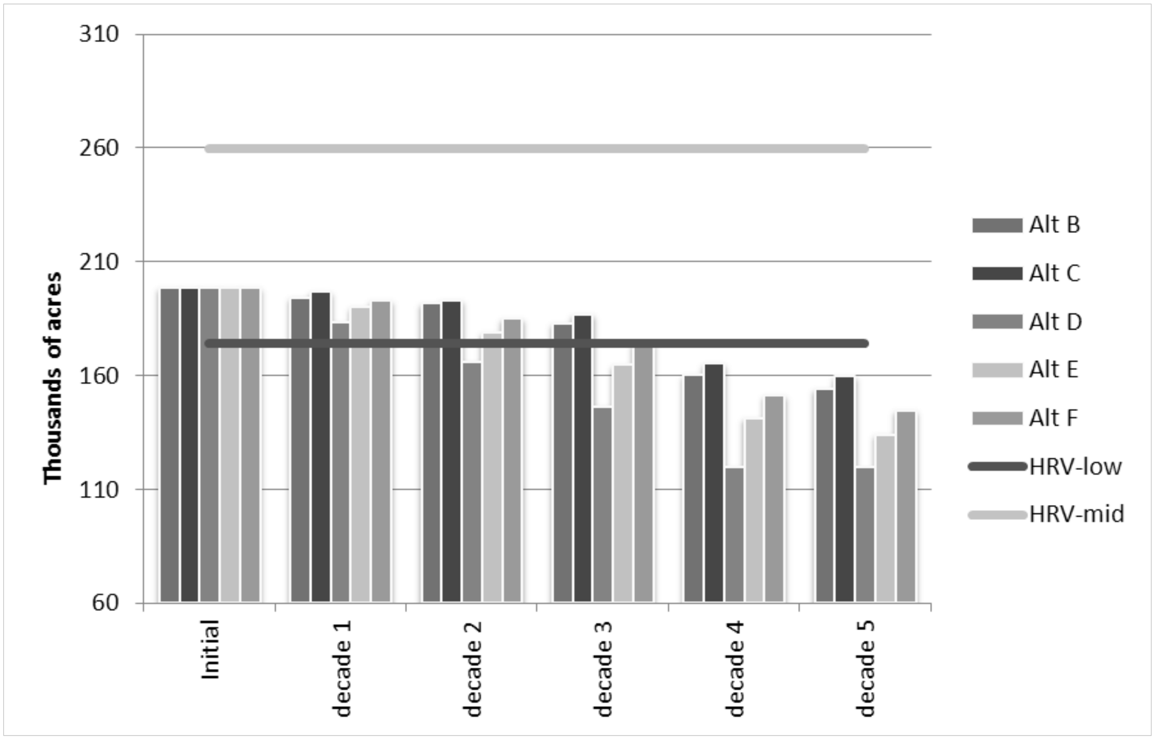

Figure 46. Wallowa-Whitman National Forest pileated woodpecker source habitat in relation to HRV displayed for each alternative for the first five decades

Because some overlap in source habitats occurs with the white-headed woodpecker, a reduction in source habitat for the pileated was anticipated. Altman (2000) considered the pileated woodpecker a principal species of the late-successional mesic mixed conifer forest. He describes this as occurring mostly at higher elevations, wetter sites, northerly aspects, and in draws where soils are mesic and well developed. It includes coniferous forest composed primarily of cool moist Douglas-fir/grand fir, cool dry Douglas-fir, western larch, hemlock, and occasional ponderosa pine. He emphasized this habitat does not include sites that were historically ponderosa pine but are mixed conifer now due to fire suppression and encroachment of other conifers. The white-headed prefers open canopied stands compared to the pileated that prefers closed canopied stands. The HRV analysis conducted by Countryman and Justice (2010) indicated that for both the cool moist and dry potential vegetation groups, open canopied old forest was substantially underrepresented within the Blue Mountains. Restoration of more open canopy ponderosa pine forest towards historical levels will likely reduce populations of species that are provided suitable habitat in the closed canopy, dense understory, mixed conifer forests that now dominate what was historically ponderosa pine forest (Altman 2000).

Population Trend for All Three Forests – The current population information available for the pileated woodpecker was discussed for alternative A and will not be repeated here. Based on the habitat analysis presented above, population trends in the Umatilla and Malheur National Forests should be stable for at least the first two decades for all alternatives, although a slight downward trend might be associated with alternatives D and E. This same trend is evident within the Wallowa-Whitman National Forest, only by the second decade, alternative D drops outside of what was estimated as the range for HRV. Population decline for pileated woodpeckers would be expected as ponderosa pine forests are restored as eluded to by Altman (2000); however, if source habitats are maintained within HRV, then populations should also be within that range.

Rocky Mountain Elk

Distribution – Historical records indicate elk were numerous and widely distributed in Oregon prior to arrival of nonnative settlers. According to Vernon Bailey, Rocky Mountain elk (*Cervus elaphus*) occupied the whole of the Blue Mountains Plateau in Northeastern Oregon (ODFW 2003a). Elk were nearly extirpated from Oregon by the late 1800s (Verts and Carraway 1998). Through hunting regulation and reintroductions, populations have recovered (ODFW 2003a) to the point where they have become depredators of crops in some areas, particularly on private lands, near the interface of valley and montane zones (Sallabanks et al. 2001).

Habitat – Thomas et al. (1979, p. 109) stated, “Optimum…elk habitat is the amount and arrangement of cover and forage areas that result in the maximum possible proper use of the maximum possible area….” Thomas et al. (1988), in developing a habitat-effectiveness model for winter ranges in the Blue Mountains of Oregon, identified the following habitat attributes as important: 1) size and spacing of cover and forage areas, 2) road density of open roads, 3) quantity and quality of forage, and 4) the quality of available cover. Armentrout et al. (1997) identifies similar management needs, but cautions that because of their (elk and mule deer) complex habitat needs, habitat management should be at the landscape scale and not the scale of individual units. Additionally, desired habitat conditions need to be expressed in relation to the landscape’s ecological potential.

Thomas et al. (1979) indicated that optimum habitat for elk requires cover, which was defined as two types: thermal and hiding. Thomas et al. (1988) defined cover as either satisfactory or marginal and stated that if a stand was neither satisfactory nor marginal cover then it was a forage stand. Satisfactory cover was defined as a stand of coniferous trees 40 feet or greater in height with an average canopy cover of 70 percent or greater and marginal cover is defined as a stand of coniferous trees 10 feet tall or taller with an average canopy cover of 40 to 69 percent (*ibid*). The quality of available cover is important, and is best expressed by what percent of available cover is considered marginal and what percent is satisfactory. Obviously, the higher the amount of satisfactory cover, the better the habitat would be for elk.

Elk use a mixture of habitat types in all successional stages in both forest and grassland vegetation. Their uses of these habitats change in daily and seasonal patterns. In winter, native bunchgrasses are dormant and are low in digestible protein. Elk use early succession grasses, if available that are still growing, and provide high-quality digestible protein when other forage is dormant. Guidelines that target a cover to-forage ratio of 40:60 have been widely accepted (Skovlin et al. 2002).

During the 1980s and early 1990s, elk management on National Forest System lands often centered on providing hiding and thermal cover (ODFW 1989, Sally 2000, Smith and Long 1987, Thomas et al. 1988, Winn 1985). Although security cover is still an important habitat consideration for elk management, the more recent scientific information highlights open motor vehicle routes (Rowland et al. 2000, Rowland et al. 2004) and the quality, quantity, and availability of forage as key determinates of habitat suitability (Cook et al. 1998, Damiran 2006, Findholt et al. 2004).

Habitat effectiveness for elk is adversely affected by the presence of roads open to vehicular traffic (Thomas et al. 1979). Thomas et al. (1988) indicated a habitat effectiveness rating of 40 percent (0.4) for elk when open road densities are approximately 3 miles per square mile of habitat. Towry (1984) indicated that, miles of road per square mile of habitat should not exceed 1 for primitive road, one-half for secondary, and one-quarter for primary roads. Habitat models considered adequate to provide quality elk habitat in a forest managed for timber production do not and never were intended to provide adequate security for elk during hunting seasons (Lyon and Christensen 2002).

Elk numbers are managed through legal hunting to meet state management objectives. Other factors, including predation, disease, accidents, and poaching, also influence elk numbers.

Rocky Mountain Elk Management Indicator Species Status Under Alternative A (No Action)

All three 1990 forest plans selected elk as a management indicator species. The Wallowa-Whitman National Forest chose elk because it "is a highly-valued game animal and is selected as a management indicator species because of the quality of habitat diversity, the interspersion of cover and forage areas, and the security of cover provided" (USDA Forest Service 1990b). The Umatilla National Forest selected this species for general forest habitat (USDA Forest Service 1990a). The Malheur National Forest stated that it was chosen because it was a commonly hunted species (USDA Forest Service 1990).

Rocky Mountain elk habitat was analyzed within the Blue Mountains during the 1990 planning effort using a habitat model developed by Thomas et al. (1979, 1988). Though the winter habitat model developed by Thomas et al. (1988) was never intended for application on spring-summer-fall ranges, it has been widely applied on nonwinter ranges. Elk management on National Forest System lands has centered on providing hiding and thermal cover (ODFW 1989, Sally 2000, Smith and Long 1987, Thomas et al. 1988, Winn 1985). A large body of research has been conducted during the 27 years since publication of these models and this research needs to be incorporated into a new model. For example, Cook et al. (2005) saw little justification for retaining thermal cover as a primary component of habitat evaluation models for elk, and postulated that it may be time to shift attention towards the relationships between herd productivity and nutrition-based attributes of habitat.

The indicators used to describe elk habitat conditions in the no-action alternative include: Habitat Effectiveness Index (HEI), cover and forage ratio, road density, and hiding and thermal cover. HEI uses quality of cover, cover and forage, and open roads to indicate the effectiveness of elk habitat. Optimum habitat has a value of 1.00.

Forage is defined as areas having less than 40 percent canopy cover, which includes grasslands, meadows, and riparian areas. Forage is available in grasslands, meadows, and riparian areas, and also within forested areas where grasses, sedges, forbs, and shrubs grow. Elk and deer also consume lichen, leaves, and bark from trees, especially during winter months. Optimum amounts of forage prepare elk and deer for winter survival.

Cover in the cover to forage ratio is a combination of satisfactory and marginal cover. Optimum elk habitat is approximately 40 percent cover (20 percent hiding cover, 10 percent thermal cover, 10 percent either hiding or thermal cover) and 60 percent forage (40:60 ratio) (Thomas 1979). Satisfactory cover is greater than 70 percent canopy cover, marginal cover is 40 to 70 percent canopy cover, and forage has less than 40 percent canopy cover.

The 1990 forest plans recognize that the HEI model was designed for habitat analysis at the subwatershed level or 3,000 to 15,000 acres in size but stated that for “planning purposes and analysis and comparison of alternatives, the HEI has been used to give a forestwide picture of habitat conditions for elk. Forestwide application of the model has masked the more subtle differences between alternatives during the 50 year planning horizon. However, generalized differences between alternatives can be addressed and are discussed below…” (USDA Forest Service 1990). The 1990 forest plans also recognized that the forestwide analysis did not account for the size or distribution of habitat components, but assumed that forage and cover areas were properly distributed throughout the national forest and were of usable size (USDA Forest Service 1990a). All three 1990 forest plans recognized that only those lands that have the potential for active management would be modeled. Since the 1990 forest plans were implemented, the HEI model has gone from being a computer model in DOS (Ager and Hitchcock 1994) to a model in ARCgis. The ARCgis model developed for the national forests in the Blue Mountains was used for this analysis.

The most significant amendment that affects achieving the conditions set forth for elk is the 1995 Regional Forester’s Eastside Forest Plan Amendment 2 (Eastside Screens), which essentially altered the management direction envisioned in the 1990 forest plans (Lowe 1995). In 1993, interim direction, similar to the Eastside Screens, was adopted which recognized the threat to late and old structure forests. The intent of Eastside Screens was to move stands towards the desired HRV and especially toward late and old structure. Although there was a shift in how the national forests were to be managed, there was no corresponding shift in the cover requirements for elk. Table 331 displays the results based on vegetation dynamic development tool (VDDT) modeling and resulting acres that would meet elk cover requirements based on the potential vegetation group. Baty et al. (1995) concluded that although elk might benefit from the ecosystem management on ponderosa pine dominated winter ranges, a concern for security exists. The difficulty of meeting the standards for elk cover, especially within the Malheur National Forest, based on the landscape was recognized early on and resulted in 11 site-specific plan amendments between 1992 and 2004.

Table 331. Percent of the forested landscape that would meet cover and forage requirements for Rocky Mountain elk by Potential Vegetation Group based on VDDT modeling*

Elk Habitat	Cold Forest (percent)	Moist Forest (percent)	Dry Forest (percent)
Hiding cover	50-60	45-55	5-10
Thermal cover	40-50	30-40	10-15
Forage	25-30	25-35	75-95

* Results from HRV VDDT model (years 200 to 500 average)
Dry forest thermal = 40-plus percent canopy cover
Moist and Cold forest thermal = 60-plus percent canopy cover

Effects from Alternative A to Rocky Mountain Elk

In order to project alternative A, the no-action alternative, the existing condition was calculated for each of the management areas identified by the forests has having an HEI requirement (see project record for detailed discussion). The forest plan revision effort has classified vegetation into broad categories of either forested, woodland, herbland, or shrubland. The classification is further broken out as upland or riparian. The forested groups are classified into potential vegetation groups and densities of open or closed (Countryman 2007), which correspond to canopy covers of 40 percent or more in the dry vegetation group and 60 percent or more in the moist and cold vegetation groups. Within the VDDT model, vegetation is broken into structural stages, which were then classified as whether they met the needs for hiding or thermal cover. Using these break downs could overestimate the amount of satisfactory cover compared to the original definitions (using 60 percent instead of 70 percent), but should still provide an accurate portrayal of total cover since they reflect the combination of marginal cover and satisfactory cover. However, it may also lead to an overestimate of the amount of forage, because in the moist and cold vegetation groups, open stands would be considered forage stands but could have canopy covers up to 59 percent, exceeding the definition of forage areas as being those of less than 40 percent canopy cover. As previously mentioned, existing conditions were calculated by national forest for each management area designation that had an existing targeted HEI or cover requirement (see table 332). Satisfactory cover in two of three management areas within the Malheur National Forest and one of three within the Umatilla National Forest is below the desired condition, but overall cover and the HEI are at or above the desired condition.

For alternative A, the existing HEI was calculated using the existing management strata (i.e., 3a, A10, 1, etc.) and the current cover-forage map. Because projections for the future are not spatial, no attempt was made to calculate an HEI for future decades. The amount of cover and forage at the end of each decade was calculated for each potential vegetation group and treatment strata (Active, Reserve, Wilderness) and then proportioned back out to the management areas identified in table 1 (appendix A) to produce projected cover based on potential vegetation group and management area (see table 333). It is assumed that if open motor vehicle route density remained constant then changes in cover would reflect changes in HEI. A slight improvement in satisfactory cover is noted for those management areas currently below desired conditions (table 332); however, they still remain below desired conditions. As pointed out by Powell (2005 (revised 2008)), it may be difficult to achieve satisfactory cover based on potential vegetation group, especially within the Malheur National Forest.

Rocky Mountain Elk Population Trend – According to CFR 219.19(a)(6), “Populations trends of the management indicator species will be monitored and relationships to habitat determined. This monitoring will be done with State fish and wildlife agencies, to the extent practicable.” All three national forests rely on survey data collected by state fish and wildlife agencies [Oregon Department of Fish and Wildlife (ODFW) and the Washington Department of Fish and Wildlife (WDFW)] for population numbers and trend analysis of all game species. Additionally CFR 219.19(a)(1) states, “These species shall be selected because their population changes are believed to indicate the effects of management activities.”

Although two of the 1990 forest plans referred to populations and predicted changes, all three 1990 forest plans acknowledged that populations of elk are influenced by many factors, such as predation, hunting, disease, competition with other animals, weather, etc., and that “habitat effectiveness might decline but have no influence on the number of elk”(USDA Forest Service 1990b). Population management through hunting has the greatest influence on population trends; however, most elk populations reach a social carrying capacity (the willingness of landowners and local residents to accept elk) well before they reach their environmental carrying capacity (ODFW 2003a). For current trend analysis, the population trend data provided by each agency has been used. Elk numbers (state management objectives) are managed by hunting, both sport and depredation. Habitat in general and conifer vegetation types in specific have not proven to be a limiting factor for population expansion. Population levels will instead be determined by hunting pressure.

Table 332. Current Habitat Effectiveness Index (HEI) and cover percentages by national forest and management area compared to current desired condition (the shaded areas are those that are below desired conditions). Optimum habitat has a value of 1.0.

National Forest	Management Area	HEI_S[1]	HEI_R[2]	HEI_F[3]	HEI_C[4]	HEI	Cover			HEI	Current Cover Desired Condition		
							Satisfactory	Marginal	Total		Satisfactory	Marginal	Total
MAL	MA 1, MA 2, MA F22	0.23	0.38	0.5	0.55	39%	3%	30%	33%	40%	12%	20%	32%
	MA 20, MA 20B, MA 21	0.69	0.86	0.5	0.59	65%	8%	39%	47%	70%	NA	NA	40%
	MA 4A, MA F20, MA F21	0.62	0.45	0.5	0.53	52%	2%	27%	29%	50%	10%	15%	25%
UMA	A10,C4,F4	0.64	0.57	0.5	0.72	60%	21%	27%	48%	60%	15%	15%	30%
	C3,C3A,C8	0.67	0.64	0.5	0.58	60%	7%	34%	41%	79%	10%	20%	30%
	C7,E2	0.56	0.52	0.5	0.65	56%	14%	33%	47%	45%	10%	20%	30%
	E1	0.62	0.40	0.5	0.50	50%	0%	64%	64%	30%	NA	NA	NA
WAW	MA 1, MA1 W	0.62	0.45	0.5	0.65	55%	15%	35%	50%	50%	NA	NA	30%
	MA 3, MA 3A, MA 18	0.62	0.56	0.5	0.65	58%	12%	29%	41%	74%	NA	NA	NA

1. HEI_S derived from the size and spacing of cover and forage areas
2. HEI_R derived from the density of roads open to vehicular traffic
3. HEI_F derived from the quantity and quality of forage
4. HEI_C derived from cover quality

Table 333. Projected cover percentages by national forest, management area, and decade for alternative A compared to current desired condition (the shaded areas are those that are below desired conditions)

National Forest	Management Area	Cover Decade 2			Cover Decade 5			Current Cover Desired Condition		
		Satisfactory	Marginal	Total	Satisfactory	Marginal	Total	Satisfactory	Marginal	Total
MAL	MA 1, MA 2, MA F22	6%	34%	40%	6%	31%	37%	12%	20%	32%
	MA 20, MA 20B, MA 21	13%	40%	53%	12%	37%	49%	NA	NA	40%
	MA 4A, MA F20, MA F21	3%	29%	32%	3%	28%	31%	10%	15%	25%
UMA	A10,C4,F4	23%	22%	45%	20%	13%	33%	15%	15%	30%
	C3,C3A,C8	8%	24%	32%	7%	15%	22%	10%	20%	30%
	C7,E2	20%	30%	50%	17%	21%	38%	10%	20%	30%
	E1	0	36%	36%	0%	18%	18%	NA	NA	NA
WAW	MA 1, MA 1W	18%	28%	46%	15%	20%	35%	NA	NA	30%
	MA 3, MA 3A, MA 18	15%	24%	39%	13%	18%	31%	NA	NA	NA

Effects to Rocky Mountain Elk in the Malheur National Forest – Figure 47 displays the estimated population and management objectives (MOs) for game management units that have at least 10 percent of the Malheur National Forest within the boundary. This includes Desolation, Northside, Murderers Creek, Beulah, Malheur River, and Silvies. It would appear that most years the total management objective for the national forest is being met or exceeded. For 2001, data was missing for three of the six GMUs, but based on estimates for 2000 and 2002 the management objective for 2001 was probably met or exceeded as well.

Cover, especially security cover is still important and according to table 333, even though the desire is to move towards HRV, the amount of treatment that could alter cover is so small (less than one percent per year) that in the first decade, cover remains close to what was envisioned in the 1990 forest plan. Open motor vehicle route density is not expected to increase above what was currently modeled for the HEI results previously discussed (see table 332), and in fact is expected to be reduced. This, coupled with the elimination of cross-country travel and the projected cover, would result in maintaining the current HEIs. Therefore, no measurable change in elk populations would be expected based on Forest Service management actions.

Effects to Rocky Mountain Elk in the Umatilla National Forest – Figure 48 and figure 49 display the management objective and estimated population for those game management units that contain at least 10 percent of the Umatilla National Forest within unit boundaries. This includes Desolation, Heppner, Ukiah, Wenaha, Mt. Emily, and Walla Walla in Oregon. The Umatilla National Forest also extends into Washington, incorporating all or portions of game management units Dayton, Lick Creek, Mountain View, Tucannon, and Wenaha. The Wenaha and Mountain View herds are interstate herds and the best population data for Wenaha is actually from Oregon (Fowler 2010). Therefore, data for Wenaha was not included in figure 49.

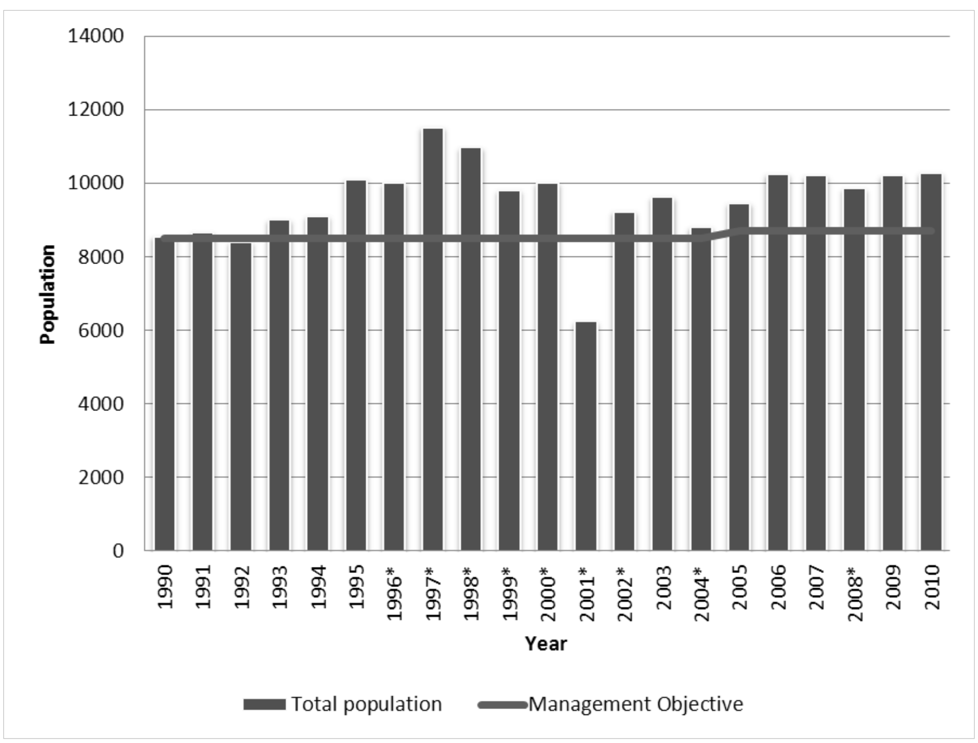

Figure 47. Estimated elk population for game management units within the Malheur National Forest compared to the management objective for 1990-2010 (asterisk indicates data missing for at least one game management unit)

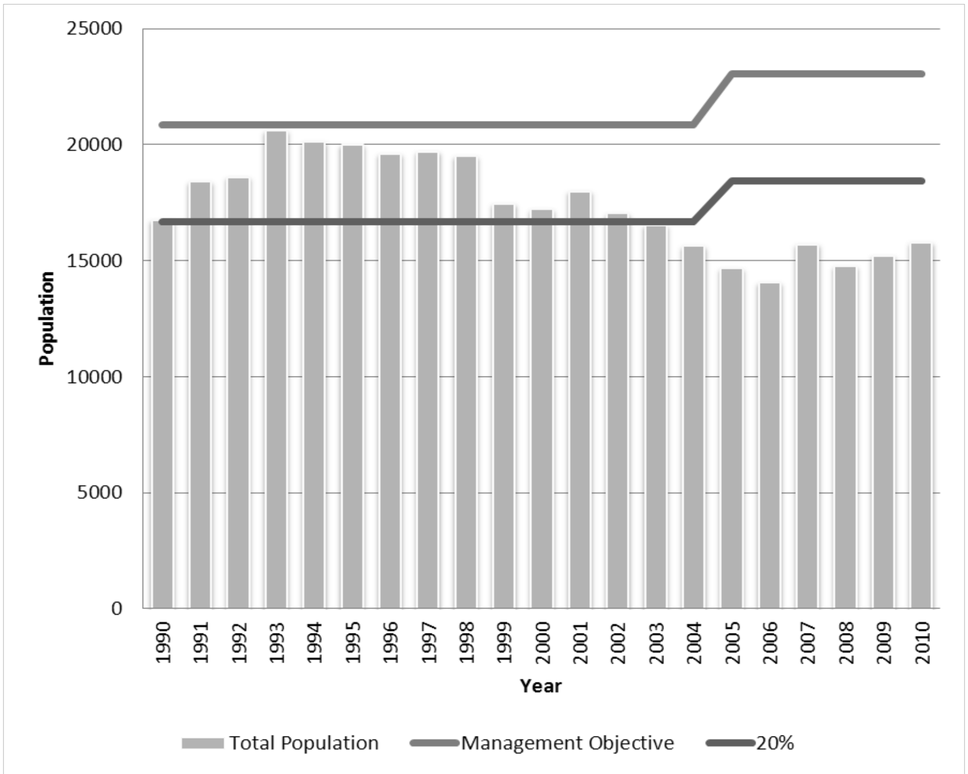

Figure 48. Estimated elk population for Oregon game management units within the Umatilla National Forest compared to the management objective for 1990-2010

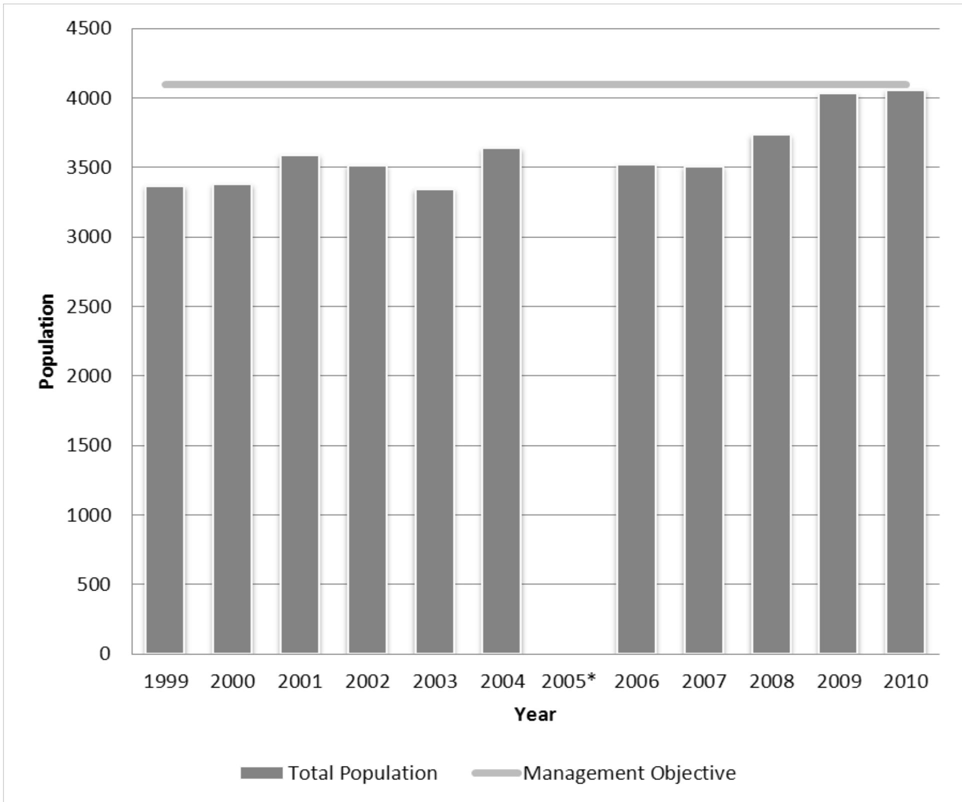

Figure 49. Estimated elk population for Washington game management units within the Umatilla National Forest compared to the management objective for 1999-2010 (asterisk indicates data is not available for at least one game management unit)

As displayed in the figures, the management objectives for the two states have not been met during the last decade. The forest plan indicated that when populations fell below 20 percent of the management objective for a herd unit, it should be determined if the cause is from Forest Service management. Oregon increased the management objective in 2005 for the Heppner Unit, which led to the change in figure 48, but populations would have still been below the 20 percent threshold even without this change. As displayed in table 332 and table 333, the national forest has generally met or exceeded desired conditions for HEI as well as for cover, indicating that forest management may not be responsible for this decline in population. Since 2004 two units, Wenaha and Mt. Emily, have consistently been 20 percent below the management objective(see table 334). The Wenaha unit has been documented as having low calf survival for several years, which has been attributed to predation (Fowler 2001, ODFW 2003a, ODFW 2006, Johnson 2011). ODFW is conducting a study within the Mt Emily unit on cougars, which are thought to be one of the leading factors for the decline to 50 percent of the elk management objective for that unit (Johnson 2011).

Similar to the discussion for the Malheur National Forest, the Umatilla National Forest still achieves the cover requirements as projected in the original plan also partly due to a predicted treatment level of less than 1 percent of the suitable acres.

Table 334. Percent of elk population management objective achieved by year and by game management unit (GMU)

GMU	2003	2004	2005	2006	2007	2008	2009	2010
Wenaha	33	32	34	38	38	36	35	38
Walla Walla	85	80	77	83	82	83	83	83
Mt. Emily	81	75	68	60	53	53	43	49
Ukiah	100	96	90	82	80	80	80	81
Desolation	105	95	92	108	108	95	84	98
Heppner	95	90	79	59	64	70	80	90

Effects to Rocky Mountain Elk in the Wallowa-Whitman National Forest – Figure 50 displays the estimated population and MOs for those game management units that have at least 10 percent of the Wallowa-Whitman National Forest within the unit boundaries. These units include: Minam, Imnaha, Catherine Creek, Keating, Pine Creek, Lookout Mountain, Snake River, Chesnimnus, Sled Springs, Starkey, Sumpter and Desolation. It would appear that in the last four years, the total management objective for the national forest has been met or exceeded. Between 1998 and 2005, a drop occurs and several units were not within the 15 percent identified as a trigger point in the forest plan. Most recently, even though the national forest is at or above the combined MO, two units, Keating and Sumpter, have been below the 15 percent level 4 out of the last 4 years.

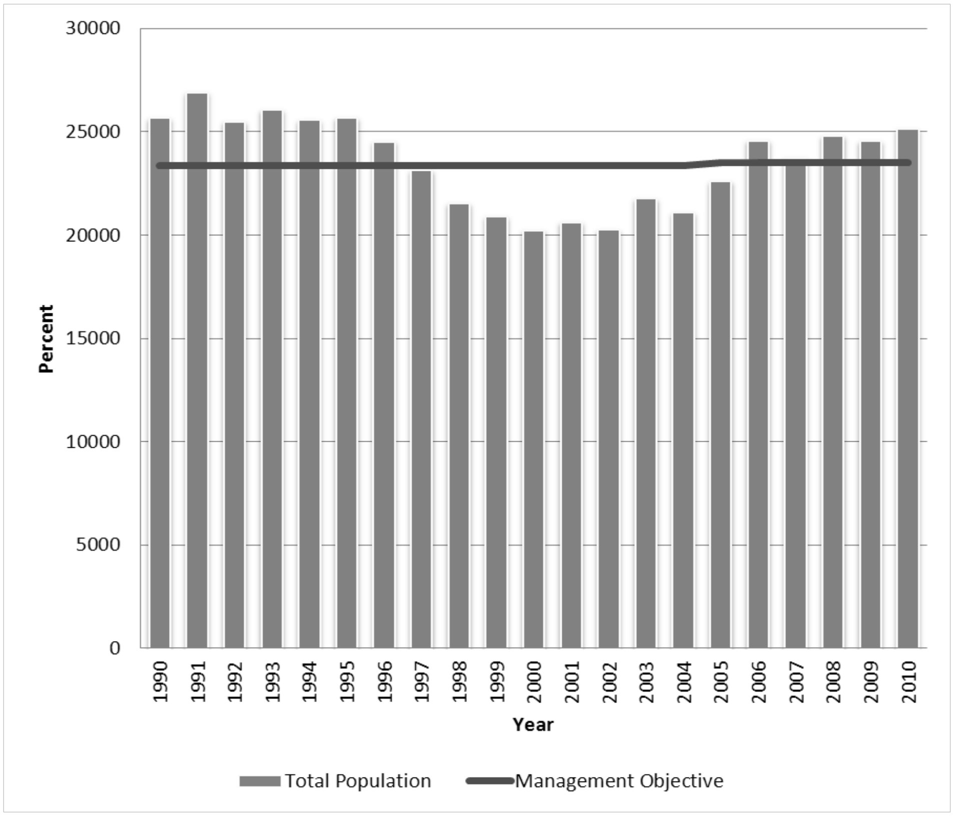

Figure 50. Estimated elk population for Oregon game management units within the Wallowa-Whitman National Forest compared to the management objective for 1990-2010

Again from table 332 and table 333, it would appear that the national forest has been achieving most of its standards for HEI and cover, so it is unlikely that Forest Service management was the cause of not meeting the population objectives.

Rocky Mountain Elk Security in Areas of Motor Vehicle Access – Rocky Mountain elk were selected as a management indicator species for the new planning effort for the Wallowa-Whitman (Farnsworth 2011) and Umatilla National Forests (Martin 2010) and will be used to represent security areas/motorized use management. Elk were selected as a management indicator species for the previous planning effort to represent general forest conditions. After review of several other forest plan revision efforts (Caribou, Medicine Bow, Payette, Boise, Sawtooth, Uinta, and Wasatch-Cache National Forests) and reviews of the intent of a management indicator species (Cooperrider 2002; Niemi et al. 1997; Owen 2010), it was decided that although hunted species such as elk do not truly meet the criteria to fulfill the purpose of management indicator species (changes in populations can be directly attributed to Forest Service management), they are very important both socially and economically and, as such, should be carried forward. Because elk occur in every habitat type and at virtually every elevation across the Blue Mountains, it was felt that they would be a useful species to monitor the effectiveness of motor vehicle use management and the change in availability of secure habitat. Open motor vehicle route density is a key element in determining whether or not elk remain in an area after the hunting seasons have started. If open motor vehicle route density is high, and security cover is low, elk will move until secure areas are found. Open motor vehicle route density is often the easiest and most effective attribute to manage since hiding cover criteria may take many years to meet the desired future condition.

Managing access to reduce elk vulnerability to hunting has some inherent problems in that the same controls used to restrict hunter travel also restricts sightseers, firewood gatherers, motorcyclists and others who use public lands (Moroz 1991). Unless the nature of the landscape somehow impedes human travel, access management will largely rely upon the willingness of people to voluntarily comply with travel restrictions (*ibid*). Open-road density of one mile per square mile has been considered a threshold above which elk will displace to avoid human disturbance (Christensen et al. 1993, Lyon 1983). Lyon and Christensen (2002) concluded that hiding cover alone cannot satisfy hunting season security requirements and neither can road closures and prevention of habitat fragmentation.

As such, the forest plan management question to be answered by selecting elk as a management indicator species is, "Can the state management objectives for populations continue to be achieved as the desired conditions for vegetation are achieved through the management of security areas (wilderness and roadless areas) and meeting the desired conditions for open motor vehicle routes?"

Many wildlife species, respond negatively to human disturbance (Boyle and Samson 1985, Gaines et al. 2003, and Tempel et al. 2008). Although two species were identified as focal species for human disturbance (USDA Forest Service 2010), Rocky Mountain elk and their relationship to human disturbance have probably received the greatest amount of study (Edge and Marcum 1991, Lyon 1983, Naylor et al. 2009, Rowland et al. 2004). The Blue Mountains are a popular area for resident and nonresident hunting and receives some of the greatest hunting pressure for elk in the State. Providing security areas, especially during the fall hunting seasons, is important for elk management. Many studies during the last three decades have shown that elk, when disturbed by humans, will leave an area that lacks sufficient cover (Hillis et al. 1991). Where forest canopy is greater than 50 percent, hiding cover and security areas can generally be provided.

Intrusion from sources other than hunting is increasingly a problem for elk managers (ODFW 2003a). This is particularly true on multiple-use public lands where access by motor vehicle and nonmotorized traffic is largely unrestricted and increasing (*ibid*). Traditional elk habitat models recognized the impacts from access, and used road density in order to evaluate impacts of proposed land management actions. This approach was better suited to the 1980s when most proposed projects were timber sales and associated roads needed for implementation. Since the early 1990s, both road building and timber sales have decreased while recreational, nonmotorized and motor vehicle cross-country activities and facilities have dramatically increased. While road density is still important, the impact from recreational access that doesn't use designated roads or trails is emerging as a pressing issue. Many federally administered public lands are open to cross-county travel by any means unless specifically closed (i.e., wilderness, seasonal area closures, etc.). The past growth of motor vehicle and nonmotorized recreational pursuits is believed by elk managers to threaten some herds and to have contributed to shifts of elk from some public lands onto adjacent private lands. When the forest plans were approved in 1990, cross-country motor vehicle travel was prohibited within much of the Umatilla National Forest; however, the Wallowa-Whitman National Forest did not prohibit cross country travel unless an area was closed to it by order. It is assumed that through implementation of the 2005 Travel Management Rule (36 CFR 212), both national forests will have very limited cross-country summer travel.

Security is provided through limiting open motor vehicle road and trail densities (Unsworth and Kuck 1991); maintaining vegetation that adequately shields elk from a hunters view (Edge et al. 1990) and the topography of the landscape (Edge and Marcum 1991). The Hillis paradigm (Hillis et al. 1991) is often cited for the criteria that define security areas. Briefly, it identifies the size (250 or more acres), shape (nonlinear), and distance from open roads (more than 0.5 mile) for security areas as well as how much of the area (more than 30 percent) should be dedicated to security. At some point, however, the availability of security areas will not compensate for hunter density (Unsworth and Kuck 1991). Lyon and Christensen (2002) concluded that hiding cover alone cannot satisfy hunting season security requirements, and neither can road closures and prevention of habitat fragmentation.

Effects from Alternatives B, C, D, E, and F to Rocky Mountain Elk

Effects to Rocky Mountain Elk in the Umatilla National Forest – Security areas are those areas that have open motor vehicle route densities below 1 mile per square mile. As displayed in figure 51, for alternative C, 55 percent of the Umatilla National Forest would be considered security areas for Rocky Mountain elk. This is a result of the establishment of MA 3C, which would have a desired condition for open motor vehicle route density of less than 1 mile per square mile. In actuality, MA 3C currently would have open motor vehicle route densities higher than the desired, but during the life of the plan it is anticipated that the desired condition would be achieved. Alternatives E and F are essentially the same, and achieve a greater amount of security habitats through the anticipated implementation of the desired condition for roads in bull trout watersheds. Only slight differences occur between alternatives A, B, and D, with less than 25 percent of the landscape in security areas.

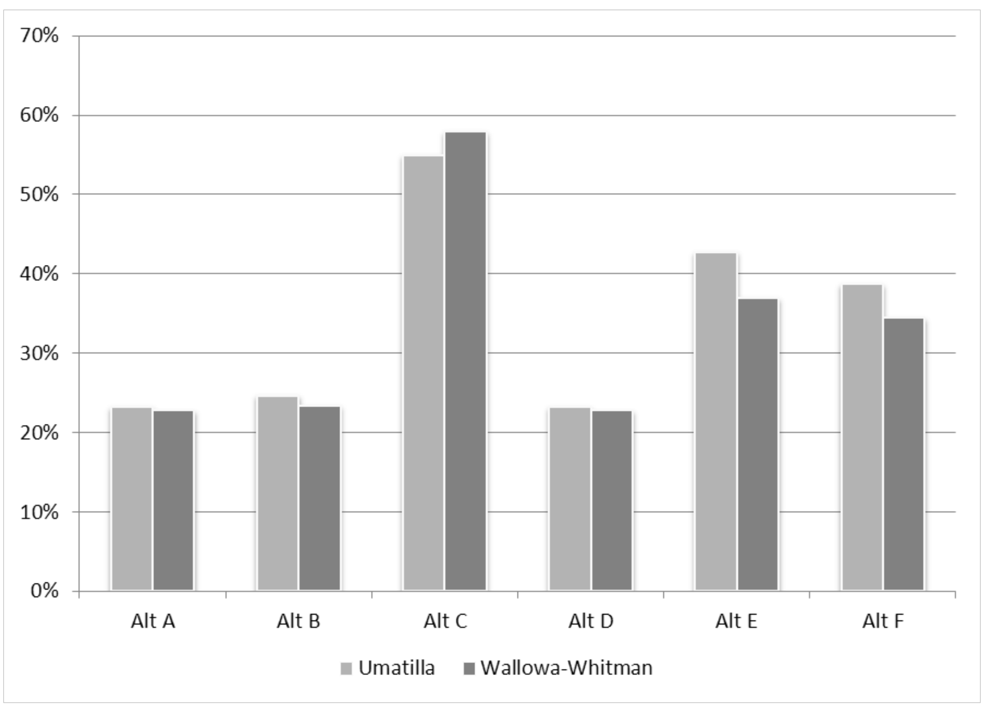

Figure 51. Percent of the Wallowa-Whitman and Umatilla National Forests in security habitats available for Rocky Mountain elk by alternative

Open motor vehicle routes (roads and trails) and security cover are the greatest consideration on summer range relating to habitat effectiveness (Christensen et al. 1993). Open motor vehicle route density during the hunting season is primarily an elk vulnerability consideration, since hunting is the primary source of elk mortality (Lyon and Christensen 2002). The alternatives address travel management by providing a range of desired open motor vehicle route densities (open miles/square mile) by management area and forest landscape scales (see the access management effects discussion). Security cover then becomes important in those areas that have open motor vehicle routes in excess of 1 mile per square mile. It becomes a requirement for maintaining elk populations where hunting or human harassment occurs, and humans have easy access to elk habitat. Edge et al. (1990) believed this was the crux of the issue concerning the potential effects of timber harvesting on elk habitat effectiveness on spring-summer-autumn ranges. As displayed in figure 52, for three alternatives, less than half of the Umatilla National Forest has road densities that increase the importance of security cover for elk. For alternatives B and D, security cover would be important on more than 60 percent of the national forest. Assuming that the amount of land base in lower road density would indicate improved habitat for elk, then alternative C followed by E and then F would be the better alternatives for elk.

Although the Hillis paradigm (Hillis et al. 1991) indicates a need to have at least 30 percent of an area in security areas, historically this probably did not occur in all areas. Vegetation within the Blue Mountains national forests was modeled using VDDT to establish HRV (Countryman and Justice 2010). This data was then evaluated by potential vegetation group and structural stages to determine what percent of the landscape would come close to meeting the various definitions of cover (see table 333). The need for vegetative cover is reduced in areas of steep, convex topography which limits human access during hunting season as well as enhances the probability of elk escapement (Edge and Marcum 1991).

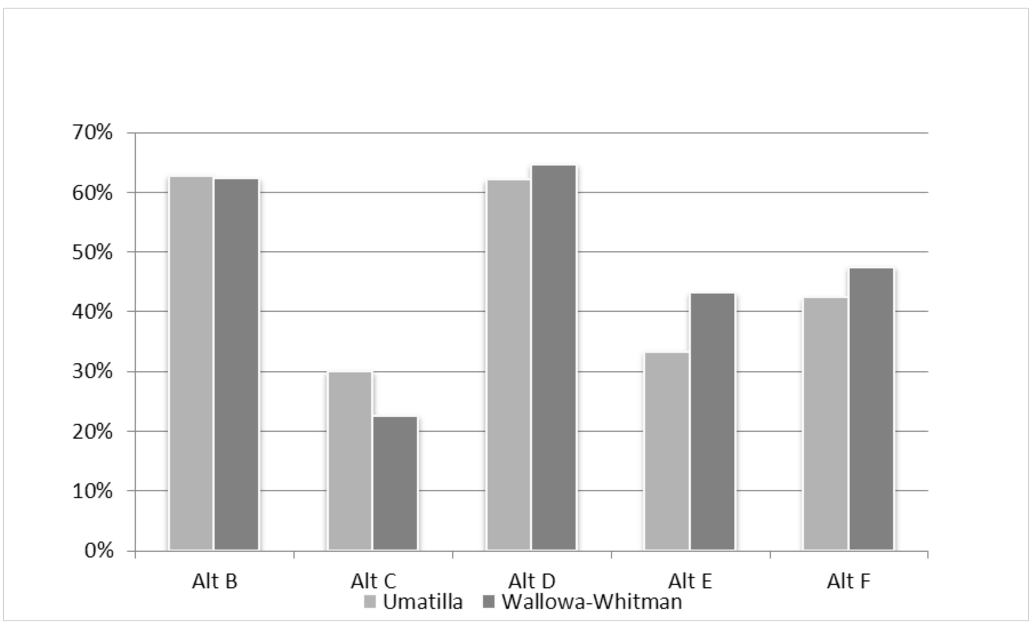

Figure 52. Percent of each National Forest by alternative that have open motor vehicle route densities higher than one mile per square mile

Using the HRV analysis as a basis, historical levels of hiding cover were determined for each alternative and each national forest for lands outside of the security areas presented above (wilderness, roadless, etc.). At the end of the second decade, none of the alternatives would have 30 percent of MA 4A General Forest in security cover (see figure 53) within the Umatilla National Forest. However, alternative D, the most aggressive treatment alternative, maintains security cover within the expected range of historical variability (see figure 54) at the scale of MA 4A.

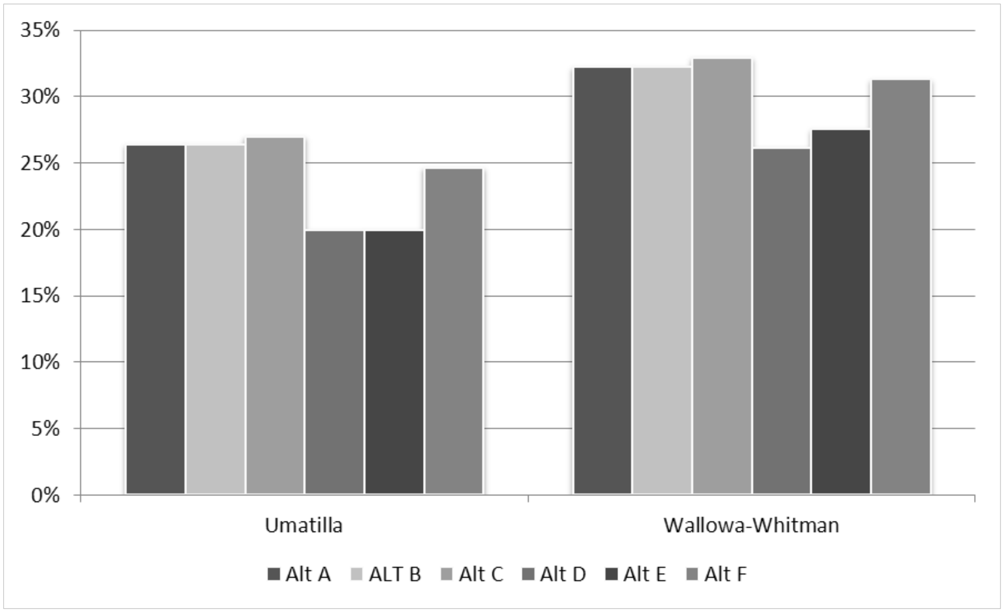

Figure 53. Hiding cover available for Rocky Mountain elk by alternative and national forest at the end of the second decade

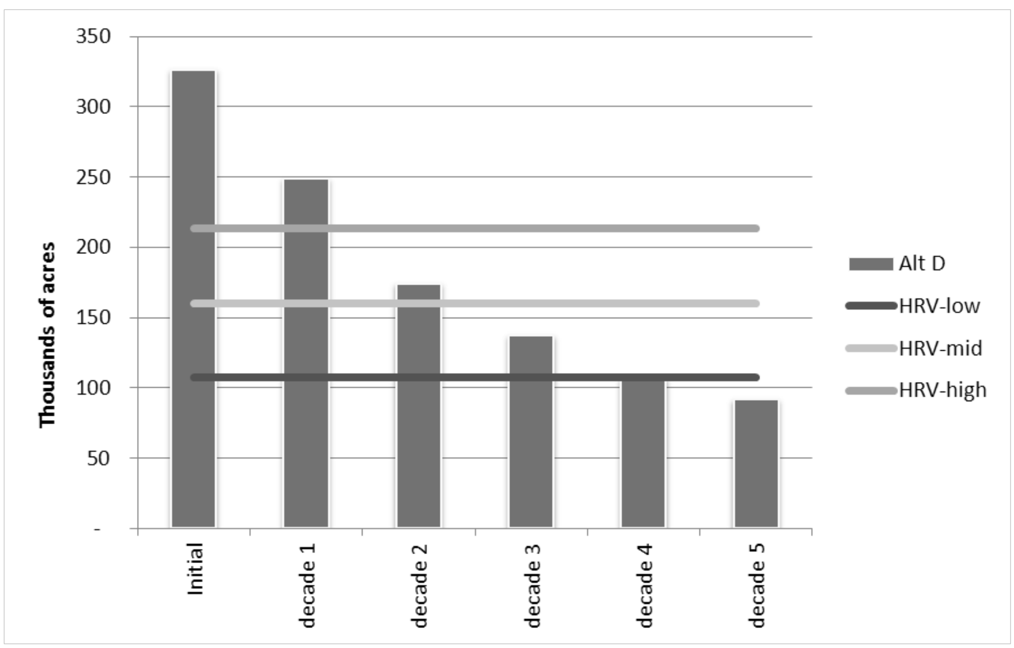

Figure 54. Elk hiding cover within active management areas in relation to HRV for alternative D during the first five decades for the Umatilla National Forest

None of the alternatives meet the paradigm of 30 percent security cover presented by Hillis et al. (1991); however, all alternatives would maintain levels of security cover that exceed what would have been expected historically. The effect of this lack of security cover is ameliorated somewhat by the amount of wilderness areas and backcountry areas within the Umatilla National Forest.

Alternative D is the only alternative that has a desired condition for open motor vehicle route densities greater than 2.4 miles per square mile. Although it appears that the proposed desired condition for open motor vehicle route density within the Umatilla National Forest (2.4 miles per square mile) is greater than the 1990 forest plan desired condition (two miles per square mile), the 1990 forest plan desired conditions are for the entire national forest, which includes using wilderness areas and roadless areas to calculate road density per square mile. It is recognized that there will be areas where achieving the desired density will not be possible due to the high standard of a road and its connectivity to other end points, but these hopefully will be the exception and not the rule. Taking all of these factors together, alternative C provides the greatest security for elk, followed by E, F, B, and finally D.

Effects to Rocky Mountain Elk in the Wallowa-Whitman National Forest – At the end of the second decade, all alternatives except D and E maintain more than 30 percent of the landscape in security cover within the Wallowa-Whitman National Forest (see figure 53). Security cover begins to dip below the 30 percent level by the fourth decade. At the scale of MA 4A, alternative D, the most aggressive treatment alternative, maintains vegetative conditions that meet security cover definitions within the range of historical variability (see figure 55).

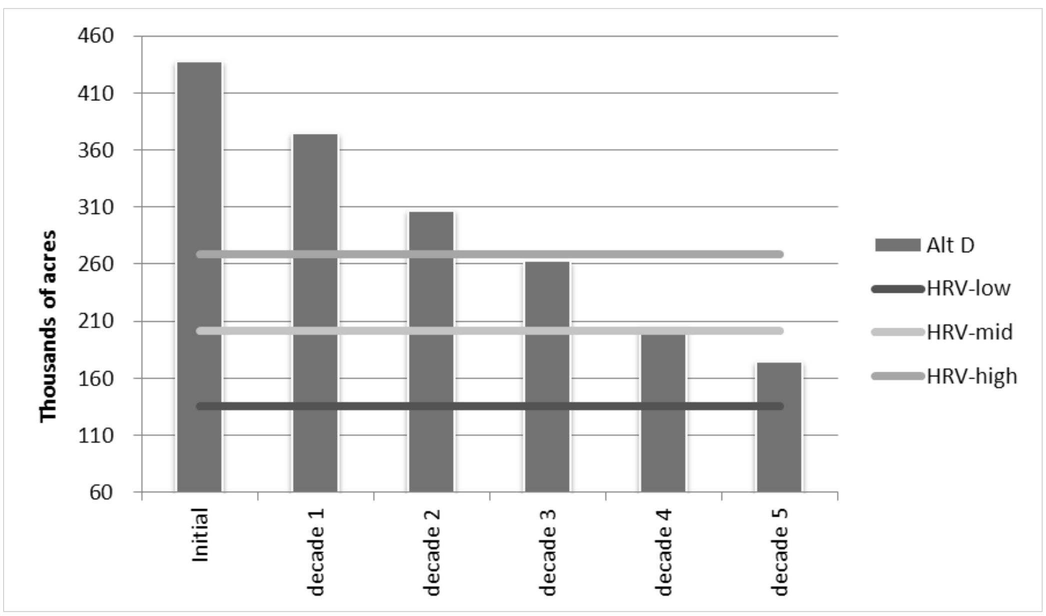

Figure 55. Hiding cover available for Rocky Mountain elk for the first five decades compared to HRV for alternative D within the Wallowa-Whitman National Forest active management areas

Similar to the discussion for the Umatilla National Forest, alternative D is the only alternative that has a desired condition for open motor vehicle route densities greater than 2.4 miles per square mile. It is recognized that there will be areas where achieving the desired density will not be possible due to the high standard of a road and its connectivity to other end points, but these hopefully will be the exception and not the rule. Taking all of these factors together, alternative C provides the greatest security for elk, followed by E, F, B, and finally D.

Rocky Mountain Elk Population Trends – Current population trends were discussed in detail for alternative A and all alternatives anticipate continuing the use of population data collected by the state game and fish agencies to assess population trends. Although alternative C reduces access to a large portion of all three Blue Mountains national forests and alternative D maintains the current situation, the population of Rocky Mountain elk is expected to remain stable during the life of the plan for any of the alternatives. This is because herd numbers are managed by the state game agencies to stay within the population objectives that have been set by the respective agency.

State elk populations objectives within the Blue Mountains are displayed in table 335. Of the 23 game management units encompassing portions of National Forest System lands, nine are not currently within plus- or minus-10 percent of the population objectives and four units exceed the population objectives. It could be important to assess motor vehicle access management to help bring populations within the desired objective. Most units contain multiple ownerships, which must be considered in attempting to either increase or decrease access to achieve population objectives. Elk populations are expected to remain abundant due to their social and economic importance, management emphasis by state wildlife agencies, and the adaptability of the species.

White-headed Woodpecker

The white-headed woodpecker is considered a sensitive species within Region 6 and is listed as apparently secure in the United States and imperiled and vulnerable to extirpation or extinction for both Oregon and Washington (Natureserve 2011). It has been identified as a focal species in several of the subbasin plans completed for the Northwest Power and Conservation Council within the Columbia Basin and is currently considered as a focal species for the Blue Mountains national forests plan revision effort. Wisdom et al. (2000) indicated that source habitats basin-wide have declined moderately or strongly in more than 50 percent of watersheds containing appropriate habitat types for this species. The Blue Mountains Ecological Unit showed a balanced mix of increases and decreases of habitat within watersheds (*ibid*).

Because the white-headed woodpecker was discussed in some detail as a focal species previously, only the analysis associated with its function as a management indicator species is discussed here.

Effects from Alternative A to the White-headed Woodpecker – The white-headed woodpecker was a member of the primary cavity excavators identified as a management indicator species for all three national forests. The Malheur National Forest specifically named this species, whereas the Wallowa-Whitman National Forest included it in a list of the species it considered primary excavators, The Umatilla National Forest indicated primary excavators, which would have included this species. As previously mentioned, areas subject to management were to maintain snags at a level that would maintain at least 60 to 65 percent of the potential population. Based on appendix 22 from Thomas et al. (1979), this would include 13.5 snags per acre greater than or equal to 10 inches d.b.h. in both ponderosa pine and mixed conifer.

Because all three national forests were actually using the suite of primary cavity excavators as management indicator species, an analysis of alternative A for the white-headed woodpecker is not presented here. Rather, the reader is referred to the analysis that has already been presented for primary cavity excavators.

Table 335. Percent of Rocky Mountain elk population objective achieved by management zone, game management unit, and year for the last decade for units containing National Forest System lands in the Blue Mountains

		National Forest		Year									
Management Zone	**GMU**	**UMA**	**WAW**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Wallowa	Minam	NA	73%	90	90	100	100	105	105	105	105	105	105
	Imnaha	NA	74%	100	119	125	138	138	138	150	238	225	225
	Catherine Creek	NA	23%	68	84	67	64	90	117	117	140	180	160
	Keating	NA	41%	60	50	54	64	43	82	72	61	75	85
	Pine Creek	NA	57%	120	105	125	162	158	77	81	106	87	168
Totals				**95**	**90**	**105**	**112**	**113**	**107**	**119**	**134**	**136**	**158**
Wenaha-Snake	Snake River	NA	93%	81	79	88	89	92	97	97	105	95	95
	Chesnimnus	NA	47%	69	83	83	86	89	97	97	100	106	106
	Sled Springs	NA	18%	73	76	78	78	95	95	95	91	91	91
	Wenaha	69%	NA	26	27	33	32	34	38	38	36	35	38
	Walla Walla	30%	NA	85	85	85	80	77	83	82	83	83	83
	MT Emily	36%	8%	85	85	81	75	68	60	53	53	53	49
Totals				**70**	**73**	**75**	**73**	**76**	**78**	**77**	**78**	**77**	**77**
Umatilla-Whitman	Starkey	3%	60%	89	88	100	92	100	123	107	100	101	97
	Ukiah	27%	6%	120	102	100	96	90	82	80	80	80	81
	Sumpter	NA	29%	100	100	102	84	90	88	80	79	72	76
	Desolation	53%	15%	145	125	105	95	92	108	108	95	84	98
	Heppner	27%	NA	110	100	95	90	79	59	64	70	80	90
	Fossil	3%	NA	150	130	125	125	169	67	67	64	67	75
Totals				**119**	**108**	**105**	**97**	**103**	**88**	**84**	**81**	**81**	**86**
Washington State	Blue Creek-Watershed	8%	NA	136	128	88	91		105	90	122	128	121
	Dayton	23%	NA	106	76	79	92		74	86	92	111	105
	Tucannon	80%	NA	65	69	66	75		62	87	76	65	67
	Wenaha	100%	NA		20				62	47			34
	Mountain View	33%	NA	42	65	97	83		101	87	55	88	93
	Lick Creek	71%	NA	77	88	79	98		89	79	103	91	102
Totals				**72**	**74**	**67**	**73**		**82**	**79**	**75**	**81**	**87**

Effects from Alternatives B, C, D, E, and F to the White-headed Woodpecker – The white-headed woodpecker was chosen as a management indicator species to represent the open-canopied ponderosa pine forests and specifically the medium to large trees and snags associated with older stands. The following management indicator species assessment utilizes the same definition for source habitat used by Wales et al. (2011).

Effects to White-headed Woodpecker in the Malheur National Forest – Figure 56 displays the predicted amount of source habitat for each alternative for the next five decades. As illustrated for all alternatives, although they are well below HRV, they have a positive trend for increasing source habitat. The results of the focal species assessment model indicated that habitat for the white-headed woodpecker is not well distributed. There is relatively little change in source habitat between alternatives B, C, E, and F in the first decade. All alternatives indicate an upward trend in source habitat over time and such a trajectory would indicate that populations should be stable throughout the plan period, assuming no other complicating factors occur. Alternative C shows the slowest recovery rate in source habitat over time, whereas alternative D shows the fastest. Habitat levels are a result of past management activities and even the increase (nearly double) projected for alternative D, is not sufficient to reach the 40 percent level often cited in the literature as a critical threshold (Landres et al. 1999, Lindenmayer and Luck 2005, Rompré et al. 2010, With and Crist 1995). Because of this, a key management concern for this species will be the spatial arrangement of habitat. Flather and Bevers (2002) suggest that as habitat amount falls below a critical threshold (i.e., 40 percent); the arrangement of that habitat becomes an even more important factor in enhancing viability of species.

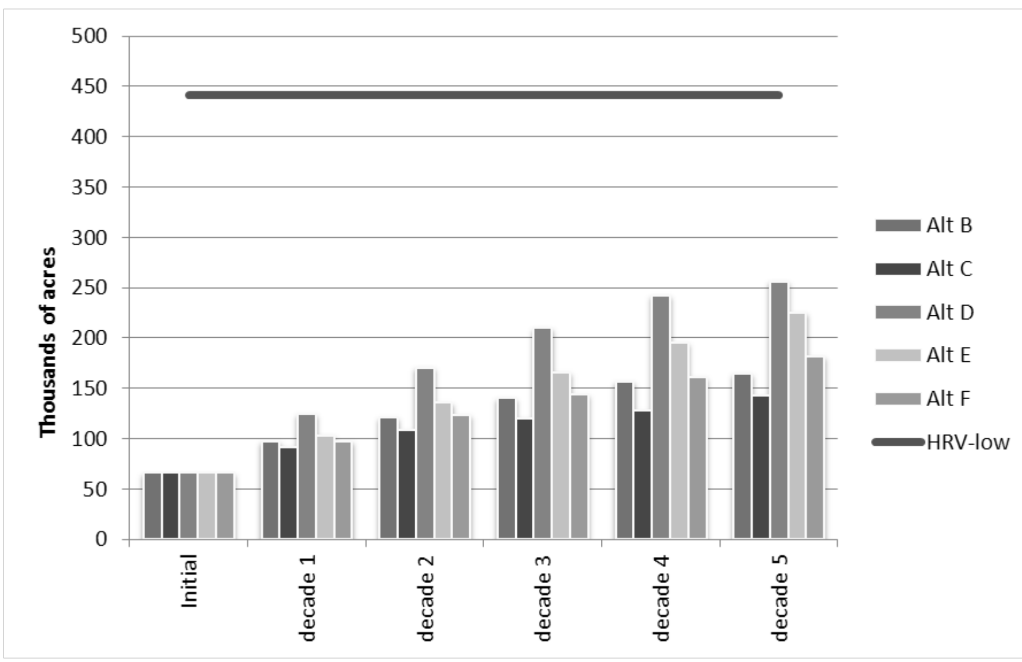

Figure 56. Decadal changes of white-headed woodpecker habitat on the Malheur National Forest compared to what would have been expected historically

Effects to White-headed Woodpecker in the Umatilla National Forest – Figure 57 displays the predicted amount of source habitat for each alternative for the next five decades. As illustrated for all alternatives, although they are well below HRV, the alternatives have a positive trend for increasing source habitat. Essentially the same trend described for the Malheur National Forest would occur for the Umatilla National Forest. The discussion will not be repeated.

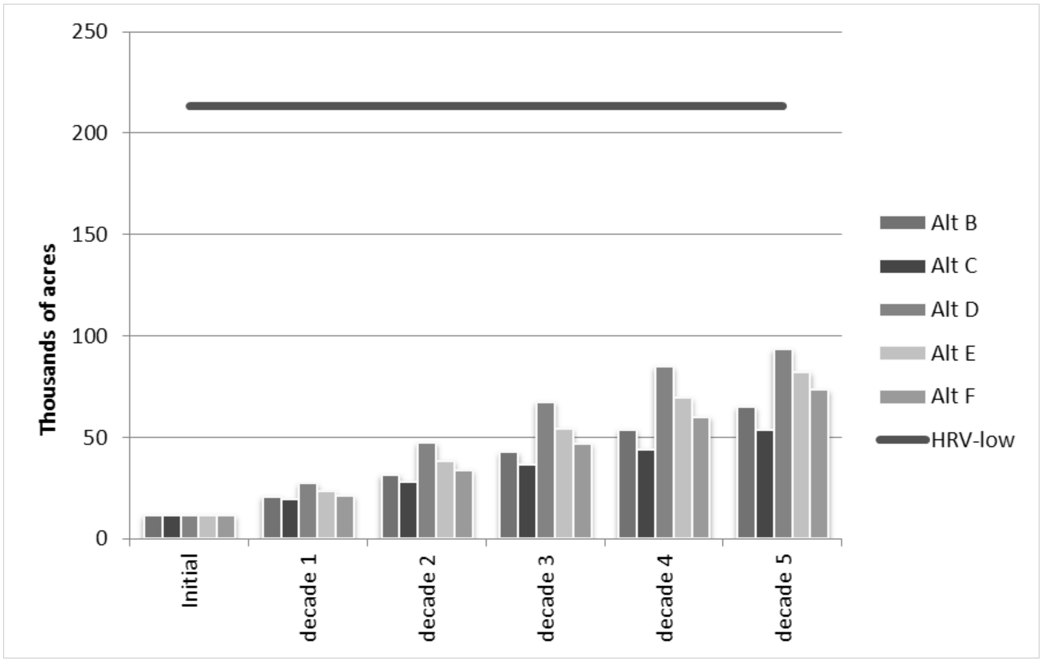

Figure 57. Decadal changes of white-headed woodpecker habitat on the Umatilla National Forest compared to what would have been expected historically

Effects to White-headed Woodpecker in the Wallowa-Whitman National Forest – Figure 58 displays the predicted amount of source habitat for each alternative for the next five decades. Again, the trend for the Wallowa-Whitman National Forest would be the same as for the Malheur and the Umatilla National Forests. The discussion will not be repeated.

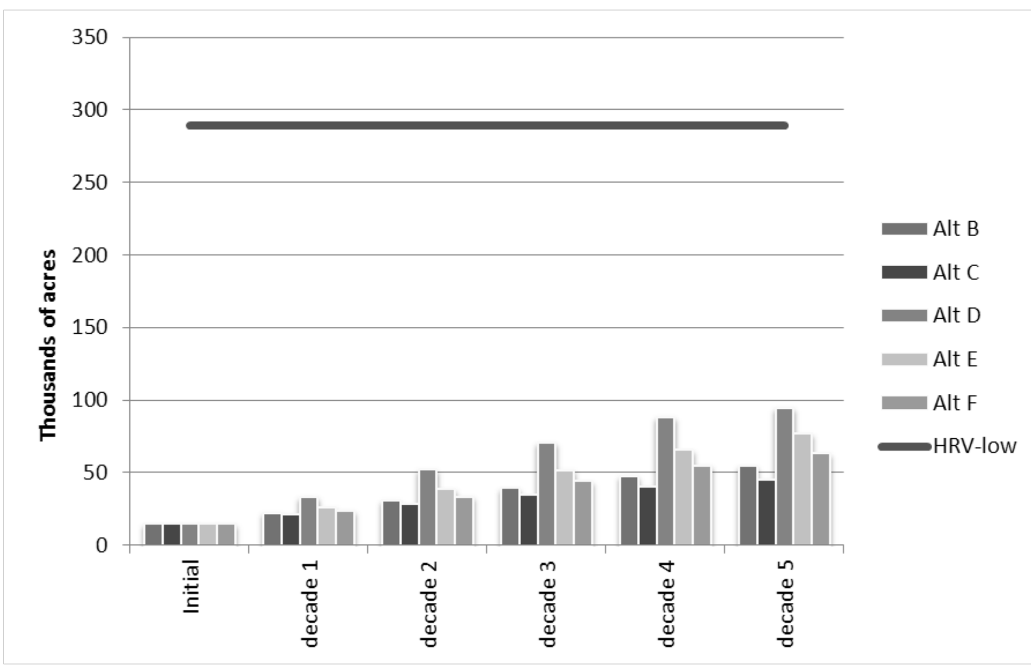

Figure 58. Decadal changes of white-headed woodpecker habitat on the Wallowa-Whitman National Forest compared to what would have been expected historically

White-headed Woodpecker and Snags – Large snags are a part of the habitat for which the white-headed woodpecker has been identified as a surrogate to measure how well the desired conditions of the plan alternatives are being met. Essentially all alternatives, with the exception of alternative D, would have the same standard and guideline (WLD-HAB-12 S-7) to provide protection for all snags 21 inches d.b.h. or larger and would maintain at least 50 percent of the current snags between 12 and 21 inches d.b.h. The desired condition for all alternatives is to have varying levels of snag density and sizes across the landscape. As such, it is not anticipated that levels of snags would vary substantially between alternatives and as shown in table 336, it would appear that snags are within the historical range of variability for roost and nest sites of the white-headed woodpecker.

Table 336. Snag density greater than 20 inches d.b.h. per acre for 30, 50, and 80 percent tolerance levels found at white-headed woodpecker nest and roost sites in the ponderosa pine-Douglas-fir forest, larger trees vegetation condition class, percent of the landscape that historically met these levels, and percent of the landscape currently meeting these levels for the dry forest potential vegetation group based on Mason and Countryman (2010)

Species tolerance levels from DecAID table PP_DF_O.sp-22			Percent of landscape that historically met species tolerance levels (snags per acre)		Percent of landscape that currently meets species tolerance levels (snags per acre)	
30%	50%	80%	< 80% (> 0 to ≤ 2)	> 80% (> 2)	< 80% (> 0 to ≤ 2)	> 80% (> 2)
0.2	1.3	2.8	79%	15%	81%	13%

White-headed Woodpecker Population Trend – Data needed to assess population trends of the white-headed woodpecker are lacking at the national forest, region and range scales. The breeding bird surveys for Oregon show no trend (Sauer et al. 2008). However, the accuracy is considered to be very imprecise (Red) and would not be able to detect a five percent per year change over the long term. Based on the habitat predictions, it is anticipated that populations would at least remain stable for all alternatives. Although habitats could be poorly distributed, dispersal within the planning area was not considered to be of concern for this species (Wales et al. 2011).

Management Indicator Species Common to Alternatives B, C, D, E and F

Mule Deer – Malheur National Forest

Similar to the discussion for Rocky Mountain elk, mule deer (*Odocoileus hemionus*) are a hunted species and do not truly meet the criteria to fulfill the purpose of management indicator species (where population change can be directly attributed to Forest Service management). Because they are important both socially and economically, mule deer were selected as a management indicator species for the new planning effort only for the Malheur National Forest (Gouchner 2010). They were selected to represent security areas/motor vehicle use management and the herbaceous understory of early successional and opened canopy dry forest.

Mule Deer Distribution – Mule deer are extremely adaptable and can be found in all major climatic and vegetation zones of the Western United States except the arctic, tropics and extreme deserts (Boyd and Cooperrider 1986). Mule deer are native to Oregon and typically are found east of the crest of the Cascade Mountain Range. Vernon Bailey (1936) estimated Oregon’s mule deer population to be 39,000 to 75,000 animals from 1926 to 1933. Mule deer populations increased through the 1930s and 1940s, peaking during mid-1950s, mid-1960s and in the mid-1970s. Fluctuations in mule deer populations can be attributed to several factors that directly or indirectly affect habitat. Drought conditions reduce forage and cover values, while severe winter weather conditions can result in large losses of deer.

Mule Deer Habitat – Oregon's deer management plan (ODFW 2003a) describes mule deer habitat in eastern Oregon:

> The most important deer habitats in Eastern Oregon are summer habitat (including areas needed for reproductive activities) and winter habitat. Preferred summer habitat provides adequate forage to replace body reserves lost during winter and to maintain normal body functions. Summer habitat also includes areas specifically used for reproductive purposes. These areas must have an adequate amount of succulent vegetation, offering highly nutritional forage. In addition, areas used for reproduction should provide isolation from other deer, security from predators and minimal competition from other ungulates. Summer habitat areas are common throughout Eastern Oregon, and can be found in areas varying from lowland agricultural lands to high elevation mountain areas.
>
> Winter habitat is found predominately in lower elevation areas of Eastern Oregon. These areas usually have minimal amounts of snow cover and provide a combination of geographic location, topography, and vegetation that provides structural protection and forage. Due to the low nutritive values of available forage during the winter, deer are forced to rely on their body reserves acquired during the summer for winter survival.

Deer habitat has changed dramatically during the last 100 years. Overgrazing by livestock during the late 1800s and early 1900s resulted in rangelands that were dominated by shrubs and forb species more favorable for deer, and populations increased (ODFW 2003b). Mule deer numbers in general have decreased during the past decade across the western United States, which is partly explained by mule deer's need for early and mid-successional habitats; habitats that are being lost due to a lack of disturbance either from fire and/or mechanical (timber harvest) treatment. Similar patterns were noted in most western states (Unsworth et al. 1999). Increased fire suppression activities allowed the encroachment of woody vegetation resulting in old decadent shrub plants that have less nutritional value for deer, the loss of desirable shrub and forage species, and the loss of forested areas that were maintained as opened canopy under natural fire regimes and provided for the growth of many important deer browse plants (Hayden et al. 2008).

Nutritional intake is a critical component of deer biology. Mule deer, like elk, are somewhat of a habitat generalist, although deer have a more selective diet, selecting higher quality forage than elk (ODFW 2003b), mostly forbs and shrubs/trees (Bartmann 1983, Findholt et al. 2004). Findholdt et al. (2004) suggested this lack in flexibility could result in increased competition for forage resources with cattle and elk when densities of these animals are high or forage production is low. Because the emphasis currently on National Forest System lands is to manage towards HRV, it was felt that mule deer would respond to the improvement in the understory in the dry forest because of the movement towards more open canopy as well as the increase in early seral stages.

Along with a concern for improving forage conditions for mule deer, is the concern of maintaining adequate security areas (Vavra et al. 2005, Wisdom et al. 2005, Wisdom et al. 2005a). Mule deer reaction to human disturbance is slightly different than elk (Taylor and Knight 2003). Deer are found closer to roads than elk on shared ranges, which may be a result of mule deer avoidance of elk (Johnson et al. 2000, Wisdom et al. 2005, Wisdom et al. 2005a). Human disturbance still results in reducing the quality of habitat for mule deer and therefore they were selected to indicate the effectiveness of motor vehicle use management and secure habitat change. Where road density is high, and security cover is low, deer will move until secure areas are found. Open-road density is often the easiest and most effective attribute to manage since hiding cover criteria may take many years to meet the desired future condition.

As such, the forest plan management question to be answered by selecting mule deer as a management indicator species for the Malheur National Forest is, “Will achieving HRV in the dry forest and meeting the desired conditions for human access on the Forest help the State achieve their population management objectives?”

Effects from Alternatives B, C, D, E, and F to Mule Deer

Figure 59 displays the amount of forest structure (open forest, early successional) within the dry potential vegetation group that is anticipated to provide forage for mule deer. In the first decade, there does not appear to be a large difference between alternatives. The trend appears to be that alternatives B and F are relatively stable; alternatives D and E increase; and alternative C decreases the amount of forage over time.

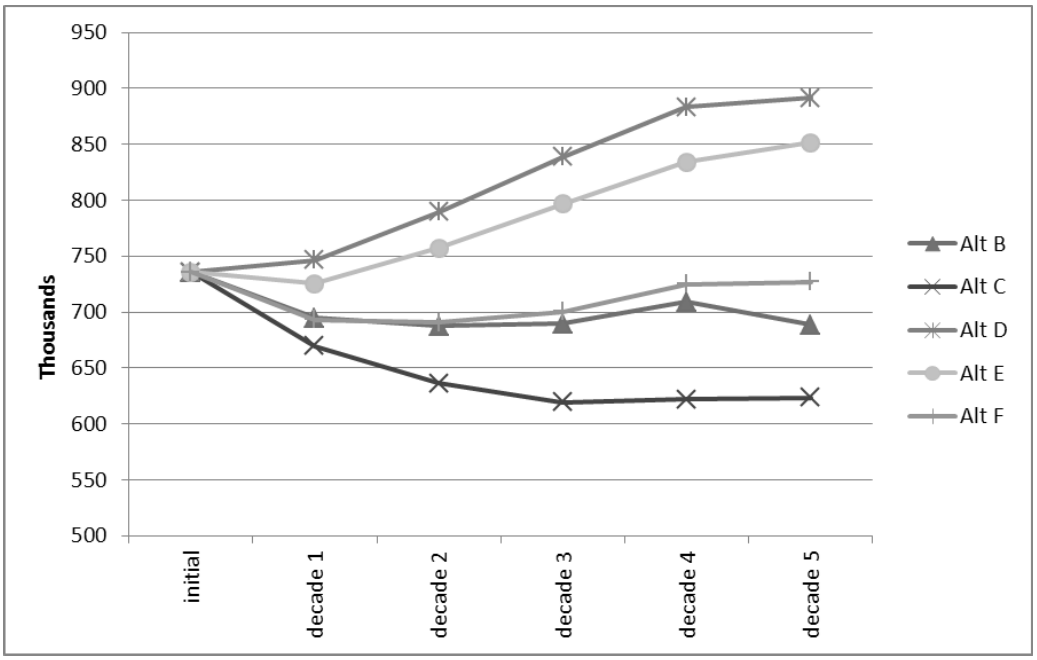

Figure 59. Acres of mule deer forage areas within the Malheur National Forest by alternative for the first five decades

On the other hand, when comparing the amount of area that provides security, a different trend is apparent: alternative C would provide the greatest amount of secure areas, whereas the least amount would be provided by alternative D (figure 60). Finally, hiding cover within the areas to be actively managed is still important (Germaine et al. 2004). None of the alternatives approach what historically has been considered the optimum amount of cover (40 percent) for elk and mule deer habitat (Thomas et al. 1979). Reynolds (1969) indicated that deer need areas of heavy stocking levels (in excess of 160 square feet of basal area in immature stands) to provide escape and security cover. Cover continues to be important in the presence of human disturbance as mule deer, unlike elk, probably hide rather than flee disturbance (Vavra 2009). As with secure areas, alternative C provides the greatest amount of hiding cover over time with alternatives B and F being relatively the same during the first three decades (see figure 61). Alternative D, which provides the greatest increase in forage, provides the least amount of hiding cover. Considering the tradeoffs between all of the alternatives, in all likelihood either alternative B or F would provide the best combination of increased forage while maintaining security areas for mule deer.

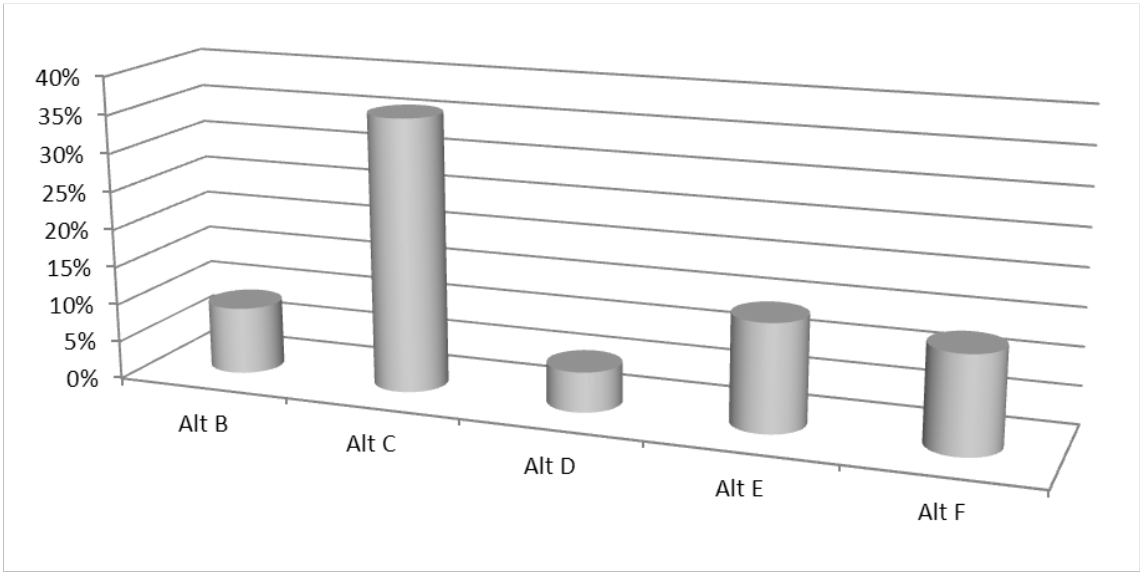

Figure 60. Mule deer security habitat available by alternative for mule deer for the Malheur National Forest

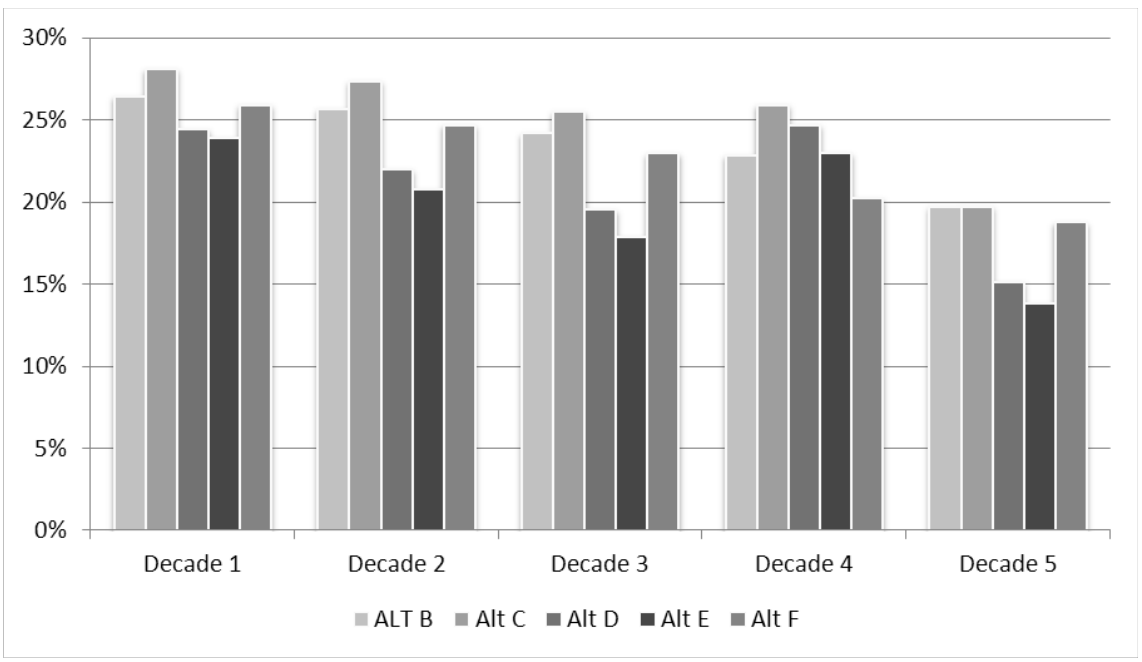

Figure 61. Percent of active landscape in mule deer hiding cover by alternative for five decades within the Malheur National Forest

Mule Deer Population Trends – According to CFR 219.19(a) (6), "Populations trends of the management indicator species will be monitored and relationships to habitat determined. This monitoring will be done with State fish and wildlife agencies, to the extent practicable." The Malheur National Forests would rely on survey data collected by the Oregon Department of Fish and Wildlife (ODFW) for population numbers and trend analysis of all game species.

Vernon Bailey (1936) estimated Oregon's mule deer population to be 39,000 to 75,000 animals from 1926 to 1933. Between 1990 and 2001, populations of mule deer were consistently below the management objective for Oregon (ODFW 2003b). This continues to be the case for mule deer within the Malheur National Forest as well (figure 62).

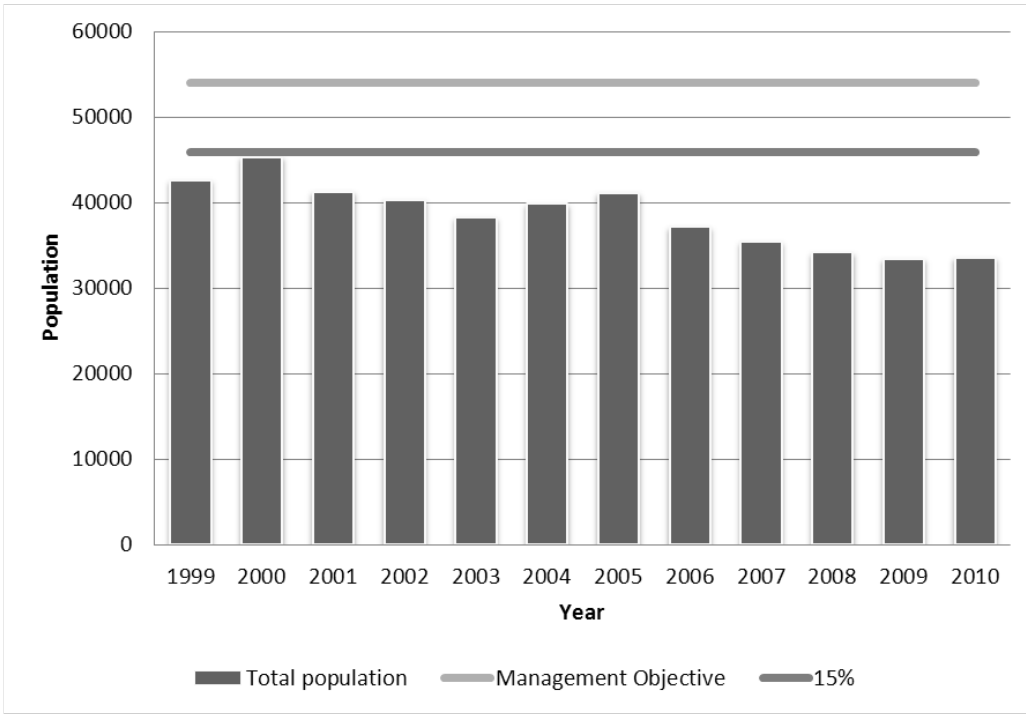

Figure 62. Estimated population of mule deer in comparison to the management objective for those units within the Malheur National Forest between 1999 and 2010

Many mule deer ranges will no longer support historical deer population levels, in part due to reduction of habitat caused by human development and changes in land use (Mule Deer Working Group 2003). Moderate population increases may be attained in some units with careful management; however, a return to the high deer population levels present in the 1950s, 60s and 70s probably will not occur due to changes to habitat and public acceptance (ODFW 2003a).

Fluctuations in mule deer populations can be attributed to many factors including drought, which reduces forage and cover values, and severe winter weather that result in large losses of deer. Both factors can cause poor deer condition and result in lower deer survival. In contrast, years of adequate moisture and mild winters will normally result in increased deer populations. Predation has recently been acknowledged as a contributor to suppressing deer populations (ODFW 2006, Robinson et al. 2002).

Mule deer numbers are held in check by hunting, both sport and depredation. State wildlife departments can change the number of harvest permits allocated, season lengths, and sex to be harvested by game management units, all of which affect populations. Although improvement is anticipated, especially in forage conditions, for all alternatives, the total number of acres that would be treated in the dry potential vegetation group probably wouldn’t be enough to cause a perceptible increase in populations that could be attributed to Forest Service management activities. It is assumed that mule deer populations would remain stable for all alternatives.

Domestic Livestock Grazing in Relation to Management Indicator Species

Forest Service regulations (36 CFR §219.20) related to forest planning and grazing states:

> In forest planning, the suitability and potential capability of National Forest System lands for producing forage for grazing animals and for providing habitat for management indicator species shall be determined as provided in paragraphs (a) and (b) of this section. Lands so identified shall be managed in accordance with direction established in forest plans.
>
> (a) Lands suitable for grazing and browsing shall be identified and their condition and trend shall be determined. The present and potential supply of forage for livestock, wild and free-roaming horses and burros, and the capability of these lands to produce suitable food and cover for selected wildlife species shall be estimated. The use of forage by grazing and browsing animals will be estimated. Lands in less than satisfactory condition shall be identified and appropriate action planned for their restoration.

Consistent with 36 CFR §219.20(a), this analysis will supplement the Rangeland Resources section to identify capable management indicator species habitat on National Forest System lands and where management indicator species source habitat is coincident with open domestic livestock grazing allotments. The Rangeland Resources section identified rangelands that were in less than satisfactory condition. National Forest System lands that exist outside open allotments, while important to management indicator species, are not addressed here as they are not affected by domestic grazing animals. For detailed analysis in this section, the following criteria must be met:

1. Management indicator species source habitat must occur within open domestic grazing allotments
2. Domestic livestock grazing must pose a direct or indirect effect that either (a) is measurably contributing to the less than satisfactory condition of capable management indicator species habitat within an open allotment, and/or (b) measurably threatens the ability to restore capable habitat

The following discussion assesses each management indicator species relative to these criteria: (a) and (b).

Domestic Livestock Grazing in Relation to Pileated Woodpecker – The pileated woodpecker is a management indicator species for the medium/large trees in the cool moist potential vegetation group. While pileated woodpecker habitat does occur within open allotments (criteria 1), livestock grazing is not identified as a major threat to pileated woodpecker habitat. Threats to pileated woodpecker habitat from livestock impacts are believed to be incidental and limited to localized areas where livestock tend to congregate. The majority of pileated habitat typically provides sparse or little livestock forage, an indication that grazing, should it be present, has a low likelihood of posing a risk to development or maintenance of source habitat characteristics, such as large tree development or dense conditions.

Domestic Livestock Grazing in Relation to White-headed Woodpecker – The white-headed woodpecker is a management indicator species for the medium/large trees in the open and mature ponderosa pine and mixed ponderosa pine/Douglas-fir forests in the Blue Mountains. Past timber harvest has had the most significant impact on suitable habitat for white-headed woodpeckers (Wisdom et al. 2000). Large numbers of unregulated livestock in the early to mid-1900s resulted in a loss of fine fuels and created extensive areas of mineral soil that resulted in numerous successful conifer seedlings becoming established (Belsky and Blumenthal 1997, Borman 2005).

Grazing is not identified as a direct risk or threat to white-headed woodpeckers (Garrett et al. 1996, Wales et al. 2011, Wisdom et al. 2000), although it may indirectly influence some of the factors affecting white-headed woodpecker source habitat (Altman 2000). For example, grazing is believed to have some localized effects to the development of younger forests and aspen stands, including incidental trampling of reproducing tree seedlings. It can also result in localized areas of increased soil erosion, and increases the potential for introduction and spread of invasive weeds and other nonnatives. However, livestock grazing does not affect the presence and abundance of large tree structure (living and dead) on the landscape. White-headed woodpecker habitat does occur within open allotments (criteria 1) within the Blue Mountains, but impacts are believed to be incidental and limited to localized areas and not a measurable threat to the restoration of capable management indicator species habitat identified as in less than satisfactory condition

In summary, while management indicator species source habitat for both the pileated and white-headed woodpecker occurs within open allotments, livestock grazing does not measurably contribute to the less than satisfactory condition of management indicator species source habitat within an open allotment, nor would it measurably threaten the ability to restore source habitat. As such, no further analysis of grazing impacts to pileated or white-headed woodpeckers will be done.

Domestic livestock Grazing in Relation to Rocky Mountain Elk – Rocky Mountain elk were chosen as a management indicator species for security areas/cover. While Rocky Mountain elk security habitat does occur within open allotments (criteria 1), livestock grazing is not identified as a major threat to security habitat. Elk are an adaptable species and somewhat of a generalist in their use of habitat and forage (Cooperrider 2002). Regarding their habitat overall, and specifically foraging habitat, many studies have indicated that grazing management can have either positive or negative impacts on their habitat (Wambolt et al. 1997, Halstead et al. 2002, Torstenson et al. 2002, Findholt et al. 2004, Damiran 2006, and Vavra 2009). Management indicator species source habitat does occur within open allotments (criteria 1) and it is believed that livestock grazing across the range of the species within the Blue Mountains may have some effects to the quantity and quality of forage available to elk, although not to security habitat.

Domestic Livestock Grazing in Relation to Mule Deer – Mule deer were selected to represent forage conditions in the dry forest understory and, to a lesser degree, security areas and motor vehicle use management. Mule deer, like elk, are considered a habitat generalist, although deer have a more selective diet and tend to select higher quality forage than elk (ODFW 2003b). At times this less flexible diet, which comprises mostly forbs and shrubs/trees (Bartmann 1983, Findholt et al. 2004), could result in increased competition for forage resources with cattle and elk (Findholt et al. 2004). As with elk, several studies have indicated that grazing management can have either a positive or negative effect on mule deer habitat (Damiran 2006, Findholt et al. 2004, Kie et al. 1991, Loft et al. 1987, Torstenson et al. 2006, Vavra 2009, Willms et al. 1980). Management indicator species source habitat does occur within open allotments (criteria 1), and it is believed that livestock grazing across the range of the species within the Blue Mountains may have some effects to the quantity and quality of forage available to mule deer.

In summary, management indicator species source habitat for both Rocky Mountain elk and mule deer occurs within open allotments and livestock grazing may contribute to less than satisfactory conditions of management indicator species source habitat. Although some differences do exist in their responses to livestock grazing, for the most part deer and elk are very similar. As such, both will be analyzed together, assuming the responses would be the same unless specifically noted.

The dominant forage of cattle, elk, and deer includes shrubs, forbs and grasses (Findholt et al. 2004). The time of year and the order in which species (cattle, elk or deer) graze determines what resource is utilized (Coe et al. 2005). Findholt et al. (2004) concluded the following: 1) cattle will utilize more grasses and sedges than forbs and shrubs in pastures not previously grazed by cattle; 2) elk will utilize more resources and more evenly than deer and cattle; 3) elk responded to a decline in available lichens by increasing their consumption of grasses and sedges, which increased the competition between cattle and elk; and 4) the competition between elk and cattle also increased during the late summer. Skovlin et al. (1968) found that both elk and mule deer used pastures not grazed by cattle more than any of the cattle-grazed pastures, with use declining as cattle stocking rate increased. They found less of an effect by cattle on mule deer than on elk. Coe et al. (2005) found that deer and elk alike selected different resources when cattle were present and may also move out of pastures where cattle had been released.

For Rocky Mountain elk and mule deer, all lands, with the exception of talus slopes, water, and rock, are suitable for grazing and browsing. Although elk and deer will utilize steeper topography, they prefer gentler slopes and therefore suitable forage areas for elk and deer were limited by the same slope restriction as for domestic sheep (60 percent). Figure 63 displays those areas considered as suitable forage areas for deer and elk that are within active domestic livestock grazing allotments. On all three national forests, alternative C would have the fewest acres of overlap between domestic livestock grazing and elk/deer forage areas. On the Malheur and Wallowa-Whitman National Forests, alternative D has the greatest overlap and alternatives A, B, E and F would be similar. On the Umatilla National Forest, alternative B has the greatest overlap and alternatives A, D, E and F are essentially the same.

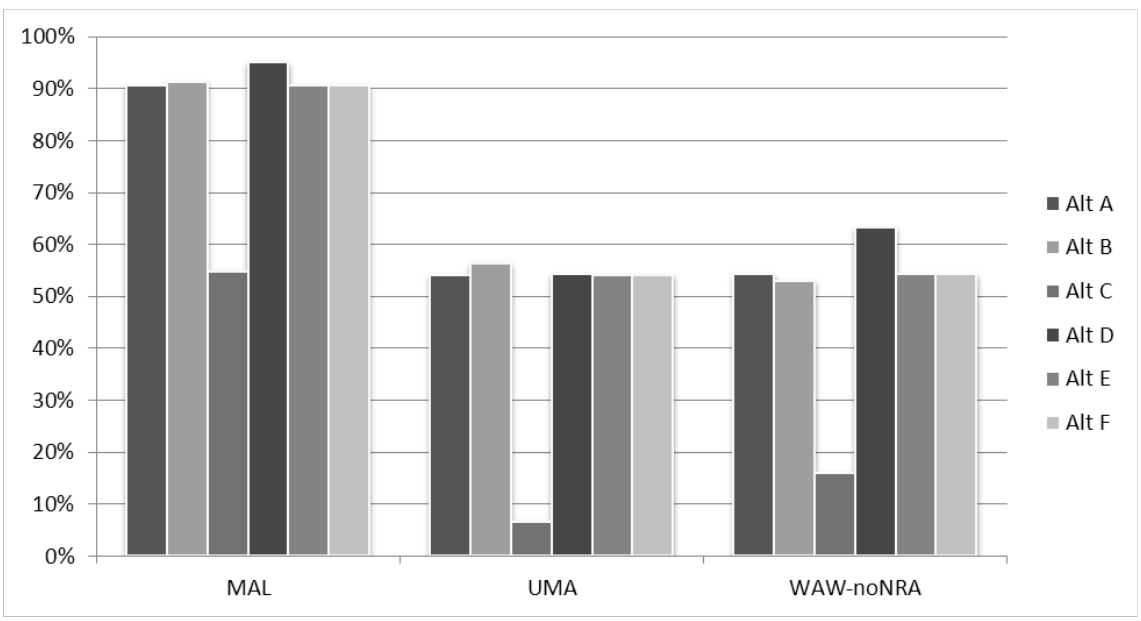

Figure 63. Suitable elk and deer forage areas within identified active domestic livestock grazing areas by alternative and national forest

Not all lands that are suitable as forage areas for elk and deer are subjected to domestic livestock grazing. However, wild ungulate use is not restricted to these areas and therefore must be accounted for on all lands, even those managed for domestic livestock grazing. As with domestic livestock, meadows and grasslands provide the most efficient forage areas for elk (Ager et al.

2003, Collins and Urness 1983, Wickstrom et al. 1984,), especially in early spring, while overall forage is limited on summer range. Also, elk may leave an area being grazed by cattle, but will often return to a pasture after cattle leave (Yeo et al. 1993).

Nutritional status is a key factor in the welfare of individual animals and hence elk herd productivity (Johnson et al. 2005). Therefore, the quantity and quality of forage available for deer and elk populations is an important factor in determining habitat effectiveness (Beck et al. 1997, Roloff 1997). Especially important is the quality of forage available in the fall to store fat reserves for winter and in the spring to replace fat reserves and satisfy gestation requirements (Cook et al. 2004). Damiran (2006) indicated that moderate grazing by livestock and elk has little effect on the subsequent nutrient intake rate of cattle, deer, and elk in mixed-conifer rangelands during the late-summer in northeast Oregon. It is important to keep in mind that it is the plant community and the health of the plants themselves that must be the ultimate measure of use by herbivores (Vavra 1992). As discussed in the livestock grazing section under focal species, utilization levels that do not exceed long term utilization of 40 percent probably do not have negative effects on plant health. As such, it is anticipated that those alternatives with utilization levels of 40 percent or less (table 312) will continue to provide quality forage for elk and deer. Alternative C would be the best at providing for the needs of elk and deer, followed by E and F. As Vavra and Riggs (2010) point out, interactions of ungulates and their environment is very complex, so other aspects such as timing of grazing can also affect the quality and quantity of forage available for deer and elk (Clarke et al. 2000, Westenskow-Wall et al. 1994). Also, on some public lands, developments, such as roads, trails, and campgrounds, and disturbance from recreational and management activities, increasingly influence available forage by causing elk and deer to abandon forage areas due to disturbance (Wisdom et al. 2005, Wisdom et al. 2005a).

According to the range analysis (see “Livestock Grazing and Grazing Land Vegetation” section) an evaluation of monitoring data shows a recovery in terms of native species composition beginning in the mid-1900s and continuing until about the turn of the century. Since 2000, improvement has slowed for reasons that are unclear; however, it may be related to factors such as weather (e.g., precipitation timing and amounts) or the cumulative effects from other impacts such as fire (both exclusion and occurrence), forested vegetation management (including canopy cover, invasion into historical grassland or shrublands, as well as opening of forest canopy in some areas), and could even be somewhat related to climate change.

Some sites may or may not improve with improved grazing management. For example, some upland bunchgrass plant communities have been invaded by cheatgrass and/or invasive species (Quigley and Arbelbide 1997) and since currently there is not a feasible means of eliminating cheatgrass, these sites may have passed the threshold where recovery is achievable. It has also been suggested that early spring or late fall use by wild ungulates, such as elk or deer, are known to impact bunchgrass communities by heavy and improperly timed grazing such that the more palatable, and early growing (e.g., cool-season or C-3) species have been negatively impacted (Briske and Richards 1994).

Riparian areas are also of concern as they not only provide forage areas for both elk and deer, but also a source of hiding cover for deer (Loft et al. 1987). Monitoring data conducted as part of the PACFISH/INFISH Biological Opinion (PIBO) effort (Archer et al. 2009) have indicated that, on a broad scale, there has been a recovery for many of the parameters most closely associated with livestock grazing effects. Analysis of PIBO data for the three national forests also indicates a favorable trend in many of the parameters important to deer and elk; however, this has not occurred to the extent that sites fully meet desired conditions. The rate of recovery may also not be in the time frame desired. Additionally, it is recognized that localized areas may be lagging behind in recovery, but it is anticipated that they will be dealt with at the project level.

A broad scale assessment of available forage was completed by calculating pounds per acre of forage for each plant association group. The basic data for this was derived from the plant association guides completed for the Blue Mountains (Johnson 1987 and Johnson and Clausnitzer 1992). It should be remembered that these estimates are coarse, and even though a single number was used to calculate potential forage, the reality is that production can be variable and influenced by site specifics, such as the seral stage of vegetation being analyzed or annual variations due to precipitation. A further caveat is that total herbaceous production was estimated, which probably overestimates what would actually be palatable forage.

Table 313 in the Focal Species section under livestock grazing attempted to broadly characterize if adequate forage is being produced to provide for domestic livestock grazing, wild ungulate grazing, and the needs of plant and watershed health. Although it only displays elk, it would appear that based on current numbers of ungulates, in general across the landscape there is more than adequate forage available.

In summary, the available information indicates an excess of forage production that is capable of meeting the current and projected needs for permitted livestock, as well as for large wild ungulate populations, and for providing for the basic needs of the plants, soils, and other rangeland resources. This analysis was conducted at the landscape scale and it is recognized that there may be site-specific conflicts that are believed to be generally small in scope and extent. Project planning will deal with potential conflicts at that scale.

Considering the previous discussion, it would appear that proposed stocking levels for any of the alternatives would leave sufficient residual biomass available for wild ungulates on lands considered suitable foraging areas. However, livestock do not make uniform use of suitable rangeland, but rather graze in a pattern that varies in a gradient from higher use in the more preferred lower slopes and near water, to near zero use in areas with steeper slopes or farther from water. As such, actual utilization across suitable range may vary from the proposed utilization levels to zero percent, but would average perhaps 20 to maybe 40 percent.

Alternative C would have the least impact on suitable habitat for elk and deer because the least amount of suitable foraging habitat coincides with proposed domestic livestock grazing areas. The proposed utilization level is below the threshold where utilization levels may impact the forage base, indicating that few if any site specific areas would be negatively impacted. Although alternatives A, B, D, E, and F have similar amounts of habitat exposed to domestic livestock grazing, E and F would have the least impact, again because proposed utilization levels are not expected to reduce the health of the forage base. Both alternatives A and B are either at or above the level where plant health may be compromised, and although alternative D has more acres subject to domestic livestock grazing, the proposed utilization level is at or below the risk level of plant health reduction.

Cumulative Effects to Management Indicator Species

The clearest concept of a management indicator species would be a species highly associated with a specific habitat type (Niemi et al. 1997) and home ranges small enough to be influenced mostly by management activities on National Forest lands (Hayward et al. 2004, Landres et al. 1988, Owens 2010). Few species, however, are unaffected by events that are not controlled by the

Forest Service. As such, the cumulative effects described below have the potential of influencing populations of those species.

Several of the species analyzed as management indicator species for the various forest plan alternatives include game species managed by state wildlife departments. These departments can change the number of harvest permits allocated, season lengths, and sex to be harvested, which can affect population levels. Cumulative effects not only include harvest regulations of management indicator species, but also changes in harvest regulations for predators of management indicator species. For example, prohibiting the use of dogs to harvest mountain lions in Oregon has led to an increase in mountain lion populations, which may affect some local elk and deer populations (ODFW 2006). Access to other non-federal and federal ownerships during the hunting season can also influence populations. Most game management units contain multiple ownerships, which influences the ability to achieve population objectives.

Some of the species spend a portion of their time outside of the National Forest boundary. For example, elk and deer inhabit areas under private, state, and other federal administrations. Much of the winter habitat, especially for deer, is found on private lands that may be subject to urbanization, conversion to, or a change in agricultural use. Others, like the goshawk and Lewis’s woodpecker, are partial migrants (Wisdom et al. 2000) that most likely winter off of the national forest. Still others occupy habitats that occur abundantly on private lands, like the white-headed woodpecker which inhabits ponderosa pine or the northern flicker which inhabits juniper. Vegetation management on other ownerships has not necessarily featured the retention of preferred habitat attributes for these species (large trees and snags) in the past, and may not in the future. Wisdom et al. (2000) estimated a 62 percent reduction in source habitat for the white-headed woodpecker from historical conditions in the Columbia River Basin and a reduction of 79 percent in the Blue Mountains.

Other species like the northern (American) three-toed woodpecker and pileated woodpecker have much of their preferred habitat on lands administered by the Forest Service. Wisdom et al. (2000) estimated a 21 percent decrease in source habitat basin-wide for the pileated woodpecker, but found more than a 100 percent increase in source habitat in the Blue Mountains Ecological Recovery Unit from historical to current times, indicating that few cumulative effects would be anticipated from lands under private, state, or other federal administration within the Blue Mountains.

Affected Environment – Resident and Migratory Birds

It is estimated that the planning area supports over 265 species of birds (Altman 2000, Thomas et al. 1979), including those that utilize stopover habitats during their annual migration or that only breed occasionally within the planning area. Of these, 120 species are considered land breeding birds, many of which are Neotropical migrants that breed during the summer within or near the national forests of the Blue Mountains (Altman 2000). Generally, these species winter south of the United States border. Most bird species are still common; however, some populations are declining. Neotropical migratory bird species are of particular concern within the planning area due to the international issues associated with their conservation. The planning area contributes most heavily to species that utilize spruce-fir, lodgepole pine, mixed conifer, and ponderosa pine habitats. However, habitats such as riparian areas and wetlands ecosystems that make up smaller portions of the landbase are also of conservation concern due to these areas’ critical importance to bird species.

The Migratory Bird Treaty Act (MBTA) prohibits the taking, killing, or possessing of migratory birds unless permitted by regulations promulgated by the Secretary of the Interior. While some courts have held that the MBTA does not apply to Federal agencies, in July 2000, the United States Court of Appeals for the District of Columbia Circuit ruled that the prohibitions of the MBTA do apply to Federal agencies, and that a Federal agency's taking and killing of migratory birds without a permit violated the MBTA.

On January 10, 2001, President Clinton signed Executive Order 13186 placing emphasis on conservation of migratory birds. The Executive Order (EO) directs agencies to take certain actions to further comply with the migratory bird conventions, the MBTA, the Bald and Golden Eagle Protection Act (BGEPA), and other pertinent statutes. The MBTA, signed in 1918 and amended in 1936, 1974, and 1989, implements the United States' commitment to four international conventions (with Canada, Mexico, Japan, and Russia) for the protection of migratory birds. EO 13186 requires Federal agencies to develop memorandums of understanding (MOU) with the U.S. Fish and Wildlife Service (USFWS) to promote the conservation of migratory bird populations. The MOU between the Forest Service and USFWS was signed by the Chief of the Forest Service in December 2008.

The MOU directs the agency to address the conservation of migratory bird habitat and populations when developing, amending, or revising management plans for national forests and grasslands, consistent with NFMA, the Endangered Species Act (ESA), and other authorities. When developing the list of species to be considered in the planning process, the Forest Service must:

- Consult the current USFWS Birds of Conservation Concern list, state lists, and comprehensive planning efforts for migratory birds
- Evaluate and consider management objectives and recommendations from conservation planning efforts for migratory birds
- Acknowledge special designations that may apply to all or part of the planning area, such as Globally Important Bird Areas in the United States
- Acknowledge such designations in the appropriate plan documents

Additionally, within the NEPA process, the Forest Service must evaluate the effects of agency actions on migratory birds, focusing first on species of management concern along with their priority habitats and key risk factors.

Determining whether or not any particular bird species detected in a free-flying and unrestrained condition in the United States or its territories is protected by the MBTA depends on answering two simple questions (Trapp 2005 (updated 2009)):

3. Is it native to the United States or its territories?
4. Does it belong to a family, group, or species covered by one or more of the four migratory bird conventions to which the United States is a party?

All species of birds that occur within the planning area are protected by the MBTA except the following species that are (1) native and (2) belong to families not covered by any of the conventions implemented by the MBTA:

Family Phasianidae

Bonasa umbellus, Ruffed Grouse+ (cont. U.S.)
Centrocercus urophasianus, Greater Sage-grouse+ (w. U.S.)
Dendragapus obscurus, Dusky Grouse+ (w. U.S.)
Dendragapus fuliginosus, Sooty Grouse+ (w. U.S.)
Falcipennis canadensis, Spruce Grouse (n. U.S.)
Lagopus leucurus, White-tailed Ptarmigan+ (n. U.S.)
Meleagrus gallopavo, Wild Turkey+ (cont. U.S.)

Family Odontophoridae

Callipepla californica, California Quail+ (CA, NV, OR)
Colinus virginianus, Northern Bobwhite+ (cont. U.S.)
Oreortyx pictus, Mountain Quail+ (w. U.S.)

The Birds of Conservation Concern list (USFWS 2008) and the priority species and habitats identified in the Conservation strategy for the Northern Rockies of eastern Oregon and Washington (Altman 2000) help frame the conservation needs of birds within the planning area. The Birds of Conservation Concern list highlights species of particular interest within large geographic areas of the United States, referred to as Bird Conservation Regions (BCRs), while the Landbird Conservation Plans provide information for more localized bird conservation priorities. The majority of the land administered by the Blue Mountains national forests occurs within the Northern Rocky Mountains (U.S. portion only) Bird Conservation Region (BCR 10), which encompasses portions of Oregon, Washington, Idaho, New Mexico, Colorado, Montana, and Wyoming. The Birds of Conservation Concern list for BCR 10 contains 22 species (table 337), some of which do not occur or would be considered accidental within the planning area. The landbird conservation strategy for the Oregon and Washington portion of BCR 10 (Altman 2000) supplemented the National Partners in Flight (PIF) approach of identifying species most in need of conservation action by placing a greater emphasis on ecosystem function.

Table 337. USFWS birds of conservation concern by bird conservation region, respective focal species from regional bird conservation plans and how they were addressed by the current DEIS

Species	USFWS Bird Conservation Region	Representative Focal Species from Altman 2000 and Altman and Holmes 2000	Treatment of Species in Blue Mountains National Forests
Bald eagle	9 and 10	None mentioned	Identified as a focal species in R6 Assessment and is assessed in detail in Wales et al. 2011 and the Biological Assessment as a sensitive species
Swainson's hawk	10	None mentioned	Identified as a possible focal species in R6 Assessment but not chosen for the Blues. A member of the grassland group of the woodland/grass/shrub family in the R6 Assessment which is represented by the northern harrier as the focal species. The northern harrier is assessed in detail in Wales et al. 2011.

Species	USFWS Bird Conservation Region	Representative Focal Species from Altman 2000 and Altman and Holmes 2000	Treatment of Species in Blue Mountains National Forests
Ferruginous hawk	9 and10	None mentioned	Identified as a member of the woodland/grass/shrub group of the woodland/grass/shrub family in R6 Assessment which is represented by both the golden eagle and lark sparrow as the focal species. Both focal species are assessed in detail in Wales et al. 2011.
American peregrine falcon	9 and 10	None mentioned	Identified as a focal species in R6 Assessment for the habitat generalist group of the human disturbance family in R6 Assessment and is assessed in detail in Wales et al. 2011 and the Biological Assessment as a sensitive species
Upland sandpiper	10	Focal species for mesic and dry conditions of montane meadows	Identified as a focal species in R6 Assessment for the upland grassland group of the upland grassland family in R6 Assessment and is assessed in detail in Wales et al. 2011 and the Biological Assessment as a sensitive species
Long-billed curlew	9 and 10	Upland sandpiper Vesper sparrow for Steppe-Shrublands	Identified as a member of the grass/shrub group of the woodland/grass/shrub family in the R6 Assessment which is represented by the bighorn sheep as the focal species in the Blue Mountains with a detailed analysis in Chapter 3 of the DEIS.
Yellow-billed cuckoo	9 and 10	None mentioned	Identified as a member of the shrubby/deciduous group of the riparian family in the R6 Assessment which is represented by the MacGillivray's warbler as the focal species in the Blue Mountains assessed in detail in Wales et al. 2011.
Flammulated owl	9 and 10	Focal species for old forest with grassy openings and dense thickets in dry forest habitats	Identified as a member of the dry forest group of the large/medium tree family in the R6 Assessment which is represented by the white-headed woodpecker as the focal species in the Blue Mountains assessed in detail in Wales et al. 2011, Chapter 3 of the DEIS and the Biological Assessment as a sensitive species.
Black swift	9 and 10	None mentioned	Identified as a member of the conifer riparian group of the riparian family in the R6 Assessment which is represented by the inland tailed frog as the focal species in the Blue Mountains assessed in detail in Wales et al. 2011. The black swift is addressed in detail in the Biological Assessment as a sensitive species.

Species	USFWS Bird Conservation Region	Representative Focal Species from Altman 2000 and Altman and Holmes 2000	Treatment of Species in Blue Mountains National Forests
Calliope hummingbird	9 and 10	Veery (dense understory riparian habitats)	Identified as a member of the all forest communities group of the open forest family in the R6 Assessment which is represented by the western bluebird, fringed myotis and fox sparrow as the focal species in the Blue Mountains assessed in detail in Wales et al. 2011. The western bluebird and the fox sparrow are also addressed in detail in chapter 3 of the DIES and the fringed myotis is addressed in detail in the Biological Assessment as a sensitive species.
Lewis's woodpecker	9 and 10	Focal species for burned forests and riparian woodland with large snags	Identified as a focal species in R6 Assessment for the post fire habitat group of the open forest family and is assessed in detail in Wales et al. 2011 and the Biological Evaluation as a sensitive species
Williamson's sapsucker	9 and 10	White-headed woodpecker Vauk's swift (large snags) Red-naped sapsucker (Aspen)	Identified as a member of the all forest communities group of the medium/large tree family in the R6 Assessment which is represented by the Cassin's finch as the focal species in the Blue Mountains assessed in detail in Wales et al. 2011 and in chapter 3 of the DIES.
White-headed woodpecker	9 and 10	Focal species for large patches of old forest with large trees and snags in dry forest habitats	Identified as a focal species for the dry forest group of the large/medium tree family in the R6 assessed in detail in Wales et al. 2011, Chapter 3 of the DEIS and the Biological Assessment as a sensitive species.
Olive-sided flycatcher	10	Focal species for edge and openings created by fire in mesic mixed conifer (late successional) habitats	Identified as a member of the post fire habitat group of the open forest family in the R6 Assessment, which is represented by Lewis's woodpecker and black- backed woodpecker. Both of these species are assessed in detail in Wales et al. 2011 and Chapter 3 of the DIES. Additionally the Lewis's woodpecker is addressed in the Biological Evaluation as a sensitive species
Willow flycatcher	9 and 10	Focal species for shrub density in riparian habitats	Identified as a member of the shrubby/deciduous group of the riparian family in the R6 Assessment which is represented by the Macgillivray's warbler as the focal species in the Blue Mountains assessed in detail in Wales et al. 2011.
Loggerhead shrike	9 and 10	Focal species for Steppe-Shrubland habitats and interspersion tall shrubs-openings	Identified as a focal species in R6 Assessment for the woodland/shrub group of the woodland/grass/shrub family in R6 Assessment and is assessed in detail in Wales et al. 2011.

Species	USFWS Bird Conservation Region	Representative Focal Species from Altman 2000 and Altman and Holmes 2000	Treatment of Species in Blue Mountains National Forests
Sage thrasher	9 and 10	Focal species for Sagebrush habitats and sagebrush height	Identified as a focal species in R6 Assessment for the shrub group of the woodland/grass/shrub family in R6 Assessment and is assessed in detail in Wales et al. 2011
Brewer's sparrow	9 and 10	Vesper sparrow (10) Focal species (9) for Sagebrush habitats and sagebrush cover	Identified as a member of the shrub group in the woodland/grass/shrub family in R6 Assessment which is represented by the sage thrasher as the focal species. The sage thrasher is assessed in detail in Wales et al. 2011.
Sage sparrow	9 and 10	Focal species for Sagebrush habitats and large contiguous patches	Identified as a member of the shrub group in the woodland/grass/shrub family in R6 Assessment which is represented by the sage thrasher as the focal species. The sage thrasher is assessed in detail in Wales et al. 2011.
McCowan's longspur	10	None mentioned	Does not occur in Oregon
Black rosy-finch	9 and 10	Gray-crowned rosy-finch for alpine habitats	Identified as a member of the Alpine group in the alpine/boreal family in R6 Assessment which is represented by the gray-crowned rosy-finch as the focal species. The gray-crowned rosy-finch is assessed in detail in Wales et al. 2011. Additionally the black rosy-finch is addressed in detail in the Biological Evaluation as a sensitive species.
Cassin's finch	10	Flammulated owl Chipping sparrow for open understory with regenerating pines in the dry forest habitat Olive-sided flycatcher	Identified as the focal species for the all forest communities group of the medium/large tree family in the R6 Assessment and is assessed in detail in Wales et al. 2011 and in chapter 3 of the DIES.
Greater sage-grouse (not covered by MBTA)	9	Focal species for Sagebrush habitats and large areas - diverse understory	Identified as a member of the shrub group in the woodland/grass/shrub family in R6 Assessment which is represented by the sage thrasher as the focal species. The sage thrasher is assessed in detail in Wales et al. 2011 and the greater sage-grouse is assessed in detail in both chapter 3 of the DEIS and in the Biological Evaluation as a sensitive species.
Eared grebe	9	None mentioned	Identified as the focal species for the marsh/open water group of the wetland family in the R6 Assessment and is assessed in detail in Wales et al. 2011
Golden eagle	9	Burrowing Owl	Identified as a focal species for the woodland/grass/shrub group of the woodland/grass/shrub family in R6 Assessment which is assessed in detail in Wales et al. 2011.

Species	USFWS Bird Conservation Region	Representative Focal Species from Altman 2000 and Altman and Holmes 2000	Treatment of Species in Blue Mountains National Forests
Yellow rail	9		Does not occur in the Blue Mountains of Oregon
Snowy plover	9		Does not occur in the Blue Mountains of Oregon
Marbled godwit	9		Does not occur in the Blue Mountains of Oregon
Pinyon jay	9		Does not occur in the Blue Mountains of Oregon
Virginia's warbler	9		Does not occur in the Blue Mountains of Oregon
Green-tailed towhee	9	None mentioned	Identified as a member for the woodland/shrub group of the woodland/grass/shrub family in R6 Assessment represented by the loggerhead shrike as the focal species. The loggerhead shrike is assessed in detail in Wales et al. 2011. And the green-tailed towhee is assessed in detail in the Biological Evaluation as a sensitive species for Washington.
Black-chinned sparrow	9		Does not occur in the Blue Mountains of Oregon
Tricolored blackbird	9		Identified as member of the marsh group of the wetland family in the R6 Assessment, represented by the marsh wren as the focal species. The marsh wren is assessed in detail in Wales et al. 2011. The tricolored blackbird is not found on Forest Service lands within the planning area.

The conservation strategy for the Northern Rocky Mountains in Oregon and Washington does not include shrub-steppe, juniper-steppe, and lowland riparian habitats found in eastern Oregon and Washington. These habitats are normally found in the Great Basin BCR (9) which represents less than one percent of the planning area. These areas are covered in another PIF plan entitled Conservation Strategy for Landbirds in the Columbia Plateau of eastern Oregon and Washington (Altman and Holmes 2000). Altman (2000) indicated that 31 breeding bird survey routes were at least partially located within the Blue Mountains of Oregon and Washington. These surveys provide some information regarding status of bird species within the planning area.

An important bird area (IBA) is a site that is of outstanding importance to bird conservation. The IBA designation is recognized internationally, and thousands of IBAs have been designated across Europe, Asia and North America. The National Audubon Society oversees the North American IBA program and Portland Audubon oversees the IBA program in Oregon. Only one IBA has been identified within the three national forest areas of the Blue Mountains: the Wallowa Mountains within the Wallowa-Whitman National Forest. This IBA comprises the entire range of spruce grouse in Oregon, is the only area with regular confirmed breeding of the pine grosbeak in Oregon, and comprises the entire breeding range of an Oregon endemic taxon, the Wallowa rosy finch (subspecies of the gray-crowned rosy finch). There are no legal requirements for particular management of IBAs. The hope is simply that the owners and managers will continue to manage the site for its avian values and that recognition as an IBA may generate support for management or maintenance of the site.

Altman (2000) also identified more than 25 bird conservation areas (BCAs) in the Northern Rocky Mountains Strategy for the Blue Mountains, many of which occur on National Forest System lands. BCAs are intended to provide a focus for agencies, nongovernmental organizations, or companies or private individuals to prioritize where conservation actions should occur. They represent what was thought to be the best geographic options for maintaining or enhancing healthy populations of landbirds and prevent further declines of species. Similar to IBAs, there are no legal requirements for particular management of BCAs, but it is recommended that management and evaluation of BCAs should emphasize healthy, native vegetation within the historical range of variation for each habitat type (Altman 2000).

Environmental Consequences – Resident and Migratory Birds

Impacts to migratory and resident bird habitats are expected to be similar across all of the alternatives and all national forests as a result of management activities, mostly because all alternatives have similar desired conditions. Each alternative is expected to be guided by HRV for available habitats within the planning area. Depending upon the species group, influences on migratory and resident birds may be expected to vary in intensity and over time between alternatives. For example, alternative D has the most aggressive treatment program, whereas alternative C has the least aggressive, although both are guided by moving towards HRV. As indicated in table 336, effects to both resident and migratory birds are addressed for other categories. For example, the three species mentioned for the Wallowa Mountains IBA (gray-crowned rosy-finch, pine-grosbeak, spruce grouse) were either addressed in detail under sensitive species or were represented by a focal species (see table 298) that was addressed in detail (Wales et al. 2011). The focal species assessment essentially addressed the broad composite of habitats within the Blue Mountains and, in a landscape sense, confirmed that implementation of the various forest plan components would be expected to sustain populations within the planning area for each of the alternatives. Because all alternatives for each national forest include direction to improve structure, composition, and pattern of vegetation to move closer to HRV, and both national and local Birds of Conservation Concern lists were used to select some of the focal species, the intent of the MBTA has been met at the plan level. Because forest plans do not actually authorize site-specific activity, the MBTA taking regulation must be complied with during project NEPA analysis.

There is little anticipated change to the existing IBA from any of the alternatives. Currently, the majority of the Wallowa Mountains IBA is within the Eagle Cap Wilderness Area, which precludes any active management other than domestic livestock grazing. All alternatives, including continuing with current management (alt A), do not propose grazing within this IBA. Alternative C includes a proposal for a substantial increase in area that would be recommended for inclusion into wilderness immediately adjacent to the Eagle Cap Wilderness Area and would increase the area where active management would not occur. This, however, is not always a good thing as the risk for catastrophic events may increase.

Cumulative Effects to Resident and Migratory Birds

Many of the cumulative effects for bird species have been discussed under the individual species in other sections of this document. Suffice it to say that habitat degradation on nonpublic lands on both summer and wintering areas continue to be of concern

Affected Environment – Hunted Species

Within the planning area, big game and other hunted wildlife species are of particular interest due to their economic and cultural importance to tribal, state, and local communities. Executive Order 13443, Facilitation of Hunting Heritage and Wildlife Conservation (Bush 2007), directs appropriate Federal agencies to facilitate the enhancement of hunting opportunities and the management of game species and their habitat. The primary big game species that are hunted within the planning area are Rocky Mountain elk and mule deer. To a lesser degree, black bear, bighorn sheep, mountain goats, and mountain lion are also hunted as big game species. Other game species include blue grouse, wild turkey, mourning dove, band-tailed pigeon, ring-necked pheasant, cottontail (mountain and desert species), and various species of waterfowl.

According to Mockrin et al. (2012) from 1991 to 2006, the percentage of the U.S. population that reported engaging in any kind of hunting has declined steadily from 7.5 percent of the total population to 5.5 percent. The 2011 National survey of Fishing, Hunting, and Wildlife-Associated Recreation in Oregon indicated that the total number of hunters within the state declined between 2006 and 2011, although it was not statistically significant.

The planning area provides both summer and winter range, supporting the population objectives for deer and elk as established by ODFW and WDFW. Most of the summer range occurs on National Forest System lands that make up the planning area. Most winter range occurs at lower elevations of mixed ownership, mostly on private land (ODFW 2009), but also includes National Forest System lands, and BLM and state administered lands.

Population growth and associated activities, land use conversions, and lack of fire frequency in fire-dependent ecosystems have led to changes in big game winter range quality and availability. Winter range includes much of the low elevation areas found within the planning area and adjacent lands under other ownership. Availability of effective winter range is considered to be a limiting factor to big game populations within eastern Oregon (ODFW 2009). As early as 1995, it was recognized that, excluding security concerns, elk may benefit from the ecosystem management prescription applied to ponderosa pine dominated winter ranges in Montana (Baty et al. 1995). The 2003 elk management plan for Oregon (ODFW 2003a) recognized that forest management on public lands in Oregon has changed and emphasizes ecosystem restoration, which may not be the optimum condition for elk habitat management. At the 2003 western states deer and elk workshop, Woolever (2004) provided the following insight into the changing role of the Forest Service:

> The Forest Service manages a limited land base with many demands including a legal responsibility to provide for biodiversity and viability of species. Our current focus is to manage with ecosystems in mind and with special regard for the range of historic variation within those systems. We will continue to manage for elk and deer, although not exclusively. Our local communities depend on these species and there is a large, politically effective constituency for them. The challenge will be redeeming conservation responsibility for all species while meeting political, social and economic demands for the land they occupy. There is little doubt public values and attitudes about wildlife will continue to evolve with the continuing demographic changes in America. However, our legislative history and current polls clearly demonstrate wild places and wild things are intensely important to us as a society. It is imperative that we work cohesively and cooperatively to resolve resource conflicts and perpetuate healthy, functioning systems that benefit all wildlife including deer and elk

Portions of 19 ODFW wildlife management units (WMUs) are within the three Blue Mountains national forests. These WMUs are combined into four provinces or zones: Wallowa, Wenaha-

Snake, Umatilla-Whitman, and Ochoco-Malheur. A portion of the Blue Mountains extends into Washington and is covered by eight elk management units, six of which include some National Forest System lands. There is an interchange of elk between Washington and Oregon, which complicates the management of some herds (WDFW 2009).

The importance of the quality and quantity of forage for both species going into and coming out of winter has been acknowledged in the literature and big game winter range on public lands is important due to the loss of this habitat on private lands. The Rocky Mountain Elk Foundation (RMEF) initiated the Measure and Prioritize Elk Habitat Project (M.A.P. Habitat™) in the late 90s. The project was a cooperative effort using GIS technology and information from state, tribal, Federal, corporate, and independent biologists and elk experts to map suitable elk habitat in North America. Elk winter and summer range, parturition, migration and other important habitat areas were drawn using expert opinion of wildlife biologists on a 1:250,000 scale map, state by state across land ownership and jurisdictions in the United States and was copyrighted in 1999. The intent was to provide a GIS tool to state and Federal biologists to address habitat conservation from the big-picture, mid-scale perspective. Within this mapping effort, winter range was identified. Habitat for Oregon was mapped prior to 1997 (Wertz 1997 (18 December)). In a letter to regional foresters (Thompson 2003), the Forest Service Washington office indicated that “it is anticipated that project records for forest planning efforts would reflect forest-level consideration of the elk M.A.P. Habitat™ data. If the M.A.P. Habitat™ data is inaccurate or insufficient for planning or project use on your units, we need to work closely with the RMEF to update the data layers to ensure we are both using the same and most current information in our GIS work.”

The action alternatives do not draw a hard line around winter range as found in the no-action alternative. It was felt that wintering habitat is based on habitat attributes found in an area and these attributes can change due to fires, active management, predator presence (Pierce et al. 2004), and snow depth (Poole and Mowat 2005).Figure 63 demonstrates the difference in winter range mapping done in 1990; the extensive mapping effort conducted by RMEF in 1997; and the 2009 ODFW mapping effort, illustrating the problems associated with hard lines. As illustrated in figure 63, RMEF mapped over 60 percent more acres within the Umatilla National Forest as winter range than what was identified by the 1990 forest plan. Within the Wallowa-Whitman National Forest, the amount of winter habitat identified by both mapping efforts is almost the same, but there is less than a 50 percent overlap between the two mapping efforts. This means that more than half the acres identified for the 1990 forest plan are in different locations than those identified in 1997. A similar pattern is seen with the 2009 mapping effort, which shows an increase on all three forests over the 1997 mapping effort. The following discussion will use the 2009 winter range map to compare alternatives.

Environmental Consequences – Hunted Species

The current management emphasis on public lands for restoration based on HRV does not seek to optimize any one species of wildlife, but rather to provide those conditions under which the breadth of wildlife species occurred (Landres et al. 1999). What exactly this means in reference to populations of hunted species is difficult to assess. For example, some hunted species such as wild turkey, pheasants, and chukars are not native species and may or may not respond in a positive manner to returning to HRV.

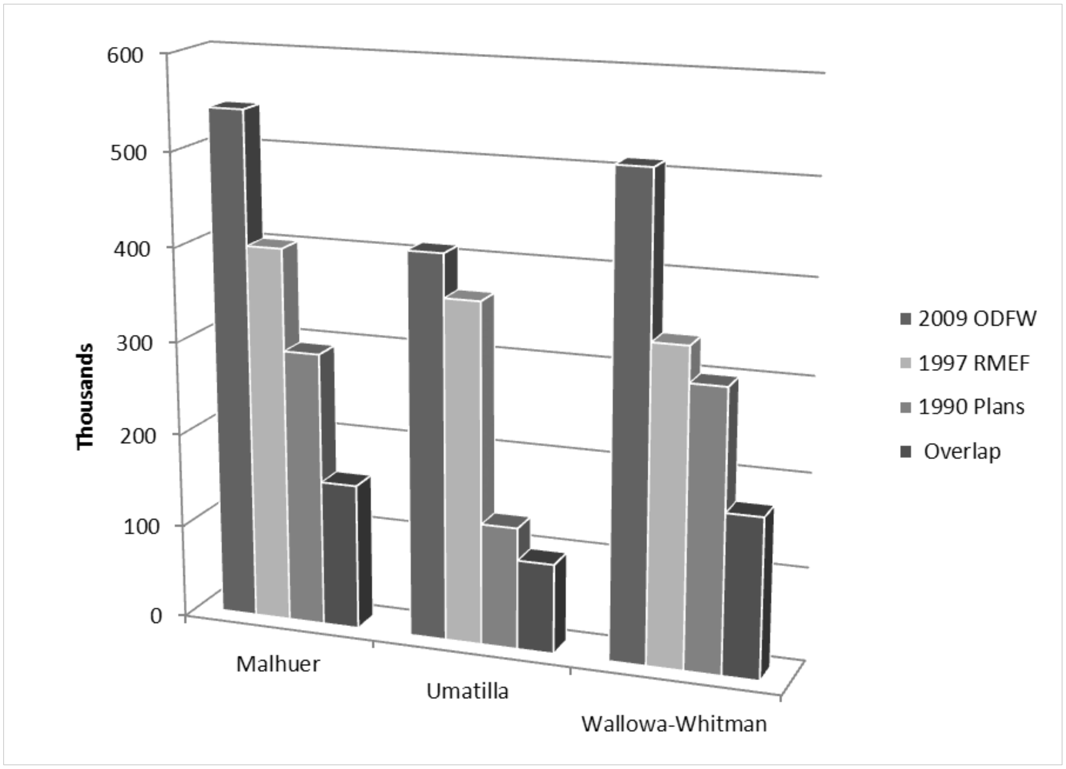

Table 338. Comparison of areas identified as Rocky Mountain elk winter range in 1990, 1997 and 2009 by national forest

Three of the most important big game species have been addressed in some detail as either focal species or management indicator species (bighorn sheep, Rocky Mountain elk, and mule deer). Hunting opportunities for bighorn sheep are below what occurred historically as populations are far below what is thought to have occurred in the early 1800s (ODFW 2003, Singer et al. 2000a). Mule deer populations are substantially lower than what occurred in the mid-1900s but they still exceed the early published estimates (ODFW 2003b). Elk were considered to be plentiful in the Blue Mountains in the early 1800s and current populations probably exceed those levels (ODFW 2003a). Baty et al. (1995) concluded that in the absence of human disturbance, both elk and deer would benefit from ponderosa pine restoration. As demonstrated in the management indicator species analysis for both deer and elk, habitat conditions for both species remains relatively stable, with slight increases in forage: alternative D creates the most and alternative C creates the least. Because proposed management for any alternative is to move towards HRV, as is the current management emphasis (Eastside Screens), it is anticipated that availability of these two species for harvest by both tribal members and the general public would also remain relatively stable as shown in figure 47 through figure 50, and figure 62.

Disturbance to big game from open motor vehicle routes was discussed in some detail previously, mostly in reference to nonwinter periods. Disturbance on winter ranges will not only come from open motor vehicle route density, but also cross-country use by snowmobiles. To comply with the new travel management rule, motor vehicle cross country travel will be extremely limited, except for over-the-snow vehicles (OSVs). The use of OSVs has increased greatly from the early 80s and it is anticipated to continue increasing. Assuming increased snowmobile use, animals on big game winter range could be increasingly stressed by motor vehicle use during the time of year they are most vulnerable to depletion of their energy reserves.

Although over-the-snow travel will not be restricted in MA 4A, the percentages in figure 64 can be deceiving as the total area that may be open to snowmobiles is further limited by steep topography, dense timber stands, and, in some cases, snow. Much of the winter range within the Umatilla and Wallowa-Whitman National Forests is below 4,000 feet, which in all likelihood will not normally have the snow conditions sought by OSV recreationists. This would not be the case for the Malheur National Forest and alternative C, which would make less than half (41 percent) of big game winter range generally unsuitable for snowmobile uses, does the most to reduce the risk of disturbance, whereas the other four alternatives are basically the same. For all alternatives, there are likely to be terrain and vegetation conditions that can restrict snowmobiles. Vegetation limitations can be substantially changed, however, by massive events, such as wildfire. Large fires can open terrain previously considered inaccessible to snowmobiles. Alternative C presents the least possibility of adverse winter effects on wildlife by having less than 50 percent of the national forest's winter ranges open to motor vehicle use (see figure 64). For the Malheur National Forest, all alternatives are essentially the same and for the Umatilla and the Wallowa-Whitman National Forests, D, E, and F are basically the same.

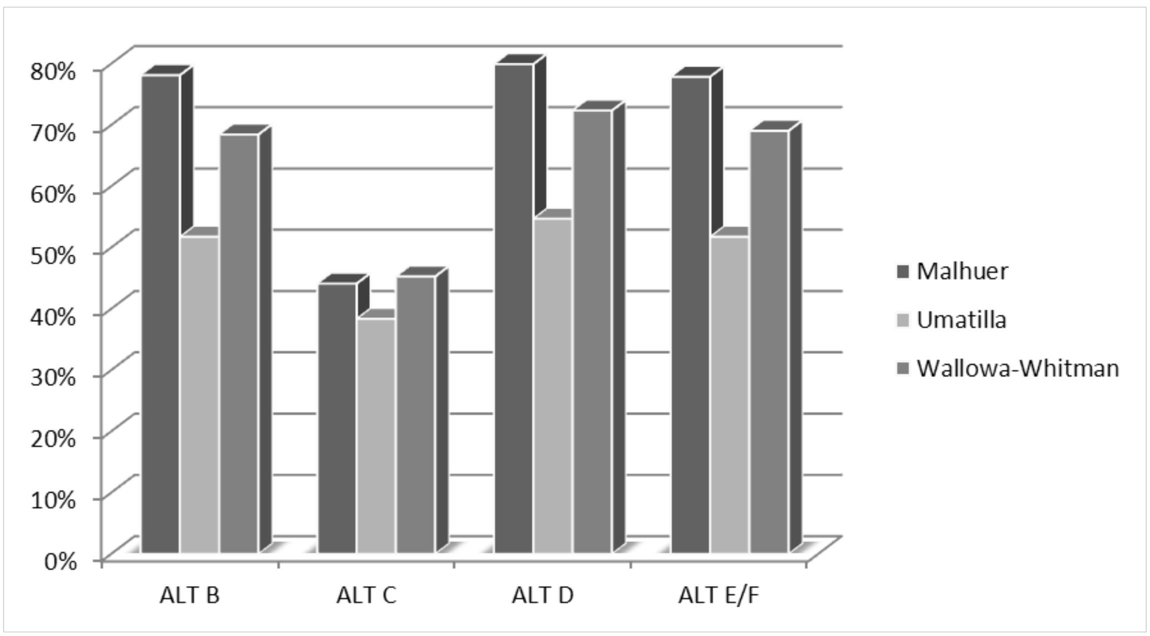

Figure 64. Big game winter range within MA 4A for each national forest by alternative (motor vehicle travel is restricted the least in MA 4A)

Although grazing was addressed in general for elk and mule deer under management indicator species, the following is a short discussion focused strictly on winter range. The issue surrounding winter range would be does sufficient residual biomass exist after summer use to provide for the needs of wintering big game and still provide protection of the health of rangeland plants. Much discussion has occurred overtime whether domestic livestock grazing can be managed to improve forage quality for wild ungulates (Anderson and Scherzinger 1975, Clark et al. 1998, Clark et al. 1998a, Vavra and Sheehy 1996, Wambolt et al. 1997,Westenskow-Wall et al. 1994). Westenskow-Wall et al. (1994) pointed out that "spring conditioning" of bluebunch wheat grass range resulted in a 33 to 47 percent reduction in available forage in November and fall conditioning of forage resulted in an 81 to 95 percent reduction. They also point out that improvement in digestibility is dependent upon regrowth and Hedrick et al. (1969) only documented regrowth after fall cattle grazing in 2 out of 5 years on crested wheatgrass in eastern Oregon. Table 339 displays how much (percent) winter range for each national forest is within areas identified for active grazing for each alternative. The key to the question of whether domestic livestock grazing improves winter forage for big game centers around whether it is actually being intensively managed to provide these benefits (Holechek et al. 1982, Vavra 2005) and this is not the case currently. As such, it would appear that, except for alternative C, there is little difference between alternatives for the Malheur National Forest. Generally alternative C would provide the greatest benefit for big game winter range for all national forests. The order between alternatives changes between forests with alternative D having the highest risk to big game winter range within the Malheur and Wallowa-Whitman National Forests, whereas alternative B has the highest risk within the Umatilla National Forest.

Table 339. Percent of big game winter range within active grazing areas for each national forest by alternative

National Forest	Alt. B	Alt. C	Alt. D	Alts. E and F
MAL	93	59	95	94
UMA	54	8	50	49
WAW	75	36	80	75

Cumulative Effects to Hunted Species

Forest Service management activities can change habitat for all wildlife species, especially big game, and can bring about localized changes in big game populations and herd composition. Substantial changes in habitat and related herd sizes, however, can be affected by factors outside the control of the Forest Service. Examples are major wild fires or insect and disease outbreaks; and although these disturbances were projected for the life of the plan based on the historic average, the amount or location cannot be accurately predicted. Many of the cumulative effects for the big game species discussed have been previously disclosed in other sections of this document.

Subtle but longer term impacts to big game winter range can occur from the development of lands adjacent to the National Forest. Many key winter ranges are in private land ownership and subject to pressures to subdivide for residential development. Much of the undeveloped private ranchlands are a valuable component in maintaining wildlife connectivity. It is not clear if there is a “break point” at which grazing management practices may cause permittees to withdraw or change the focus of their operation such that they would sell their base ranches. The pressure for development of this land into smaller and smaller parcels will continue to reduce the quality and availability of big game winter habitat.

As noted in the recreation section, many aspects of the hunting experience are within the control of the state fish and wildlife management agencies such as bag limits, difficulty or cost of obtaining tags and types of weapons to mention a few.

Affected Environment – Wildlife Habitat Connectivity

Habitats for individual wildlife species normally occur as a mosaic across the landscape. How well a species thrives within this mosaic is closely tied to being able to move across landscapes to find food and other resources, migrate between seasonal habitats, find mates, and shift to new habitats in response to environmental changes. Such movement is dependent on habitat patches being of sufficient size to provide for the life needs of an individual and that other patches occur in a network that allows individuals to successfully move between them. This resource patchiness occurs when a habitat is divided into usable areas that are separated from one another by unusable areas. Within this matrix (habitat and nonhabitat), patches may be connected by corridors (Forman and Godron 1981). Although disagreement exists regarding the utility of corridors, landscape connectivity, which is the degree to which the landscape facilitates or impedes movement among resource patches (Taylor et al. 1993), is important. The recent memorandum of understanding regarding Wildlife Corridors and Crucial Habitats (USDI et al. 2009) signed by the USDA, other Federal agencies, and 19 western states, reinforces the importance of landscape connectivity. This spatial connection of habitats means that either the patches are sufficiently close together so that movement can occur among patches or that there is some corridor along which the organisms can move (Fahrig and Merriam 1985).

In landscape ecology, patches are spatial units at the landscape scale. Patch size can affect species habitat, resource availability, competition, and recolonization. The ability to successfully move between habitats is essential for the long-term survival of many wildlife species, from large, migratory species such as elk (*Cervus elaphus*) and mule deer (*Odocoileus hemionus*), to smaller animals like white-tailed jackrabbits (*Lepus townsendii*), Greater Sage-Grouse (*Centrocercus urophasianus*), and western toads (*Anaxyrus boreas*). Spatial scale is especially important when dealing with patches because an area large enough to be a patch to one species may be a barrier or be insignificant to another species. For example, a plowed field might be a hunting ground for an owl, a barrier to a deer mouse, and of no consequence to a coyote or deer. Another important aspect of patch size is that larger patches tend to have more linkages than smaller ones (Cantwell and Forman 1993).

Connectivity usually involves corridors and networks that describe how patches are connected in the landscape. A spatial connection means either that the patches are sufficiently close that movement can occur among them, or that there is some corridor along which the organisms can move (Fahrig and Merriam 1985). Many different kinds of corridors can be found in the landscape and they can vary from wide to narrow, meandering to straight, and with high to low connectivity (Forman 1995). Corridor characteristics, such as width, connectivity, curvilinearity, pinch points, etc., control the important conduit and barrier functions of a corridor (Forman and Godron 1981). Riparian zones often function as natural corridors and migration routes for some species, providing a connection between source habitats (Machtans et al. 1996).

Connectivity of habitat patches is dependent upon the species and its ability to disperse. For example, because the pileated woodpecker flies, it would appear that few things would present a barrier to its movements. Bull (1987) documented dispersal of 3.4 kilometers for juveniles based on 8 individuals; however, searches outside of the study area were not conducted. It is probable that at least some of the 20-plus potential survivors of the 87 nestlings banded (using the survival rate given by Bull [2001]) dispersed outside of the study area or more than 16 kilometers. Using Bowman (2003), Samson (2005) calculated a dispersal distance for the pileated of more than 240 kilometers, making most habitats within a national forest available. It is difficult to identify movement patterns across the landscape for large ungulates or forest carnivores without telemetry data showing precise movement patterns. However, in the broad sense, it is possible to assess a landscape and identify areas that could be important travel ways for some species. For example Singleton (Singleton 2002, Singleton et al. 2002) conducted large scale analysis to identify potential travel corridors between large secures areas (wilderness) for forest carnivores in Washington and Oregon.

Connectivity within forested environments is not only a spatial consideration, but also temporal. In some cases, the movement needs of wildlife can be served with different land cover types than those needed to sustain resident wildlife populations (Washington Wildlife Habitat Connectivity Working Group (WHCWG) 2010). For example, a large clear-cut may pose a movement barrier for American marten immediately post-harvest; however, over time, as it begins to regenerate, although unsuitable habitat, it may have sufficient canopy cover to allow travel between suitable habitat patches. Wales et al. (2011) estimated that the probability for ease of movement through the landscape (high dispersal) within the planning area for American marten was less than 22 percent historically (see table 340). Dispersal or connectivity of habitats was considered an issue for this species, but as demonstrated, a highly permeable landscape probably did not occur historically. A slight decrease from the historical condition to the current condition, with a slight reduction in high and slight increase in the low dispersal probability, has occurred.

Table 340. Percent current and historical dispersal likelihood for the American marten by class for each national forest (Wales et al. 2011)

Time Period	National Forest	Dispersal Classes and Likelihood		
		Low	Moderate	High
Current	MAL	25	70	5
	UMA	24	52	23
	WAW	40	44	16
Historical	MAL	18	71	11
	UMA	22	48	31
	WAW	37	38	25

Maintaining linkages and connectivity may not always be beneficial. Simberloff and Cox (1987), Simberloff et al. (1992), and Hess (1994) argued that corridors might enhance the spread of disease, catastrophic disturbances, such as wildfires, or the spread of exotic species into the areas connected by corridors. Corridors might also lure animals into areas, including the corridors themselves, where they experience higher mortality [for a review see Hobbs (1992)]. Samson (2005) notes:

> …increases in intermediate-aged forests and connectivity threaten key remaining elements of biodiversity, such as areas of old growth, as these areas no longer persist in fire-protected refugia but are embedded in a well-connected matrix of intermediate-aged forest that permits the rapid spread of fire and insect outbreaks with a spatial-temporal pattern unlike the historic landscape.

Washington recently completed a statewide connectivity analysis (Washington Wildlife Habitat Connectivity Working Group [WHCWG] 2010) which incorporated a large portion of the Blue Mountains in Oregon and Idaho as well. The products produced were derived from two modeling approaches: 1) A focal species approach which produced linkage networks for 16 representative species, and 2) a landscape integrity approach which produced networks of lands exhibiting high degrees of landscape integrity and relatively intact natural areas with low levels of human modification. Linkage network was defined as a system of habitats and areas important for connecting them. Composite linkage networks for groups of focal species resulted in three "connectivity guilds"- 1) generalist, 2) montane, and 3) shrubsteppe. The networks for the generalist and montane species guilds are generally broadly connected, with the interruptions fitting the traditional view of "fracture zones", i.e., linear features that pose significant barriers to animal movement. WHCWG (2010) also found broad consistency between the linkage patterns identified by the focal species and the landscape integrity approaches. The landscape integrity approach mirrors the approach used in the California Essential Habitat Connectivity Project (Spencer et al. 2010) in that it is not tailored to specific species or habitats. It is indifferent to vegetation type—apart from degree of departure from natural conditions—and is intended to provide a coarse filter for species and processes that are sensitive to human disturbance.

Figure 65 illustrates that forested areas of the Blue Mountains are reasonably well connected for most of the focal species used within the generalist category (western toad, mule deer, elk, bighorn sheep, western gray squirrel), and no use areas are a result of human development such as agricultural lands and highways. As mentioned above, this was the case for the montane guild as well. It should also be noted that even though five species are indicated for the generalist group and the maximum for the Blue Mountains is four, the fifth focal species (western gray squirrel) modeled for Washington does not occur in the Blue Mountains. Therefore, a linkage network for four species in the Blue Mountains would be the maximum that could occur.

Environmental Consequences – Wildlife Habitat Connectivity

The Washington analysis identified four overarching types of threats/barriers and their potential effects on species' movements:

1) **Land clearing/vegetation removal**, which limits connectivity through

- ♦ Alienation due to lack of security cover
- ♦ Change to inhospitable environment (e.g., desiccating conditions for amphibians)
- ♦ Alienation due to lack of forage or prey
- ♦ Increases in competing species, predators, invasive exotics

2) **Buildings and infrastructure**, which limit connectivity through

- ♦ Barriers to movement created by fences, walls, buildings, asphalt, canals, etc.
- ♦ Alienation due to noise, lighting, lack of forage or prey
- ♦ Increases in competing species, predators, invasive exotics
- ♦ Making important habitat areas inaccessible (e.g., streams diverted into culverts)

3) **Roads and traffic**, which limit connectivity through

- ♦ Creation of inhospitable conditions (e.g., desiccating conditions for amphibians)
- ♦ Creation of physical barriers (e.g., Jersey or Texas barriers, right-of-way fences)
- ♦ "Fatal attraction" (e.g., attraction of snakes to warm road surface)
- ♦ Increased mortalities due to collisions
- ♦ Behavioral alienation (i.e., avoidance of roads or high traffic volumes)

4) **Presence of people or domestic animals**, which limit connectivity through

- ♦ Legal harvest and poaching
- ♦ Harassment and disturbance
- ♦ Disease transmission (e.g., domestic sheep to bighorn sheep [*Ovis canadensis*])
- ♦ Intolerance (e.g., conflict resolution removals)

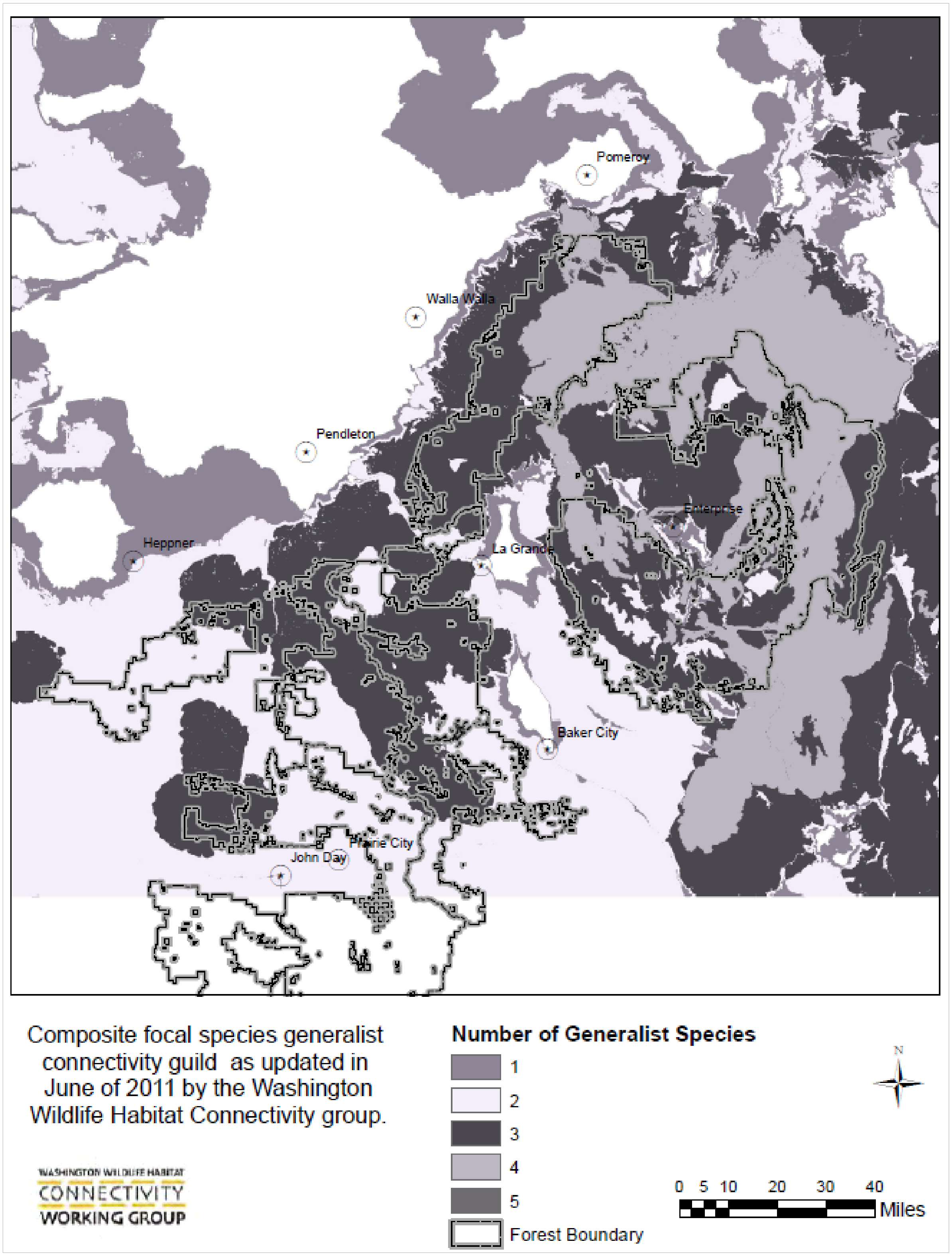

Figure 65. Composite focal species and landscape integrity map for generalist connectivity guild; Includes species that can inhabit a variety of habitats such as mule deer and western toads[10]

[10] developed from data available at http://waconnected.org/statewide-analysis

Many of these threats are not anticipated to occur on National Forest System lands, but could and do occur adjacent to them and will be discussed as cumulative effects. In general, the two greatest potential barriers on the National Forest are roads and presence of people. As mentioned, alteration of vegetation can cause short-term disruptions in travel ways used by a species such as American martens, but in general do not result in long term isolation of habitat patches. This is evidenced by the landscape integrity (areas that have low levels of human modification and are in a relatively natural condition) modeling that Washington conducted (Washington Wildlife Habitat Connectivity Working Group (WHCWG) 2010). Their assessment of the marten also showed that habitat in the Blue Mountains is largely surrounded by impermeable conditions; both natural (low-elevation forests, grasslands, and shrublands) and human created features (highways, dams, towns, and railways), suggesting this population will remain isolated from all others. They further found that habitats in the Blue Mountains of southeastern Washington and northeastern Oregon showed some linkages, but are largely isolated from each other.

All alternatives, including alternative A (no action), provide some degree of secure areas and connectivity (see figure 36 on page 248). Both the Wallowa-Whitman and the Umatilla National Forests have more than 30 percent of National Forest System lands in areas with minimal human disturbance in all alternatives except alternative A. The Malheur National Forest only accomplishes this for alternative C.

Short-term disruption of connectivity between habitat patches for some species can occur due to vegetation treatments. As displayed in table 341, a relatively small portion of the landscape is projected to be treated during the life of the plan. The greatest potential for disruption of wildlife movement patterns occurs for alternatives D and E because of the level of mechanical vegetation treatments. Alternative C would be the less disruptive, but in all cases a very low percentage of the landscape is being treated for all alternatives. Alternatives A and C include safeguards addressing connectivity (WLD-HAB-4 and Eastside Screens amendment), which, combined with desired conditions, would provide the greatest connectivity between habitat patches.

Connected landscapes are especially important for wide-ranging species, such as carnivores (Beier 1993), and for migratory species, such as large herbivores and migratory birds (Bennett [1998, 2003]). They can be critical for maintaining genetically healthy populations, because immigration helps small populations avoid inbreeding (Hanski and Gilpin 1997). As demonstrated by the above analysis, connectedness of habitats is a complex issue. Taking into consideration all of the variables presented above, alternative C appears to provide the greatest opportunity to maintain or improve connectedness of habitats. The establishment of MA 3C provides corridors connecting large secure wildlife areas within which habitat linkages can be designed. Establishing such corridors allows for the design of ecological connections (habitat linkages) that may take a variety of forms, not just simple linear connecting patches of habitat.

The no-action alternative (A) would probably be the second best at providing for connectivity. Although more treatment would occur for this alternative within the Wallowa-Whitman National Forest in the dry forest compared to alternatives E and F, the standards and guidelines from the Eastside Screens amendment are somewhat more restrictive than the standards and guidelines for alternatives E and F. Alternative B would follow alternatives E and F, and alternative D would do the least for providing connected habitat.

Table 341. Percent of potential vegetation group being treated and treatment type during the first decade for each alternative for each national forest

Vegetation Type	Type of Treatment	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F
MAL							
Cold forest	Precommercial thinning	0.3%	0.5%	0.6%	1.0%	0.6%	0.6%
	Commercial	0.5%	1.2%	0.9%	6.1%	3.4%	2.4%
	Totals	**0.8%**	**1.7%**	**1.5%**	**7.1%**	**4.0%**	**3.1%**
Cool/moist forest	Precommercial thinning	0.0%	0.1%	0.1%	0.1%	0.1%	0.0%
	Commercial	0.4%	1.3%	0.8%	5.9%	2.5%	1.5%
	Totals	**0.5%**	**1.4%**	**0.9%**	**6.0%**	**2.6%**	**1.5%**
Dry forest	Precommercial thinning	0.9%	1.0%	0.9%	1.0%	0.7%	0.7%
	Commercial	1.6%	2.9%	1.4%	8.2%	5.1%	3.4%
	Totals	**2.5%**	**3.9%**	**2.3%**	**9.2%**	**5.8%**	**4.1%**
UMA							
Cold forest	Precommercial thinning	0.7%	0.9%	0.8%	1.2%	0.9%	0.9%
	Commercial	0.2%	0.7%	0.4%	4.1%	1.3%	0.9%
	Totals	**0.9%**	**1.6%**	**1.2%**	**5.3%**	**2.2%**	**1.9%**
Cool/Moist forest	Precommercial thinning	0.7%	0.7%	0.5%	0.6%	0.6%	0.6%
	Commercial	1.2%	2.0%	1.0%	7.3%	4.6%	2.6%
	Totals	1.9%	2.7%	1.5%	8.0%	5.1%	3.2%
Dry forest	Precommercial thinning	1.8%	2.0%	1.4%	2.0%	1.8%	1.8%
	Commercial	1.2%	3.1%	1.3%	8.8%	6.2%	3.9%
	Totals	**2.9%**	**5.1%**	**2.6%**	**10.7%**	**8.0%**	**5.7%**
WAW							
Cold forest	Precommercial thinning	0.4%	0.3%	0.2%	0.4%	0.3%	0.2%
	Commercial	1.0%	0.7%	0.4%	3.5%	1.6%	1.0%
	Totals	**1.4%**	**0.9%**	**0.6%**	**3.9%**	**1.9%**	**1.2%**
Cool/moist forest	Precommercial thinning	0.7%	0.6%	0.5%	0.8%	0.6%	0.5%
	Commercial	1.2%	1.2%	0.7%	5.8%	3.1%	2.1%
	Totals	**1.9%**	**1.8%**	**1.2%**	**6.5%**	**3.7%**	**2.6%**
Dry forest	Precommercial thinning	5.0%	2.5%	1.4%	2.4%	1.7%	1.6%
	Commercial	2.0%	2.0%	1.1%	6.8%	3.9%	2.8%
	Totals	**7.1%**	**4.4%**	**2.5%**	**9.2%**	**5.7%**	**4.4%**

Riparian zones function as natural corridors and migration routes for some species, providing a connection between source habitats (Machtans et al. 1996). Each of the alternatives establishes some degree of special designation for areas to be managed as riparian areas. The intent of these areas was the recovery of the riparian zone, but at the same time, this recovery can lead to providing travel corridors for terrestrial wildlife between source habitat patches. Alternative A, as amended by PACFISH/INFISH, has riparian management designations that vary in width from 300 feet to 50 feet depending upon the stream. Alternatives B, E, and F have riparian widths that vary from 300 feet to 100 feet. Alternative C has a riparian width of 300 feet for all situations, whereas alternative D varies from 100 feet to 50 feet. As illustrated in figure 66, alternative C provides the greatest opportunity for riparian areas to act as connectors between habitat patches on all three national forests, whereas alternative D actually provides less connectivity than what is provided by the 1990 forest plans as amended.

In addition to these considerations, climate change may force new patterns of wildlife movements in response to changing environmental conditions and shifting habitats (Heller and Zavaleta 2009).

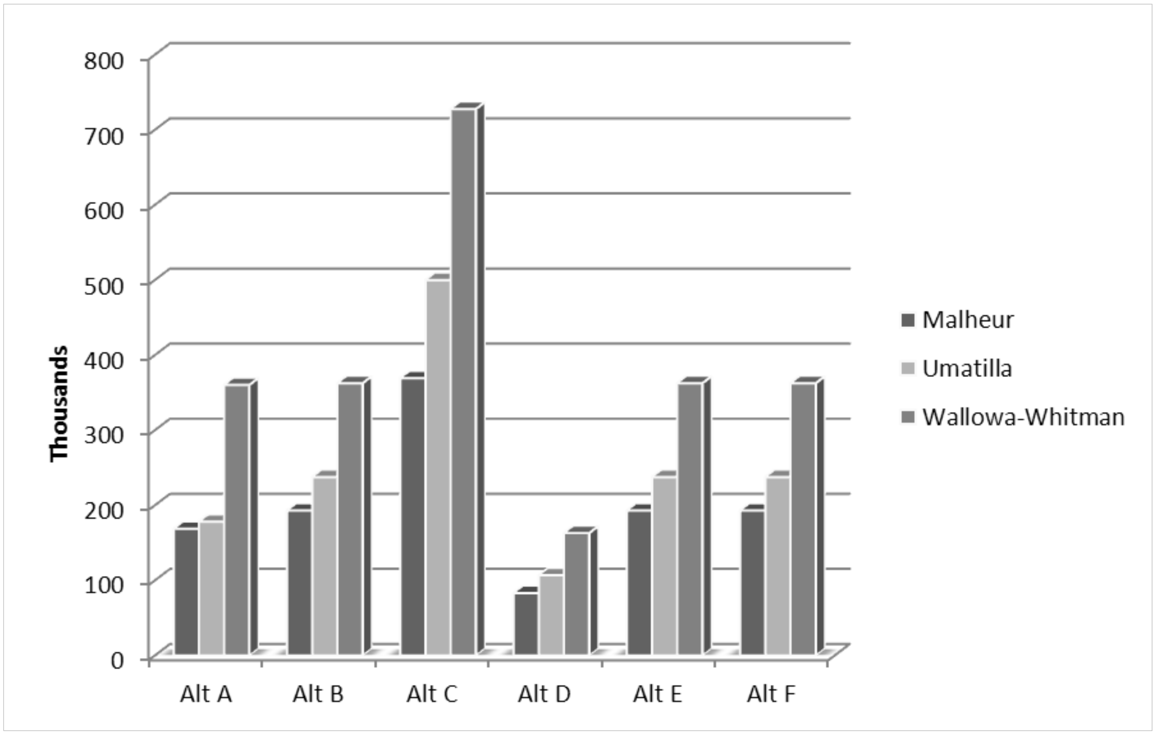

Figure 66. Riparian management areas that could provide travelways and habitat connection for wildlife within each national forest by alternative

Cumulative Effects to Wildlife Habitat Connectivity

Some of the cumulative effects suggested above have already been discussed in other sections of this document (e.g., the potential of spreading disease to bighorn sheep from privately grazed lands). Additionally, the continued sub-division of larger parcels to smaller parcels continues to be occurring on land adjacent to and/or between portions of public lands which restricts wildlife movements due to increases in fencing and other infrastructure. The continued improvement of county, state and federal roads increases the barrier effect to wildlife, isolating some habitat patches from others for certain species.

Cumulative Effects to Terrestrial Wildlife Species (Basinwide Scale)

In general, the analysis area for cumulative effects is all those lands within the Blue Mountain Ecoregion, including BLM, State and private lands as well as those lands within the Columbia Plateau Ecoregion. However, cumulative effects will vary depending on the individual needs and habitat of individual species, and impacts from resource use outside forest boundaries. Cumulative effects to wildlife are also based on the cumulative effects described for vegetation, watersheds, and aquatic resources in their respective sections in this chapter.

The lack of younger seral conditions was identified as a concern from a diversity of habitat standpoint. Management directed at striving for the historic range of variability would provide improved habitat for many species. Because private forest lands have been managed more intensively, it is highly likely that some of these early seral conditions are being provided on those lands. As demonstrated in the effects analysis, the proposed level of activity under any alternative will not be enough to bring the dry forest within HRV over the next several decades. The departure is so large that our goal can only be to produce an upward trend, and although the younger seral stages may occur on lands outside of the forest, it is extremely unlikely that the old forest structure, which is also highly departed, will be produced outside of national forest lands.

Regional risk trends for some species date from the westward expansion and settlement. For example, the greater sage grouse has seen its habitat shrink largely due to habitat losses that have occurred outside of National Forest lands. The bulk of habitat currently occurs on BLM lands. Little habitat occurs on the forest, with all known breeding sites and the vast majority of nesting habitat occurring outside the forest. As such, long-term viability of this species in Oregon is fundamentally beyond the scope of the National Forest management to affect.

Fire suppression on neighboring Federal, State and private lands are routinely coordinated. Given the likelihood of increasing populations in surrounding communities, fire management is expected to be increasingly influenced by public concerns about threats to investments, air quality, and aesthetics. The extent of this influence will be driven by public perceptions and will be variable and not quantifiable. There is the distinct possibility that wildland fire use for resource management on the forest could be trumped by adverse public perceptions to fires allowed to burn under a wildland prescription.

Growing demand for motorized recreation, snowmobiling in particular, includes all ownerships adjacent to the forest. “User built” trails are made by OHV users, expanding their play areas. Conflicts, such as trespass into areas closed to motorized use, are likely to arise as snowmobile and OHV ownership increases. Increased use of National Forests is also expected to facilitate expansion of noxious weeds and other undesirable or nonnative vegetation species. Urban expansion, both locally and regionally, reduces the ability of non-federal land to function as biological reserves and provide wildlife habitat connectivity at broad scales.

Wildlife species do not recognize political or administrative boundaries. Effective wildlife management involves local, regional, state and Federal agencies; public land users; industry; and private landowners. Oregon and Washington completed statewide conservation strategies in 2006 and 2005, respectively. These documents, developed in collaboration with the diverse groups mentioned above, provide the baseline information on the status, distribution, risks and management considerations for species and habitats of greatest concerns for the two states. In addition to these assessments, findings in local subbasin assessments, Partners in Flight products, state fish and wildlife products, and The Interior Columbia Basin Ecosystem Management Project (ICBEMP) have been reviewed for baseline information and additive actions that affect the landscape scale efforts of conservation and restoration.

ICBEMP conducted a large scale viability assessment within the Columbia basin in the late 1990s. Although datasets, analysis area (all lands vs. national forest system lands) and methodology differ slightly, the results (see table 342) are instructive. In some cases, like the white-headed woodpecker, there is strong agreement between the results from this analysis and that of ICBEMP. In other cases, such as the black-backed woodpecker, the trend would be considered increasing rather than decreasing, at least on the national forests.

Table 342. The relative change in habitat and trend category for the Blue Mountains Ecological Reporting Unit from ICBEMP (Wisdom et al. 2000)

Species	Season	Group	Change	Trend
Boreal owl	Year round	7	-3.25	Stable
Northern goshawk	Summer	5	-29.33	Decreasing
Northern goshawk	Winter	25	-24.71	Decreasing
American marten	Year round	5	> 100	Strongly increasing
Pileated woodpecker	Year round	6	> 100	Strongly increasing
White-headed woodpecker	Year round	1	-79.26	Strongly decreasing
Western bluebird	Year round	29	-64.24	Decreasing
Black-backed woodpecker	Year round	9	-30.96	Decreasing
Lewis's woodpecker	Year round	2	-72.17	Strongly decreasing
Wolverine	Year round	15	> 100	Strongly increasing
Lark sparrow	Year round	31	-46.28	Decreasing
Ash-throated flycatcher	Year round	30	> 100	Strongly increasing
Sage thrasher	Year round	33	-28.28	Decreasing
Gray-crowned rosy finch	Year round	38	0	Stable
Fringed myotis	Year round	26	14.12	Stable
Pallid bat	Year round	28	-41.98	Decreasing
Loggerhead shrike	Year round	35	-9.64	Stable
Rocky Mountain bighorn sheep	Summer	22	-47.61	Decreasing
Rocky Mountain bighorn sheep	Winter	22	-53.6	Decreasing
Townsend's big-eared bat	Year round	27	10.42	Stable

Many of the species that are addressed within this document have home ranges or territories that would be expected to extend beyond the boundaries of National Forest System lands. For some species, such as neo-tropical migratory birds, impacts from far-distant areas may have much greater effects than forest management activities. An example is the severe mortality in Swainson’s hawks from pesticide poisoning on wintering areas in Argentina (Goldstein et al. 1999). The upland sandpiper is considered a long-distant migrant, spending the breeding season in the United States, but wintering in South America. Other species such as mule deer may summer on National Forest System lands, but winter in valley bottoms and agricultural lands. As such, species are potentially exposed to local area effects, such as the continued alteration of riparian habitats on lands of other ownership, which may disrupt connectivity between habitats for species such as American martens. At the same time, local governments have been encouraging riparian habitat improvement projects on private lands that will actually be a beneficial cumulative effect. Other habitats that occur mostly on other ownerships, such as the sagebrush-steppe, will probably continue to be lost to invasive species like cheatgrass as management practices on private land, and the continued transportation corridors and resulting connectivity with un-invaded habitats, allow the spread of invasive species.

Wildlife and Climate Change

Earth is undergoing a period of rapid climate change that is enhanced by atmospheric carbon enrichment from human activity during the past 100 years. All organisms depend on their habitats for food, water, shelter, and opportunities to breed and raise young. Climate changes can affect organisms and their habitats in many ways. In fact, climate change likely impacts all life on Earth, from individual organisms to populations, species, communities, and ecosystems. It may alter behavior, population size, species distributions, plant and animal communities, and ecosystem function and stability. How strongly different species will be affected differs, depending on differences in their ecology and life history. Species with small population sizes, restricted ranges, specialized habitat requirements and limited ability to move to different habitat will be most at risk. Similarly, different habitats and ecosystems will be impacted differently, with those in coastal, high-latitude, and high-altitude regions most vulnerable.

According to Hayes (2011), the accelerating change in climate poses the single biggest threat to wildlife species in the United States. Climate change likely will lead to the loss of native species from extensive areas and result in increasingly scarce and fragmented populations in many others. Further changes within ecosystems will be triggered as invasive species, both plant and animal, fill voids that are left as native species are lost. Associated changes in the food web will cascade and further destabilize ecosystems. Climate change effects will vary by ecosystem, and, although there have been many articles published on potential climate change effects on wildlife; a large degree of uncertainty still exists.

Terrestrial Species (Ruggiero et al. 2008)

Wildlife species, such as the wolverine (*Gulo gulo*), snowshoe hare (Lepus americanus), and short-tailed weasel (*Mustela erminea*), have adapted to snowy environments. The snowshoe hare, for example, is well adapted to deep snow based on its large snowshoe-like feet. A warming climate will put this species at a disadvantage, and, importantly, this species is a food source for many predators. Specific tight relationships between predators and their prey (e.g., American marten and red squirrel (*Tamiasciurus hudsonicus*)) may break apart as each species responds differently to climate changes. Native species may be further stressed by the proliferation of invasive species that thrive in warmer conditions.

Climate projections for late century (after 2050) suggest a high probability for the loss of alpine and sub-alpine ecosystems. These cold-adapted ecosystems, such as whitebark pine forests and alpine meadows, will become smaller and will eventually disappear as they are pushed up the mountains. Populations of fauna associated with these ecosystems will become increasingly fragmented and prone to extinction. Habitat isolation and restricted species movement will become prevalent. For example, breeding populations of gray-crowned rosy finches may become isolated on lingering high-elevation, boreal islands, threatening the long-term viability of the species.

Increases in disturbance owing to fire, and insects and disease will accelerate the infiltration of weeds. This is of particular concern in the Blue Mountains, where fire frequency and severity are expected to increase as the climate warms. The loss of native ecosystems to weeds affects many species of terrestrial fauna. Many animal species could be extirpated from the Blue Mountains as changes in vegetation patterns ripple through the ecosystems.

Amphibians and Reptiles (Synthesized from Lind 2008)

For amphibians and reptiles, responses to climate change will be influenced by the following primary factors: (1) expected changes and variability in local environmental and habitat conditions, (2) the phenology (timing) of life-requisite activities, (3) interactions with emerging pathogens and invasive species, and (4) interactions with other environmental stressors (e.g., chemicals). For example, in Oregon, frogs are breeding earlier in the spring and the incidence of infectious diseases among them is increasing (Oregon Climate Change Research Institute

(OCCRI) 2010). Changes in wet periods, snowpack, and flooding frequency will determine reproductive success rates and survival to metamorphosis (OCCRI 2010). Over the long term, the frequency and duration of extreme temperature and precipitation events will likely influence the persistence of local populations, dispersal capabilities and consequently the structure of metapopulations on the landscape. Synergisms among a variety of environmental stressors adversely affect native amphibians and reptiles and climatic changes are likely to exacerbate these effects.

Although amphibians and reptiles are typically grouped together in assessments such as this one, it should be noted that these two groups represent a great variety of species that are adapted to diverse ecosystems and environments throughout the world. In general, particular ecological communities are expected to move upward in both elevation and latitude (Walther et al. 2002). As with other species, montane and higher-latitude populations of amphibians and reptiles are most at risk (Root et al. 2003). Amphibians have recently been experiencing global population declines (Stuart et al. 2004) and similar signs of decline may be emerging for reptiles (Gibbon et al. 2000).

Amphibian and reptile populations are sensitive to and respond strongly to changes and variability in air and water temperature, precipitation, and the hydroperiod (length of time and seasonality of water presence) of their environments (Carey and Alexander 2003). Many amphibians require aquatic habitats for egg laying and larval development, and moist environments for post metamorphic life stages. As temperatures warm and the availability of aquatic habitats become more variable, amphibians are likely to experience lower rates of survival. Species associated with ephemeral waters, such as shallow ponds and intermittent streams, may be particularly vulnerable to altered precipitation patterns. Some reptile species exhibit temperature-dependent sex determination during egg incubation that could be influenced by changes and variability in global climates (Gibbon et al. 2000, Hawkes et al. 2007). Increases in frequency or intensity of wildfires could create changes that may directly affect animals during the wildfire event or degrade habitat conditions necessary for their survival post wildfire.

Amphibians typically have relatively small home ranges and low dispersal rates, although there are some exceptions. Reptiles are somewhat more mobile and have a greater ability to withstand the expected dryer and warmer conditions. However, in areas where key habitats and species ranges have already been altered and fragmented by human use and development, the physical pathways to connect animals with suitable habitats (e.g., upwards in latitude or elevation) may not exist. Although some near-term benefits of climate warming may be seen for some reptile species owing to increases in preferred temperatures and activity periods (ChamaillÉ-Jammes et al. 2006), over the long term, expected variability and temperature extremes will likely not be beneficial to these taxa.

For amphibians and reptiles, the timing of key ecological events is influenced by environmental conditions, such as air and water temperature and precipitation patterns. Lawler et al. (2009) found amphibian ranges were thus more vulnerable to changes in precipitation than were those of birds or mammals. The timing of reproduction (breeding/egg laying), metamorphosis, dispersal, and migration may shift in response to higher temperatures and changes in rainfall (Beebee 1995). If such shifts in amphibian and reptile activities occur inconsistently with other ecological events (e.g., emergence of their insect prey), growth and survival rates would be affected.

Recent research on amphibian declines has documented the role of emerging pathogens and in some cases epidemic outbreaks of particular infections and diseases (Daszak et al. 2003). Changes in climatic regimes are likely to increase pathogen virulence and amphibian and reptile susceptibility to pathogens. Similarly, warm water invasive species (e.g., bullfrogs and some fishes in the western United States) are a concern to native species and may expand their ranges given warming trends, particularly earlier warming in the spring (Bury and Whelan 1984).

Birds

In North America, the northern limits of many bird species are strongly associated with various climatic variables (e.g., winter temperature). Both the ranges and the abundances of birds shift on an annual basis in concert with temperature. Studies have shown that a significant number of migrating birds are arriving up to three weeks earlier now than they did in 1960. Apparently, many bird species can and do respond to changing climatic conditions. Because their ranges are limited by vegetation, these birds probably will not be able to shift their ranges with the changing climate, at least not until the vegetation itself shifts. Consequently, natural communities of birds may change dramatically as changes in climate and vegetation favor some species and harm others. It is difficult to predict how these changes will influence community structure or function.

The pattern in Oregon is consistent with this assessment. Ranges of some birds are moving north and increasing in elevation. The other major change is the probable shift to an earlier breeding season as the temperatures become warmer earlier in the spring. Birds associated with higher elevation wetlands dependent on snowpack may be adversely affected (North American Bird Conservation Initiative (NABCI) 2010). Some forest birds already of concern may be affected by summer drying. Birds in the transition zone to the Great Basin, along the southern edge of the Blue Mountains, will be particularly vulnerable to summer drying (Olson and Burnett 2009).

Bird populations will be affected by a set of cumulative effects, including changes in ranges and migratory patterns. Earlier spring warming will affect breeding, as will changes in abundance of insects. Insects are particularly affected by climate dynamics, since their development is closely tied to temperature. For example, an increase in temperature of 2 degrees Celsius will change the availability of insects as a food source by more than 18 days (OCCRI 2010). Birds migrating may thus be adversely affected by asynchrony; they could arrive at a time when the level of insects they feed their young has declined, passed, or not yet occurred. Jones and Cresswell (2009) state:

> The phenology mismatch hypothesis predicts that migrant birds, which experience a greater rate of warming in their breeding grounds compared to their wintering grounds, are more likely to be in decline, because their migration will occur later and they may then miss the early stages of the breeding season. Population trends will also be negatively correlated with distance, because the chances of phenology mismatch increase with number of staging sites.

Because of this complicated set of trends, it is difficult to predict specific outcomes with confidence. Nevertheless, management actions to foster relatively intact and functioning ecosystems will be the best strategy to mitigate these effects.

Plant Species Diversity and Threatened, Endangered, and Sensitive Plants

Threatened, endangered, and proposed plant species are designated under the Endangered Species Act by the U.S. Fish and Wildlife Service (USFWS). One threatened species, Spalding's catchfly (*Silene spaldingii*), is present within the forest plan revision area. A second threatened plant, MacFarlane's four o'clock (*Mirabilis macfarlanei*) is not present, but suitable habitat for the species may exist within the plan area.

Threatened and Endangered Plants

Affected Environment – Spalding's Catchfly

Spalding's catchfly is an herbaceous perennial in the pink family (Caryophyllaceae). Seasonal stems emerge in the spring from the root crown, sending usually one, but sometimes multiple shoots 8 to 24 inches in height. Each stem has typically 4 to 7 pairs of leaves and 3 to 20 flowers on reproductive shoots. Stems, leaves, and the floral calyx are covered with dense sticky hairs that catch insects. The species is noted for its very long taproot that can exceed 1 meter (39 inches). Spalding's catchfly begins blooming in mid to late July. Blooming continues through August and sometimes into September. Fruits mature from August until September. Seeds are small (2 mm), wrinkled, and winged and are dispersed by wind from a dehiscent capsule (USFWS 2007).

Spalding's catchfly is endemic to the Palouse region of southeastern Washington and adjacent Oregon and Idaho, and is disjunct in northwestern Montana and British Columbia, Canada. Spalding's catchfly is found predominantly in the Pacific Northwest bunchgrass grasslands and sagebrush-steppe and occasionally in open-canopy pine stands. Occupied habitat is in five physiographic regions: (1) the Palouse Grasslands in west-central Idaho and southeastern Washington, (2) the Channeled Scablands in east-central Washington, (3) the Blue Mountains Basins in northeastern Oregon, (4) the Canyon Grasslands along major river systems in Idaho, Oregon, and Washington, and (5) the Intermontane Valleys of northwestern Montana and British Columbia, Canada. Spalding's catchfly was listed as a threatened species under the Endangered Species Act October 10, 2001.

As of 2007, there are 99 known populations of Spalding's catchfly across its range, with two-thirds of these (66 populations) composed of fewer than 100 plants. There are an additional 23 populations with at least 100 or more plants. The 10 largest populations are each made up of more than 500 plants. Approximately 78 percent of the total known Spalding's catchfly plants are within the 10 largest populations (USFWS 2007). The plan area includes occupied habitat in the Blue Mountains Basins (Wallowa-Whitman National Forest) and the Canyon Grasslands (Umatilla National Forest) physiographic regions.

The recovery plan for Spalding's catchfly (recovery plan) outlines a strategy to protect and maintain reproducing, self-sustaining populations in each of the five physiographic regions where it resides to ensure the long-term persistence of the species (USFWS 2007). Within each of these regions the USFWS identifies key conservation areas to focus conservation efforts on the larger populations that support at least 500 plants. Until the USFWS completes a comprehensive population viability analysis, the recovery plan assumes 500 individuals to be the minimum viable population size. A key conservation area possesses the following qualities:

- Is composed of intact habitat (not fragmented), preferably 40 acres or greater
- Native plants comprise at least 80 percent of the canopy cover of the vegetation
- Adjacent habitat is sufficient to support pollinating insects
- Habitat is of the quality and quantity necessary to support at least 500 reproducing individuals of Spalding's catchfly

According to the recovery plan, key conservation areas should be surrounded by 300 acres of habitat that is intact or could be restored to support Spalding's catchfly.

In the Blue Mountains Basins physiographic region, the recovery plan identifies four Spalding's catchfly key conservation areas. One key conservation area, Crow Creek, is almost entirely within the Wallowa-Whitman National Forest. The Crow Creek population is estimated to hold approximately 2,400 plants and is the third largest Spalding's catchfly population range-wide (USFWS 2007). A second key conservation area, Clear Lake Ridge, occupies National Forest System lands, BLM, and private lands. Most Spalding's catchfly patches at Clear Lake Ridge are on private lands, but more than half the plants (520 of 850) grow at one site within the Wallowa-Whitman National Forest. An additional 330 plants occupy several small patches that are predominantly on private land. Only a small portion of one patch overlaps BLM administered land. The two additional key conservation areas in the Blue Mountains physiographic region are on private lands. In the Blue Mountains physiographic region, National Forest System lands that make up the plan area contribute two of the four Spalding's catchfly key conservation areas (Crow Creek, Clear Lake Ridge). As the third largest population range-wide, the Crow Creek key conservation area plays a leading role in the conservation of Spalding's catchfly.

The recovery plan identifies five Spalding's catchfly key conservation areas in the Canyon Grasslands physiographic region. One key conservation area, the Blue Mountains Foothills is within the Umatilla National Forest and has an estimated population of approximately 1,070 plants. Another key conservation area is located on Nez Perce Precious Lands immediately adjacent to the Wallowa-Whitman National Forest. Spalding's catchfly populations also occur in the adjacent Hells Canyon National Recreation Area (HCNRA) but are outside the forest plan revision area. Spalding's catchfly sites in the HCRNA have not been identified as key conservation areas because they contain fewer than 500 plants. In the Canyon Grasslands physiographic region National Forest System lands contribute one of five Spalding's catchfly key conservation areas.

Spalding's Catchfly Occurrence within the Umatilla National Forest

Spalding's catchfly is the only federally listed plant species occurring within the Umatilla National Forest. No other listed plant species are suspected to occur within this national forest.

Spalding's catchfly occurs in an area within the Umatilla National Forest Peola and MacKee range allotments. Both allotments have been surveyed for the presence of sensitive species, including specific surveys for Spalding's catchfly in 1997 and 2000 (Wood 2006; see table 343). The Sourdough area where Spalding's catchfly occurs includes at least portions of four open ridges on the south side of Lick Creek (Cabin, Sheep, Sourdough, and Bracken ridges) and their intervening draws that support plant communities typical of the Canyon Grasslands (USFWS 2005, Johnson and Simon 1987, Tisdale 1986).

The condition of grasslands in the vicinity inhabited by Spalding's catchfly is described as variable: the northerly slopes and ridge tops are reported in good to excellent condition (USDA

Forest Service 2006), whereas the southerly slopes have been invaded by exotic plants, including state-listed noxious weeds, such as *Centaurea solstitialis*.

National Forest System lands that support Spalding's catchfly within the Umatilla National Forest are currently allocated to MA C3 big game winter range. Under this management allocation all management actions are suitable, but with some modifications of timber resources. Permitted grazing utilization standards for upland grasslands in big game winter range are 55 percent for pastures in satisfactory condition and zero to 35 percent for pastures in unsatisfactory condition [although the pastures of the Peola Allotment that are occupied by Spalding's catchfly are in a resource protection status (i.e., not grazed, to assist in the conservation of the species) (USDA Forest Service 2006)]. One road passes through the area following Sourdough Gulch. Three patches of Spalding's catchfly are about 100 to 130 meters southeast of the road and between 100 and 200 feet higher.

Table 343. Site locations of Spalding's catchfly in the Sourdough Area

State Element of Occurrence Number	Umatilla National Forest Site Number	Date Discovered	Number of Plants Reported	Allotment	Pasture
49	1007	September, 2011	200	Peola	Cottonwood
49*	20	August 16, 1995	45	Peola	Lower Sourdough
49	21	August 5, 1997	130	Peola	Lower Sourdough
49	831	August 15, 2000	150	Peola	Lower Sourdough
49	14	August 6, 1997	490	Peola	Upper Sourdough
49	15	August 6, 1997	83	Peola	Upper Sourdough
49	61	August 6, 1997	113	Peola and MacKee	Upper Sourdough
49	832	August 16, 2000	10	Peola	Upper Sourdough
49	57	August 16, 1995	6	MacKee	NA
58	76 and 77	July 28, 1997	21	Peola	Lower Sourdough
88**	State land: Smoothing Iron Ridge	September 2008	greater than 5,000	NA	NA

* EOR Numbers 50 and 56 were combined into EOR 49 in 2006 (per G. Glenne, USFWS).

** EOR 88 is within Washington Department of Fish and Wildlife land that is currently grazed. This population was discovered in 2008 with 713 plants. In 2009, additional inventory resulted in a count of 5,977 plants.

Spalding's Catchfly Occurrence within the Wallowa-Whitman National Forest

The recovery plan identifies four Spalding's catchfly key conservation areas in the Blue Mountains Basins physiographic region. One key conservation area, Crow Creek, is located almost entirely within the Wallowa-Whitman National Forest. The Crow Creek population is estimated at approximately 2,400 plants and is the third largest Spalding's catchfly population range-wide (USFWS 2007). A second key conservation area, Clear Lake Ridge, occupies National Forest System, BLM, and private lands. Most patches of Spalding's catchfly at Clear Lake Ridge are on private land, but more than half the plants (520 of 850) grow at one site within the Wallowa-Whitman National Forest. An additional 330 plants occupy several small patches that are predominantly on private land. Only a small portion of one patch overlaps with BLM administered land. The two additional key conservation areas in the Blue Mountains Basins physiographic region are on private lands. In the Blue Mountains Basins physiographic region, National Forest System lands that make up the plan area contribute two of the four Spalding's catchfly key conservation areas (Crow Creek, Clear Lake Ridge). As the third largest population range-wide, the Crow Creek key conservation area plays a leading role in the conservation of Spalding's catchfly.

Both the Crow Creek and Clear Lake Ridge vicinities are currently allocated to MA 4A General Forest Timber/Range. The maximum livestock utilization rate for upland grasses and forbs (for pastures rated in satisfactory condition) is 55 percent.

Rare plant species occurrence information is recorded by state Heritage Programs in a numbered record called an element occurrence record (EOR) displayed in table 344. Each EOR may include one or more sites (often called subpopulations), which are defined as distinct patches of the plant on the landscape. The Forest Service tracks each site on National Forest System lands with its own spatial database (geographic information system (GIS)) number. Table 344 displays the population at Crow Creek. Population sizes were obtained via visual estimates.

A systematic approach to measure population sizes began in 2008 in partnership with The Nature Conservancy. Using statistically valid methods, The Nature Conservancy measured the area, frequency, and density of Spalding's catchfly at Crow Creek and Clear Lake Ridge. Density and area measurements were then used to estimate population size. Three years of results have been summarized (Jansen and Taylor 2010). The Nature Conservancy statistical population estimates exceed the values reported by Forest Service visual estimates and approximately double both the Crow Creek and Clear Lake Ridge populations.

Table 344. Spalding's catchfly population estimates at Crow Creek and Clear Lake Ridge

State Element of Occurrence Number	WAW GIS Number	Number of Plants Reported	Combined Population Estimate	TNC Population Estimate
Crow Creek				
EOR 016	1266, 1267 East	99-203	Crow Creek East 266-1,006	Crow Creek East 1,665-7,363 (2008) 520-2,284 (2009) 558-2,368 (2010)
EOR 014	0519, 1337, 1338, 0518/new sites in 2004, 0600-0608 East	126-295/414		
EOR 013	0516, 0517 East	41-94		
EOR 017	1268, 1269 West	58-79	Crow Creek West 822-2,259	Crow Creek West 2,306-7,242 (2008) 2,834-7,740 (2009) 854-3,586 (2010)
EOR 019	1280 West	14-20		
EOR 020	1275-1279 West	659-1,860		
EOR 018 (PVT)	1265 West	91-300		
Clear Lake Ridge				
Unassigned	061602	520	750-1,970	NA
Clear Lake Ridge TNC	NA	230-1,450 (837)		230-1,450 (2009)

Spalding's Catchfly Modeled Suitable Habitat (Wallowa-Whitman National Forest)

Suitable habitat for Spalding's catchfly within the Wallowa-Whitman National Forest has been identified using a model (Murray 2001). Physical and biological attributes from known

Spalding's catchfly sites, including vegetation type, elevation, slope, and aspect, were weighted and used to identify and map areas that have the potential to support the species. Habitats were assigned categories of probability: moderate, high, or very high. The purpose of the model is to identify areas to prioritize field inventories for Spalding's catchfly, not definitively identify suitable habitat, whether occupied or not. Nearly all known Spalding's catchfly sites are in high or very high modeled habitat, but three occurrences discovered in 2010 were found in areas not predicted by the model. Although the model does a good job of predicting potential habitat for focusing inventories, it is not perfect. Within the Wallowa-Whitman National Forest, the model identifies 9,637 acres of high potential habitat and 13,615 acres of very high potential habitat.

Threats to Spalding's Catchfly

Across its range, the main threats facing Spalding's catchfly are habitat loss due to development, habitat degradation associated with adverse grazing and trampling by domestic livestock and wildlife, and invasions of aggressive, nonnative plants (USFWS 2007). In addition, a loss of genetic fitness is a problem for small, fragmented populations where genetic exchange is limited. Other impacts include changes in fire frequency and seasonality, off-road vehicle use, and herbicide spraying and drift.

The main threats to Spalding's catchfly on National Forest System lands are invasions by aggressive, nonnative plants, adverse livestock grazing management, and changes in fire frequency and seasonality. The Spalding's catchfly population within the Clear Lake Ridge key conservation area is infested with sulfur cinquefoil (*Potentilla recta*). North Africa grass (*Ventenata dubia*) is present at the Crow Creek key conservation area. Annual exotic bromes (*Bromus tectorum*, *B. japonicus*, *B. secalinus*) are present at most Spalding's catchfly sites. Livestock grazing is currently being managed to reduce impacts at the Crow Creek area through avoidance or deferred pasture rotation (USFWS 2005). The Blue Mountains Foothills key conservation area (Umatilla National Forest) is not being grazed (resource protection status). Yellow-star thistle (*Centaurea solstitialis*), an aggressive invasive plant, does threaten the Spalding's catchfly in this area. Off road vehicle use is impacting Spalding's catchfly in the Blue Mountains Foothill key conservation area within the Umatilla National Forest, contributing to nonnative plant spread and degradation of habitat. In 2010, a fence was discovered severed with fresh vehicle tracks within 50 feet of Spalding's catchfly.

Within the Wallowa-Whitman National Forest, Spalding's catchfly populations appear stable or increasing where multiple years (15 to 20 years) of inventory has been done (USDA Forest Service 2008). Populations range from 20 to more than 500 plants. The populations on National Forest System lands in Oregon are within grazing allotments. The Mud Duck allotment is presently closed. The FEIS and record of decision (ROD) for the Joseph Creek Rangeland Analysis and associated biological assessment and biological opinion (USFWS 2005) for Spalding's catchfly in the Swamp Creek and Crow Creek Allotments were completed in 2005. Direction from the ROD continues grazing within the Crow Creek and Swamp Creek allotments where Spalding's catchfly occurs; however, an adaptive approach to grazing management was implemented with specific protections for sensitive areas. Management direction is designed to improve range condition through monitoring, reduction of trailing through the pastures, and rotation so that spring grazing is rested. Conservation measures for Spalding's catchfly include spring drought protections and rest every third year, restrictions on herding through the Doe Gulch pasture, and restricting use to spring and fall, mostly outside the active growing season. Current management direction allows the Dorrance pasture to be used during June, but not in every year. The goal of effectiveness monitoring is to ensure that the conservation measures are working as designed.

Two populations of Spalding's catchfly within the Swamp Creek allotment are within one-quarter mile of a diffuse knapweed site (about 10 acres) along Crow Creek. The population that spans both private and public land, on the terminal moraine at the north end of Wallowa Lake, is grazed and has a diffuse knapweed problem. In one Crow Creek population, both Kentucky bluegrass and *Ventenata* (an exotic annual grass) have been documented. Other annual grasses, yellow starthistle, and sulfur cinquefoil occur within one-quarter to one-half mile of populations on the Wallowa plateau (USDA Forest Service 2005).

Environmental Consequences – Spalding's Catchfly

Effects from Livestock Grazing

Livestock grazing can directly impact Spalding's catchfly by herbivory and trampling and indirectly impact Spalding's catchfly via soil compaction, soil erosion, the introduction of nonnative plants, and loss of pollinator habitat. Grazing of Spalding's catchfly has been observed and is considered a threat to the species (Kagan 1989, Hill and Gray 2004, Taylor 2007). Direct herbivory removes flowers or seeds, thereby limiting reproduction. Herbivory of leaves inhibits a plant's ability to manufacture carbohydrates necessary for seasonal growth and storage in the perennial taproot. Trampling can easily break off entire plants at the ground level and damage the root crowns from which stems emerge. Root crown damage is more frequently associated with early season grazing (Hill and Gray 2004). Late summer grazing or heavy grazing is especially detrimental to Spalding's catchfly (Hill and Gray 2004). Sufficient research has not been completed to discern what levels of grazing may allow the Spalding's catchfly to persist (USDI 2007).

Indirect effects can impact the habitat of Spalding's catchfly. Although grassland ecosystems of the arid, intermountain west experienced little grazing pressure from large, hoofed animals during the last 10,000 years (Mack and Thompson 1982, Lyman and Wolverton 2002) they cannot tolerate the levels of grazing exerted by domestic livestock in the 1800s and early 20th century. Both *Pseudoreigneria spicata* and *Festuca idahoensis* are poorly adapted to herbivory by comparison to other grass species, having little compensatory growth, such as tiller production (Caldwell et al. 1981). Disturbances, most frequently linked to adverse livestock grazing and trampling, have dramatically altered western arid ecosystems in a progression from native perennial bunchgrass communities to invasive nonnative annual grasslands that are then susceptible to more invasive perennial plant invasions (DiTomaso 2000).

Of greater concern is the impact livestock grazing may have on the pollinator community in Spalding's catchfly habitat. Described as the first large-scale manipulative study of the effect of grazing intensity on native bee communities in a North American grassland, Kimoto (2010) found that increases in grazing intensity showed a linear decline in bee diversity, abundance, and richness, especially with bumblebees (*Bombus* spp.), which have been identified as the most significant pollinator (*B. fervidus*) of Spalding's catchfly in a range-wide study (Lesica and Heidel 1996). In the absence of open pollination, Spalding's catchfly experienced an 85 percent reduction in fecundity and a loss of fitness, due to inbreeding depression, resulting in an estimated total reduction in fitness of 99 percent (Lesica 1993). Therefore, management practices that significantly reduce pollinators, especially bumblebees, could have a significant impact on the recruitment of new plants into a Spalding's catchfly population. Even though Spalding's catchfly is long lived, without seedling recruitment populations would decline over time. Forage utilizations approaching 50 percent showed very little to zero bumblebee abundance (Kimoto 2010). Therefore, grazing utilization of 50 percent within Spalding's catchfly populations and surrounding habitat would not likely contribute toward maintaining bumblebee populations, thereby limiting Spalding's catchfly reproduction. Kimoto (2010) found that even moderate grazing (22 to 40 percent utilization) led to bumblebee declines.

Effects Common to all Alternatives

Within the Wallowa-Whitman National Forest, known Spalding's catchfly populations, including potential habitat as modeled by Murray (2001), are within lands suitable for livestock grazing. Direct and indirect effects could occur to populations of the species. As projects are planned or revised (or ongoing actions brought into compliance with the forest plan upon its implementation), livestock grazing actions would need to comply with standards PL-TES-1 and PL-TES-2 that restrict the timing of livestock grazing in occupied habitat to outside the growing season for Spalding's catchfly for pastures in satisfactory condition (low departure from the upland grassland desired condition). For pastures in unsatisfactory condition (moderate or greater departure from the desired condition) grazing is to be avoided in occupied habitat. These standards would ensure that Spalding's catchfly would not be grazed or trampled and that occupied habitat in moderate or greater departure from the upland grassland desired condition would recover to phase A or B faster than if grazed.

For alternatives B, D, E, and F, nearly all the known sites within the Umatilla National Forest are within a proposed botanical area, where livestock grazing would not be suitable. Two patches, with approximately 200 plants (about 3 percent of the Spalding's catchfly plants within the Umatilla National Forest) are north of the proposed botanical area. These two patches would be in MA 4A General Forest for all alternatives. For alternative C, all known Spalding's catchfly sites within the Umatilla National Forest would be allocated to a wilderness study area, where livestock grazing would be suitable. For alternative A, known Spalding's catchfly plants would be within the current C3A allocation, which is also suitable for livestock grazing. Therefore, livestock grazing would not affect the majority of the known population of Spalding's catchfly within the Umatilla National Forest. For all alternatives, about 3 percent of the population could be affected by grazing. These patches and other Spalding's catchfly populations that may be discovered during the life of the plan would be managed according to standards PL-TES-1 and PL-TES-2 as described for the Wallowa-Whitman National Forest.

Effects from Invasive Plants

Exotic, invasive plant species threaten the viability of Spalding's catchfly. Invasive plants compete with Spalding's catchfly for water, nutrients, and light. Of greatest concern is the effect of invasive plants on seedling establishment, a vulnerable state for perennial plants. Not only are invasive species able to outgrow seedlings of Spalding's catchfly, they often leave behind increased leaf litter, inhibiting the germination of other plants. In one study in Washington, high levels of exotic plants (*Bromus secalinus*, *Hypericum perforatum*, and *Ventenata dubia*) were associated with less vigorous occurrences of Spalding's catchfly (Caplow 2002). Invasive plants also provide competition for pollinators, affecting fecundity and individual fitness in Spalding's catchfly (Lesica and Heidel 1996). Insects may switch from Spalding's catchfly to an invasive plant if it is more abundant or provides more pollen or nectar (Richards 1997). Lesica and Heidel (1996) found lower visitation rates for Spalding's catchfly in sites infested with *Hypericum perforatum* (St. John's wort).

With the increased level of activity expected for alternative D, the risk of increased invasive plant spread would be more likely compared to the other alternatives. See the Non-native Invasive Plants section for a discussion of these effects from invasive species.

Forest plan objective 1.5, "Reduce current infestations of invasive plant species," would contribute to the conservation of Spalding's catchfly by reducing or eliminating invasive species in and around occupied habitat. Invasive plant treatment actions designed to reduce or eliminate infestations may affect Spalding's catchfly. The main concern here is the use of herbicides to treat invasive plants, which, if applied indiscriminately, may cause mortality or damage to Spalding's catchfly. The forest plan would address this concern by incorporating standards from the 2005 Record of Decision for the Preventing and Managing Invasive Plants FEIS. The 2005 plan standard (number 20) directs invasive plant treatments to be designed to minimize or eliminate adverse effects to species or habitats proposed or listed under the Endangered Species Act.

Effects from Prescribed Fire

Although the actual effects of prescribed fire is unknown, Spalding's catchfly is presumed to have evolved with and adapted to the historical fire regime in intermountain western North America (Lesica 1999), where fire has been a common occurrence in grasslands (Barrett and Arno 1982). Historical fire frequency in the Idaho fescue grasslands of the Blue Mountains is not well understood, but it is believed fires were frequent, with return intervals of less than 35 years (Johnson and Swanson 2005). Late summer fires are more damaging to Idaho fescue, but pre-burn cover of fescue returns usually within five years (Johnson and Swanson 2005). In the Idaho fescue grasslands of northeastern Oregon and southeastern Washington, fire is not believed necessary to promote seedling establishment of Spalding's catchfly as it apparently is in the western Montana grasslands dominated by rough fescue (Lesica 1999). Drier conditions in northeastern Oregon and southeastern Washington also limit the ability of trees and shrubs to encroach onto grasslands. Therefore, prescribed fire may not be needed to maintain grasslands in northeastern Oregon and southeastern Washington. If prescribed fires are needed to improve habitat for *S. spaldingii*, they would be carried out during the early spring or fall, when fires are more easily controlled. Fires carried out in the fall would probably have less impact to *S. spaldingii* than fires carried out during spring. During spring, it is possible seedlings could be killed. Dormant plants would probably not be affected, and older plants emerging from root crowns may suffer only minor damage. Perennial individuals damaged by spring fire are expected to send up additional shoots from axillary buds. Forest plan guideline PL-TES-7 would require sensitive plants to be buffered (minimum 100 feet) from slash piles to protect plants from the extreme temperatures that develop underneath or next to them. The overall effect of prescribed fire would benefit *S. spaldingii*, though some individual plants may be adversely affected in the short-term. [If the overall effect of an action is beneficial to the listed species, but also is likely to cause some adverse effects, the action is likely to adversely affect the listed species (USFWS and NMFS 1998)].

Effects from Climate Change

The effects of climate change are speculative, but it has the potential to affect rare plants, including Spalding's catchfly. Researchers speculate that a warming climate will alter precipitation patterns, with some regions becoming drier and others wetter. Within the Pacific Northwest, a recent model predicts warmer and wetter winters in 80 years. Being stationary, plants must migrate through dispersal, colonization and recruitment strategies, a relatively slow process compared to mobile organisms. Some researchers believe that plant species will not be able to migrate at a pace dictated by a warming climate, which would isolate and eventually doom some species, unless new adaptations arise to cope with a changing environment. Even though activities would be designed to maintain or improve Spalding's catchfly habitat or numbers, these actions may cause short term adverse effects. Restorative actions, such as prescribed fire or collecting *S. spaldingii* seed for long term storage, could cause short-term adverse effects, even though the overall effect of these actions would be beneficial.

Determination for Spalding's Catchfly

A complete biological assessment is being prepared, but the anticipated determination is that forest plan goals, objectives, standards and guidelines, and areas identified for suitable activities that may be conducted within the Wallowa-Whitman National Forest and (to a lesser extent) the Umatilla National Forest for any of the alternatives, may affect, and would be likely to adversely affect Spalding's catchfly. Though many management actions, such as nonnative invasive species abatement or prescribed fire, would assist in the recovery of Spalding's catchfly, these actions may have short-term effects that could impact individuals or their habitat, while promoting the recovery of the species in the long term.

Affected Environment – Macfarlane's Four O'clock

MacFarlane's four o'clock (*Mirabilis macfarlanei*) is a rare plant narrowly endemic to a small range (46 by 29 km) in northeastern Oregon and adjacent west-central Idaho. MacFarlane's four o'clock was listed endangered under the Endangered Species Act in 1979. As more populations were discovered, the status was downgraded to threatened (61 FR 10693-10697). Populations have not been discovered within the plan area but are in the adjacent Hells Canyon National Recreation Area. The nearest population is approximately 25 miles to the southeast in the Imnaha River canyon. Suitable habitat for the species exists within the plan area below 3,000 feet in the Joseph Creek canyon, Wallowa Ranger District, Wallowa-Whitman National Forest.

MacFarlane's four-o'clock is a perennial forb in the Nyctaginaceae or four-o'clock family. New shoots emerge in the early spring from tuberous rootstock with flowers blooming from late May to early June. Each flower produces only one barrel-shaped achene: a single seeded fruit about 6mm long. Seeds typically disperse via gravity from late June through July, and plants generally senesce shortly thereafter. Seedling establishment is apparently infrequent; most reproduction is accomplished asexually via tuberous roots that continue to grow in several directions and send up new stems.

Environment Consequences – Macfarlane's Four O'clock

MacFarlane's four-o'clock grows predominantly in blue-bunch wheatgrass grasslands below 3,000 feet in the canyon grasslands ecological type described by Tisdale (1986). Suitable habitat for Macfarlane's four o'clock within the Wallowa-Whitman National Forest has been identified using a model (Murray 2001). Physical and biological attributes from known Macfarlane's four o'clock sites, including vegetation type, elevation, slope and aspect, were weighted and used to map areas that have the potential to support the species. Habitats were assigned categories of probability: moderate, high, or very high. The purpose of the model is to identify areas to prioritize field inventories for Macfarlane's four o'clock; it does not definitively identify suitable habitat, whether occupied or not. Eleven of 12 Macfarlane's four o'clock occurrences known to occur in the Hells Canyon National Recreation Area are in very high potential (8 occurrences) or high (3 occurrences) potential habitat. One site falls in an area not predicted by the model. Similar to the Spalding's catchfly habitat model (discussed previously), the Macfarlane's four o'clock model does a good job of predicting potential habitat for focusing inventories, but is not perfect.

Within the plan area portion of the Wallowa-Whitman National Forest, the model identifies 1,258 acres of high potential habitat. The model does not identify any very high or moderate potential habitat within the plan area. A survey completed in 2004 in MacFarlane's four o'clock potential habitat in the Joseph Creek canyon (USDA Forest Service 2005e) did not detect new occurrences. This survey was conducted in the likely best available habitat within the plan area and near the known range of the four o'clock. Additional surveys conducted in 2007, 2008, 2009, and 2010 of MacFarlane's four o'clock very high and high potential habitat within the Snake River canyon did not detect new occurrences. Based on the negative survey findings in the plan area and in the Snake River canyon, it is unlikely that MacFarlane's four o'clock occurs within the plan area.

Determination for Macfarlane's Four O'clock

Given the negative survey results in the best quality suitable habitat within the plan area and the long distance of this habitat from the known range of the species, *Mirabilis macfarlanei* is presumed not present in the plan area. Therefore, any alternative would result in no effect to *Mirabilis macfarlanei*.

Sensitive Plants

Forest plan components will be evaluated for each alternative by their predicted ability to meet the direction set forth in Sections 219.26 and 219.27 of the 1982 planning rule and in their ability to achieve the desired condition for federally listed plants and plants included on the Regional Forester's Sensitive Species List.

Proposed forest plan goals, desired conditions, and standards and guidelines common to all action alternatives are found in appendix A.

Alternative A, the no-action alternative, is the continuation of the 1990 forest plans for the Malheur, Umatilla, Wallowa-Whitman, and Ochoco National Forests (the portion of the Ochoco National Forest administered by the Malheur National Forest's Emigrant Creek Ranger District). They include management direction to provide a diversity of habitat sufficient to maintain viable populations of plant and animal species.

Affected Environments – Sensitive Plants

Sensitive plants are designated by the regional forester. To facilitate analysis, sensitive species have been grouped into 14 habitats. These groups are discussed further in environmental consequences.

Habitat Groups for Sensitive Plant Species

- Alpine fellfields and subalpine parkland
- Aspen, cottonwood
- Conifer forest
- Sagebrush shrubland
- Grassland
- Basalt lithosol
- Talus, cliffs, and rock outcrops
- Aquatic
- Fens/bogs
- Seep/spring
- Riparian
- Intermittent stream
- Moist meadow
- Wet meadow

Each habitat group is represented throughout the plan area and can be found within all three national forests.

Affected Environment – Alpine Fellfields and Subalpine Parkland

Alpine areas are lands above the timberline. Within the plan area, these are found on the highest peaks of the Wallowa Mountains, Elkhorn Mountains, Greenhorn Mountains, and Strawberry Mountain. Fellfields are among the dominant vegetation community in alpine areas. Fellfields are characterized by stony soils that support sparse vegetation. Subalpine parklands are treeless plant communities at or immediately below the timberline. Subalpine parkland is more widespread than alpine areas in the Blue Mountains. Parkland can be found throughout the Wallowa and Elkhorn Mountains; it becomes less a feature of the landscape to the south and west as elevations and precipitations decline; though they are a feature in the Greenhorn Mountains and the Strawberry Mountains. The plant communities in parkland may be similar to fellfield, but the meadows that dominate parkland are usually more lush than fellfields.

Nearly all species listed for alpine fellfields and subalpine parkland are confined to designated wilderness areas. The few exceptions are discussed further:

Lomatium greenmanii: One population, the largest known, is located on the summit plain of Mount Howard, just north of the Eagle Cap Wilderness Area in the Wallowa Mountains. Two other populations are found within the Eagle Cap Wilderness Area. The current land allocation is backcountry.

Lomatium erythrocarpum: All known sites of this narrow endemic are in the Elkhorn Mountains. The current land allocation is backcountry.

Table 345. Alpine fellfields and subalpine parkland habitat group description for each species

Scientific Name	Habitat Description	MAL	UMA	WAW
Bupleurum americanum	Subalpine fellfields. Talus slopes, rocky soils, dry meadows, ridgetops. Can be in a mosaic of open areas, and scrubby coniferous forest. Generally north to northwest aspect. Coarse gravel; granodiorite and basaltic lithosols.			D
Carex nardina	Exposed arctic and subalpine tundra, usually calcareous, cliffs, rocky slopes, ridges, and summits 50-3,300 meters. Population is in the dark sedimentary rocks of Hurwal formation. Habitat well distributed. Plant not well distributed across habitat.			D
Carex pelocarpa	Alpine slopes, ridge crests, rocky lakeshores 2,700-3,700 meters. Ours are on fellfield in lower sedimentary series, scattered in alpine depression, and on streambanks. Not clear if always on calcareous soils.			D
Carex pyrenaica ssp. *micropoda*	Moist meadows, stream banks, seeps, snowbeds, and areas irrigated by meltwater 10-4,000 meters. Boulder talus.		D	D
Carex vernacula	Moist alpine tundra, moist forest openings just below treeline. High elevation only, 2,000-3,800 meters.	S	D	D
Castilleja fraterna	Open, exposed, bare rock and talus in sub-alpine tundra. Damp sub-alpine meadows and streambanks. Restricted to calcareous substrates; both sedimentary soils and Martin-Bridge limestone outcrops. Wallowa Mountains endemic.			D

Scientific Name	Habitat Description	MAL	UMA	WAW
Castilleja rubida	Talus, alpine fellfields. Wallowa Mountains endemic. Open, exposed bare rock on calcareous substrates. Hurwal sedimentary soils and Martin-Bridge limestone outcrops. Alpine tundra habitat w/low grasses, sedges, and forbs. All aspects and slopes.			D
Cymopterus nivalis	Open rocky places. Moderate to high elevations.	D	S	S
Kobresia myosuroides	Tundra, grassland, heaths, bare rocky, dry to wet ground; zero-3,500 meters (18). Moist meadows, seeps, riparian areas. Often above timberline; high elevations only in Blue Mountains.			D
Kobresia simpliciuscula	Fens, marshes, mesic to wet tundra, gravels, rocky slopes, usually on calcareous substrates; zero-3,500 meters. Moist meadows, seeps, riparian areas. Streamsides, bogs, pond edges. Moderate to high elevations in Wallowa Mountains.			D
Lomatium erythrocarpum	Ridges, fine argillite talus, open slopes. Mostly on steep slopes, with very little vegetation. Alpine knotweed (Polygonum phytolaccaefolium) is often associated. Most populations are south or east facing. High elevation in southern Elkhorn Mountains only.			D
Lomatium greenmanii	Subalpine grasslands on sedimentary rocks at basalt interface. Ridges, fine basalt-derived talus, open slopes. High Wallowa Mountains endemic. Soils are thin and fine textured.			D
Phlox hendersonii	Alpine fellfields, open gravely slopes and ridges. Glacial moraines.	S		D
Saxifraga adscendens ssp. *oregonensis*	Rock crevices, glacial moraines, alpine meadows, along streams. Damp cliffs where soil has accumulated. High elevations only. Recent sites in Wallowa Mountains are in limestone, reported also on quartzite and gneiss in Idaho.	S		D
Townsendia alpigena var. *alpigena*	Meadows, granite and limestone ridges; 2,000-3,100 meters. Rocky, dry areas, high elevations only.			D
Townsendia parryi	Meadows, grassy slopes, gravelly benches, talus; 1,500-3,000 meters. Rocky, dry areas, high elevations only here.			D

D: documented within the national forest, S: suspected to occur within the national forest.

Environmental Consequences – Alpine Fellfields and Subalpine Parkland

Indirect Effects

Wilderness area management retains the 1990 forest plan direction in all alternatives except for two instances in alternative C. For alternative C, two guidelines from 1990 management direction that are retained in alternatives B, D, E, and F become standards. One guideline would, as a standard, require new proposals for outfitter and guide special use permits, or recreation event permits, be approved only when the special use or event is consistent with wilderness area desired conditions and a need is identified by a needs assessment and capacity analysis. The second guideline, as a standard under alternative C, would prohibit camping and campfires within 200 feet of lakes, streams or other camps. This second standard, under alternative C would bring slightly better protection to sensitive species with habitat near water bodies within alpine areas and subalpine parkland. Otherwise, the 1990 management direction for congressionally designated wilderness areas, retained for alternatives B, D, E, and F, would more than meet the desired condition for sensitive species within alpine areas and subalpine parkland. In congressionally designated wilderness areas timber production, timber harvest, motor vehicle use, road construction, mechanical fuel treatment, and energy development are unsuitable uses, under all action alternatives. In effect, congressionally designated wilderness areas serve as reserves for rare plant species, as well as for many other natural resources. While it is possible that individuals of rare species inhabiting alpine environments in wilderness areas may be affected by authorized activities, these impacts are expected to be minor, and not result in a loss of population viability within the plan area. New trail construction would have to comply with standard PL-TES-10, directing that new trail construction to avoid threatened, endangered, or sensitive plant locations.

For the populations of *Lomatium greenmanii* outside wilderness areas, the alternatives vary in land management allocations and suitability of uses. In the alternatives B, E, and F, the allocation is MA 3B Backcountry (limited motor vehicle use). Under alternative D the proposed allocation is MA 4A General Forest. Alternative C would include this area as MA 3A Backcountry (nonmotorized use). The suitable uses vary from only grazing (alternative C) to all uses for alternative D. Given the subalpine habitat of the species and its current range restricted to one peak outside wilderness areas, impacts from recreation uses would be the only likely activity to impact the species. Impacts from new trail construction would be addressed for alternatives B, E, and F with guideline PL-TES-10, which directs new trail construction to avoid the occupied habitat of sensitive plant species.

In the case of *Lomatium erythrocarpum*, alternatives B and D would retain 1990 management direction of limited motor vehicle use in a backcountry area (MA 3B) within the area of the plant's habitat. Alternative E would designate this area as nonmotorized backcountry area (MA 3A), while alternative C would include the area containing the species' habitat within a preliminary administratively recommended wilderness area (MA 1B). Each of these management allocations restricts management to a lesser or greater degree and, with the possible exception of motor vehicle trail use under alternatives A, B, and D, none of the designated suitable uses under any alternative poses a threat to the species. Existing hiking trails already provide access to the area occupied by *Lomatium erythrocarpum*. Any new trail construction would be directed by guideline PL-TES-10 to avoid the occupied habitat of *Lomatium erythrocarpum*.

Affected Environment – Conifer Forest

The conifer forest habitat group includes all types of forest, from dry ponderosa pine forest to the relatively wet subalpine fir and mountain hemlock. Sensitive species that inhabit conifer forest are listed in table 346.

Environmental Consequences – Conifer Forest

Indirect Effects

Timber harvest, livestock grazing, and prescribed fire are the principal threats to sensitive plants that inhabit the conifer forest group. The forest plan would respond to these threats with guidelines for alternatives B, E, and F that would require sensitive plants to be buffered (minimum 100 feet) from timber harvest and associated activities (PL-TES-6) and piling and burning of slash (PL-TES-7), and it would limit the maximum utilization of key forage species (grasses) to 30 percent (PL-TES-4). Although some individual plants may be impacted by subsequent project actions, these guidelines would be expected to maintain the populations of species in the conifer habitat group. The action alternatives do not vary in the biological evaluation finding: may impact individuals or habitat, but will not likely contribute to a trend towards Federal listing or cause a loss of viability to the population or species.

Table 346. Conifer forest habitat group description for each species

Scientific Name	Habitat Description	MAL	UMA	WAW
Allium campanulatum	Dry PIPO forest, margins of PIPO stands adjacent sagebrush openings; mountain big sagebrush above treeline.		D-WA	
Botrychium paradoxum	In snowfields, secondary growth of pastures; 1,500-300 meters (18). Moist meadows, riparian zones, moist roadsides. Montane to subalpine grasslands or forb dominated meadows. In openings and on edges of cold coniferous forests.	S	D	D
Botrychium ascendens	Moist meadows, riparian zones, moist roadsides, openings in cold forests. Often in calcareous soils, but not always. Lower montane, mesic coniferous forest and grassy fields.	D	S	D
Botrychium pedunculosum	Brushy secondary-growth habitats along streams and roadsides; 300-100 m (18). Moist meadows, riparian zones, moist roadsides. Sometimes in openings or on edges of cold coniferous forest	S	D	D
Carex cordillerana	Naturally disturbed rocky slopes with organic layer and leaf litter in mesic mixed forests, or disturbed, open grassy slopes; 500-2,400 meters. Moist, shady woods; warm-moist plant associations. Found in aspen being taken over by Douglas-fir in Washington.	D	D	D
Collomia mazama	In southern Oregon Cascades, C. mazama inhabits high elevation (4,800-6,300 feet) forest-meadow ecotones in the red fir/mountain hemlock and lodgepole pine forest zones and occasionally along riparian areas.	D		
Cypripedium fasciculatum	Coniferous forest - moist coniferous forest usually at lower third of slope or riparian conifer forest bottomland.		D	S

D: documented within the national forest, S: suspected to occur within the national forest.

Affected Environment – Aspen and Cottonwood

Species that occur in aspen (*Tortula mucronifolia*) and cottonwood (*Carex cordillerana*) communities are listed in the following table.

Table 347. Aspen and cottonwood habitat group description for each species

Scientific Name	Habitat Description	MAL	UMA	WAW
Carex cordillerana	Naturally disturbed rocky slopes with organic layer and leaf litter in mesic mixed forests, or disturbed, open grassy slopes; 500-2,400 meters. Moist, shady woods; warm-moist plant associations. Found in aspen being taken over by Douglas-fir in Washington.	D	D	D
Tortula mucronifolia	Forms a soil crust.	S	S	S

D: documented within the national forest, S: suspected to occur within the national forest.

Aspen and cottonwood communities are classified within the warm riparian forest potential vegetation group (Countryman 2010). Patch sizes in these communities are usually less than 40 acres in size. Some stands within the Wallowa-Whitman National Forest are between 40 and 100 acres. The fire frequency interval has not been established for the warm riparian forest potential vegetation group, although recent research indicates that the return interval in riparian areas is very similar to the adjacent uplands (Olsen 2000). ICBEMP findings documented in the Status for the Interior Columbia Basin Summary of Scientific Findings (USDA Forest Service 1996) and Quigley et al. (1997) show that fire exclusion has resulted in declines in aspen communities within the Interior Columbia Basin. *Carex cordillerana* is believed to have declined in distribution and abundance through decades of fire suppression, resulting in increased growth of competing understory plants, such as snowberry, that compete for light, water, and nutrients (Carex Working Group 2008). Livestock grazing is believed to have impacted this palatable plant (Wilson et al. 2008).

Environmental Consequences – Aspen and Cottonwood

Indirect Effects

The forest plan objective for this special habitat (1.13) for all three national forests in the plan area is to increase the distribution of aspen and cottonwood as well as increase the young, or sprout, age class of these communities. Increasing the distribution of aspen and cottonwood would benefit other species dependent on the habitat provided by these hardwood tree species, including *Carex cordillerana* and *Tortula mucronifolia*. Increasing the amount of young age classes of aspen and cottonwood within existing groves would help in the longer term maintenance of these habitats, which would also benefit dependent species. This may be accomplished by thinning competing coniferous trees, which have the potential to impact both *Carex cordillerana* and *Tortula mucronifolia*; however, this prescription would benefit the species in the long term. Additional mitigation measures could be applied at the site-specific project level. Prescribed fire is expected to benefit *Carex cordillerana* in the long term.

Plan objectives to move stands in the dry and moist potential vegetation groups toward condition classes 1 and 2 would improve habitat condition for this habitat group, particularly for aspen, which is often found in smaller patches within a larger matrix of dry or moist forest or moist upland shrubland. Alternatives D and E would provide the greatest benefit with projections to treat the most acres (215,000 and 220,000 acres respectively). Alternative C projects to treat the least acres (155,000 acres), while projections for alternatives A and F are in the middle (170,000 and 190,000 acres). Tree thinning and fuels reductions used to carry out these objectives would comply with guidelines PL-TES-6 and PL-TES-7, which would require sensitive plants to be buffered (minimum 100 feet) from timber harvest and the piling and burning of slash. A thinning prescription in this habitat group would benefit the species by increasing solar radiation. Prescribed fire used to reduce fuel loads would benefit the species by helping to reduce competing vegetation. Some individual plants may be impacted by subsequent project actions, but these guidelines are expected to maintain populations of sensitive plants. The action alternatives do not vary in the biological evaluation finding: may impact individuals or habitat, but will not likely contribute to a trend towards federal listing or cause a loss of viability to the population or species.

Affected Environment – Sagebrush Shrubland

Sagebrush shrublands are sagebrush communities with at least 5 percent crown cover of sagebrush (*Artemisia tridentata* or *A. arbuscula*). Stiff sagebrush, *Artemisia rigida*, communities are included under the habitat group lithosol. Species that depend on sagebrush communities are listed in the table below. Both high elevation (cold shrubland potential vegetation group) and lower elevation big sagebrush (moist shrubland potential vegetation group) and low sagebrush (dry shrubland potential vegetation group) communities are included. Both the cold and moist shrubland potential vegetation groups include mountain big sagebrush, *A. tridentata* var. *vaseyana*; however, the understory changes from western needlegrass or elk sedge present in the cold shrubland potential vegetation group to Idaho fescue in the moist shrubland potential vegetation group. *Artemisia arbuscula*-Idaho fescue communities also comprise the moist shrubland potential vegetation group.

In an evaluation of current vegetation survey (CVS) plot data, 38 percent of the sampled plots in the moist upland shrubland potential vegetation group within the Malheur National Forest were in phase A or B (good or fair condition), 45 percent were in phase C (poor condition but can recover via succession to phase A or B) and 17 percent were in phase D (altered, unable to recover to natural condition of phase A or B) (Countryman 2010, Johnson and Swanson 2005). Within the Umatilla National Forest, 37.5 percent of the sampled plots in the moist upland shrubland potential vegetation group were in phase A or B, 12.5 percent were in phase C, and 50 percent were in phase D. Within the Wallowa-Whitman National Forest, 20 percent of the sampled plots in the moist upland shrubland were in phase A or B, 15 percent were in phase C, and 55 percent were in phase D. In the dry upland shrubland potential vegetation group, 28 percent of the sampled plots were in phase A or B within the Malheur National Forest, 23 percent were in phase C, and 49 percent were in phase D. Within the Umatilla National Forest, 86 percent of the sampled plots were in phase A or B, 14 percent were in phase C, and zero percent were in phase D. Within the Wallowa-Whitman National Forest, 8 percent of the sampled plots were in phase A or B, 23 percent were in phase C, and 69 percent were in phase D. No data were available for the cold upland shrubland potential vegetation groups.

Table 348. Sagebrush shrubland habitat group description for each species

Scientific Name	Habitat Description	MAL	UMA	WAW
Astragalus tegetarioides	Sagebrush flats on volcanic ash or basaltic substrates, adjacent and sometimes encroaching on ponderosa pine forest, cracks of welded tuff outcrops. Moist shrubland potential vegetation group.	D		
Camissonia pygmaea	Unstable soils or gravel in steep talus, dry washes, banks, and roadcuts. Open, bare ground. Moist or Dry Shrubland potential vegetation group.	S	S	S
Castilleja flava var. *rustica*	Talus, open dry hillsides, often with mtn. big sage. Wet, subalpine prairies, limestone cliffs, dry basalt soil, granite cliffs. Mixed conifer forest and open mtn. sage steppe. Cold shrubland potential vegetation group.	S	D	D

D: documented within the national forest, S: suspected to occur within the national forest.

Astragalus tegetariodes only occurs within the Malheur National Forest in the mountain big sage sagebrush habitat of the moist upland shrubland potential vegetation group. The state or phase condition of the shrublands within the smaller range occupied by *Astragalus tegetarioides* is not known, but the overall condition of the moist upland shrubland is modest with 38 percent in good condition and 45 percent in fair condition (phase C). Phase C is a state that is capable of recovery to phase B. The genus *Astragalus* has a propensity for disturbance regimes, so it is possible the species could be adequately maintained in phase C shrublands. Site observations indicate the species has increased its cover in disturbed areas left to recover, such as double track, jeep trail roads or the margins along unimproved roads. Timber harvest and associated activities when conducted adjacent to occupied shrublands, livestock grazing, and prescribed fire are the management activities that might impact *A. tegetariodes*. Effects to this plant would be the same as described for *Carex cordillerana*.

Camissonia pygmaea is suspected to occur but has not yet been discovered on National Forest System lands. Its habitat is suspected to occur in the warm or dry shrubland potential vegetation group. *Castilleja flava var. rustica* occurs in one isolated population in the Elkhorn Mountains within the Wallowa-Whitman National Forest and four populations within the Umatilla National Forest. Its habitat would be included the cold upland shrubland potential vegetation group.

Environmental Consequences – Sagebrush Shrubland

Indirect Effects

These three species may benefit from forest plan objective 1.7 proposed for alternatives E and F that would improve rangeland vegetation in phases C and D to phase A or B.

For *A. tegetarioides*, the range of this plant within the Malheur National Forest for both the no action and the action alternatives would be allocated to MA 4A General Forest where all uses would be considered generally suitable. Plan objectives to move stands in the dry and moist potential vegetation groups toward condition classes 1 and 2 would improve *A. tegetariodes* habitat that is immediately adjacent to timbered stands. Effects would be similar to those described for *Carex cordillerana*. Thinning pine stands encroached upon by *A. tegetariodes* would be beneficial as a result of modest soil (surface) disturbance and increased solar radiation. Objectives to improve rangeland would assist in moving this habitat type toward the desired conditions of adequate quality, distribution, and abundance.

The maintenance of *Camissonia pygmaea* (if discovered in the plan area) and *Castilleja flava* var. *rustica,* would rely on plan guidelines PL-TES-4, -5, -6, -7, -8, -9, -10, -11, and -12. These guidelines would require site specific projects to provide avoidance buffers and would require that grazing management practices be designed to reduce impacts on occupied habitat. Although some individual plants may be impacted, the guidelines are expected to maintain populations of sensitive plants. The action alternatives do not vary in the biological evaluation finding: may impact individuals or habitat, but will not likely contribute to a trend towards federal listing or cause a loss of viability to the population or species.

Affected Environment – Grasslands

Grasslands are composed of upland herbaceous vegetation dominated by grasses. Meadows and grass or grass-like dominated riparian areas are separate habitat groups. Sensitive species listed in table 349 occupy grassland habitats.

The sensitive species listed in table 350 occur in grasslands within the Umatilla and Wallowa-Whitman National Forests. These species occupy moist upland herbland and dry upland herbland potential vegetation groups as described in the vegetation section. In an evaluation of CVS plot data, 50 percent of the sampled plots in the moist upland herbland potential vegetation group within the Umatilla National Forest and 67 percent within the Wallowa-Whitman National Forest were in good or fair condition (phase A or B). In the dry upland herbland potential vegetation group, 42 percent of the sampled plots within the Umatilla National Forest and 46 percent within the Wallowa-Whitman National Forest were in good or fair condition (phase A or B) (Countryman 2010). The desired condition for herblands is that 70 to 90 percent of their area be in phase A or B.

Table 349. Grasslands habitat group description for each species

Scientific Name	Habitat Description	MAL	UMA	WAW
Allium campanulatum	Rocky ridges of grasslands.		D	
Allium diction	Rocky ridges of grasslands.		D	
Astragalus arthurii	Bunchgrass communities, mostly low elevation Idaho fescue-prairie junegrass sites; sumac and bluebunch wheatgrass, Idaho fescue- bluebunch wheatgrass/balsamroot; bluebunch-poa secunda.		D	D
Astragalus cusickii var*. cusickii*	Dry, grassy or rocky slopes; in loose, finely textured soils derived from basalt, on basalt cliffs and talus; w/bluebunch wheatgrass and Idaho fescue.		D	D
Calochortus macrocarpus var. *maculosus*	Dry plains, rocky slopes, sagebrush scrub, pine forests, usually in volcanic soil; 300-2,700 meters. Dry grasslands, ridgetops. In rocky, basaltic derived soils, on hillsides, rock outcrops and cliff bands. In grasslands on steep slopes.		D	D
Delphinium bicolor	Low larkspur is found on sites ranging from open woods and grasslands. Low larkspur is found on sites ranging from open woods and grasslands to subalpine scree.		D	D
Lomatium rollinsii	Canyon grasslands; slopes: very steep to relatively gentle; soils: gravelly and rocky to deeper loamy conditions. Associated species include Idaho fescue (*Festuca idahoensis*), bluebunch wheatgrass (*Agropyron spicatum*), and Sandberg's bluegrass (*Poa sandbergii*).		D	D
Pyrrocoma scaberula	FEID-AGSP-KOMA; Snowberry (*Symphoricarpos albus*), and native roses (*Rosa woodsii* and *R. nutkana*) are the most common shrub associates, but serviceberry (*Amelanchier alnifolia*), Oregon grape (*Mahonia repens*) and others can also co-occur.		S	D

D: documented within the national forest, S: suspected to occur within the national forest.

Table 350. Upland vegetation percent maximum utilization standards and guidelines for management systems that incorporate deferment, rest, and rotation

Departure from Desired Condition	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F
Low departure	50-60	55	30	50	40	40
Moderate or greater departure	50	35	30	45	35	35

*Moderate is 41 to 50 percent utilization (Holechek 2006).

Improper heavy grazing, unnaturally high fire frequency, and invasion by exotic plants are the biggest threats to the sensitive species occupying grassland habitat. Higher fire frequencies are to be expected in phases C and D grasslands, which have a higher proportion of nonnative invasive species at the expense of native bunchgrasses. Therefore, actions to promote the development of phase A or B herblands best address the threats from invasive plants and high fire frequencies.

Environmental Consequences – Grasslands

Indirect Effects

The alternatives include objectives to increase the proportion of phase A or B herblands, which would benefit sensitive plants that inhabit grasslands. Where alternatives vary is in utilization standards for upland vegetation and permitted AUMs. Upland vegetation maximum utilization standards and guidelines are displayed in table 350 for management systems that incorporate deferment, rest, and rotation, which comprise the vast majority of grazing allotments in the Blue Mountains national forests.

Holechek (2006) reviewed grazing studies that compared controlled intensity, timing, and frequency with grazing exclusion and concluded that grazing is sustainable and could be beneficial compared to complete exclusion when grazing intensities do not exceed 40 percent utilization. Miller et al. (1994) found that communities capable of returning to good ecological condition could occur either under grazing exclusion or at light to moderate grazing intensity. Miller did not quantify utilization at either light or moderate grazing levels, but Holechek (2006) defines these levels quantitatively and qualitatively: non-use to light grazing ranges from zero to 30 percent utilization and moderate grazing from 41 to 50 percent utilization. Holechek further defined utilization from 31 and 40 percent as conservative and heavy grazing at utilization levels exceeding 50 percent. The discussion of indirect effects summarizes the findings of effects to grazing land phases. A more complete discussion of indirect effects to rangeland vegetation with respect to utilization levels and state or phase outcomes is in the Livestock Grazing and Rangeland Vegetation section.

Effects Common to All Action Alternatives

The plan objectives to reduce current infestations of invasive plant species would assist in increasing the amount of phases A and B herblands and consequently would benefit sensitive species.

Effects from Alternative A (no action)

The relative amount of rangeland in phases A through D is expected to remain similar to the existing condition. No improvements from phase C are expected. Sensitive plant species inhabiting grasslands would have the fewest acres of suitable habitat in phase A or B. The desired condition of a minimum 70 percent of grasslands in phase A or B would not be met.

Effects from Alternative B

Areas moderately or greatly departed from the desired condition would be grazed at lower intensity, not to exceed 35 percent utilization, to allow improvement of rangeland condition and movement toward the desired condition. These kinds of improvements in condition should benefit sensitive species inhabiting upland grasslands. For areas with low departure from the desired condition, grazing at 55 percent maximum utilization, a level considered heavy by Holechek (2006), could lead to a decline in phases A and B communities. The utilization level would likely move these communities further from the desired condition, although it has been reported that the observed actual past use in upland rangelands has not exceeded 40 percent, even though the 1990 forest plans (alternative A) permitted use of up to 60 percent (see the Livestock Grazing and Rangeland Vegetation section). If utilization levels exceed 50 percent on large expanses of grasslands, declines in suitable habitat for grassland dependent sensitive species would be expected. Forest plan guideline PL-TES-4 would limit forage on key species in occupied habitat to 30 percent or less. This level is expected to maintain sensitive plants in grasslands.

Effects from Alternative C

Alternative C would provide the greatest opportunity to achieve the desired condition for sensitive plants in grasslands. There would be a beneficial affect achieved through a combination of significant reductions in AUMs (by 75 to 80 percent) and in the acres designated suitable for grazing (by about 65 percent). As a result of the reductions, sensitive species impacted by grazing, even at levels that would sustain their populations, would benefit. Compared to the other alternatives, the desired condition, that the natural range of habitats of plant species is of adequate quality, distribution, and abundance to contribute to maintaining native and desired nonnative species diversity, would be more easily achieved for alternative C.

Effects from Alternative D

The combined cattle AUMs for the Malheur and Wallowa-Whitman National Forests would increase from 212,000 to 259,000 (22 percent) for alternative D. For the Umatilla National Forest, cattle AUMs would increase from 40,000 to 52,000 (30 percent). These increases combined with grazing at moderate intensities (defined by Holechek (2006) as 41 to 50 percent) is less likely to provide suitable conditions for sensitive plants dependent upon grassland habitat than alternatives B, C, E, and F. At utilization levels of 45 and 50 percent for alternative D, desired conditions for grasslands may not be achieved. For the dry or moist upland herblands, the existing condition of 50 percent or less in phase A or B would need to increase to 70 to 90 percent in phase A or B. At best, existing conditions might be maintained and would likely impact sensitive species dependent upon grassland habitat. Because past utilization in rangelands under the 1990 forest plans has not exceeded 40 percent, even when levels up to 60 percent were permitted, the effects expected for the maximum authorized utilization may not occur. This is less likely an outcome compared to alternative B given the percent increases in AUMs for alternative D, particularly for the Wallowa-Whitman National Forest (44 percent increase in AUMs) and the Umatilla National Forest (21 percent increase in AUMs). Sensitive plant habitat is not expected to be maintained for alternative D, and desired conditions for sensitive plants are not expected to be achieved. For alternative D, individual plants or their habitat may be impacted with a consequence that the action may contribute to a trend towards Federal listing or cause a loss of viability to the population or species in the grasslands habitat group.

Effects from Alternatives E and F

Alternatives E and F would reduce upland allowable utilization to 40 and 35 percent while keeping cattle AUMs constant and decreasing sheep AUMs. These changes from the existing condition would improve the condition of grasslands. The addition of guideline PL-TES-4 that would limit utilization to not more than 30 percent on key species in occupied habitat would further contribute to maintaining sensitive plant species that inhabit grasslands. Alternatives E and F would achieve desired conditions for sensitive plants at a faster rate than alternatives A and B, but not as quickly as alternative C.

Biological Evaluation Finding for Alternatives A, B, C, E, and F

Although some individual plants may be impacted, the guidelines are expected to maintain populations of sensitive plants. The action alternatives do not vary in the biological evaluation finding: may impact individuals or habitat, but will not likely contribute to a trend towards federal listing or cause a loss of viability to the population or species.

Affected Environment – Basalt Lithosol

Lithosols are habitats with very shallow soils with little zonation on poorly weathered basalt or andesitic bedrock. While the soils can be saturated following spring snow melt, they dry quickly and are exposed to full sun for the entire growing season. Plants adapted to this harsh environment usually bloom and fruit earlier in the growing season. Basalt lithosols can be found in the dry upland shrubland potential vegetation group or dry upland herbland potential vegetation group. Basalt lithosols may also be found as small inclusions within a larger matrix of grassland and shrublands. The common plant associations within the dry upland shrubland and dry upland herbland potential vegetation groupings are stiff sagebrush or low sagebrush/Sandberg's bluegrass, bluebunch wheatgrass/Sandberg's bluegrass or Sandberg's bluegrass/one-spike oatgrass. Countryman and Swanson (2008) found that conditions had improved in the dry shrubland potential vegetation group from 30 years earlier, but that this improvement has slowed. The dry herbland potential vegetation group has experienced invasion by nonnative plants resulting in conversion of some lands to exotic herblands (Hann et al. 1997).

Within the Wallowa-Whitman National Forest, 7 percent of the sampled plots in the dry shrubland potential vegetation group were in phase A or B, 23 percent were in phase C, and 69 percent were in phase D (altered from the natural potential with little or no ability to recovery naturally). Within the Umatilla National Forest, 86 percent of the sampled plots in the dry upland shrubland potential vegetation group were in phase A or B with no lands in phase D. In the dry upland herbland potential vegetation group, 46 percent of the sampled plots within the Wallowa-Whitman National Forest were in phase A or B, 32 percent in phase C, and 22 percent in phase D. Within the Umatilla National Forest, 42 percent of the sampled plots were in phase A or B, 35.5 percent in phase C, and 2.5 percent in phase D (Countryman 2010). Within the Malheur National Forest, 28 percent of sampled plots in the dry shrubland potential vegetation group were in phase A or B, 23 percent in phase C, and 49 percent in phase D. In the dry upland herbland potential vegetation group, 21 percent of sampled plots were in phase A or B, 43 percent in phase C, and 36 percent in phase D. Active restoration would be required to return phase D to phase A or B, although given this habitat type's low productivity successful transition from phase D to phase A or B may not be possible.

Heavy grazing, spring grazing when soils are moist, and invasion by exotic plants are the main threats to basalt lithosol habitats. Given the low productivity and discontinuous fuels in this habitat group, effects from fire are not considered to be a major threat.

Plants inhabiting basalt lithosols are listed in table 351.

Environmental Consequences – Basalt Lithosol

Indirect Effects

Spring grazing could impact the species occupying lithosol habitats. During spring the soils are wet and susceptible to compaction from livestock. Guideline PL-TES-4, limiting utilization to not more than 30 percent on key species would help reduce impacts to sensitive plants inhabiting basalt lithosols. Given the low productivity on the site, 30 percent utilization would equate to a comparatively short period. Corresponding trampling associated with grazing is expected to be light. Additional mitigation measures could be developed at the site-specific project level, if further protection from trampling were needed. Guideline PL-TES-5, excluding water developments and salting within one-quarter mile of sensitive plant locations, would help reduce concentrations of livestock near occupied habitat. Reduced use and trampling by livestock would help abate invasion by nonnative plants, especially exotic annual grasses, such as cheatgrass and North Africa grass. Although some individual plants may be impacted, the guidelines are expected to maintain populations of sensitive plants. The action alternatives do not vary in the biological evaluation finding: may impact individuals or habitat, but will not likely contribute to a trend towards Federal listing or cause a loss of viability to the population or species.

Table 351. Basalt lithosol habitat group description for each species

Scientific Name	Habitat Description	MAL	UMA	WAW
Achnatherum wallowaensis	Basalt scablands and lithosols; shallow rocky soils, sometimes w/stiff sage, strict buckwheat, and ponderosa pine surrounding.	S	S	D
Achnatherum hendersonii	Basalt scablands and lithosols; shallow rocky soils, sometimes w/stiff sage, strict buckwheat; often surrounded by ponderosa pine.	S	S	S
Astragalus diaphanus	Barren hillsides, dry washes, and opening in juniper-ponderosa pine forests. Thin, gravely soils overlying basalt or on sandbars and sandy streambanks.	S	D	
Erigeron disparipilus	Gravelly and rocky slopes, ridges, sagebrush, grassland. Basalt scablands, lithosols, dry ridges in ne Oregon. Often with stiff sage.		D	D
Erigeron engelmannii var*. davisii*	Bare, rocky ridges and slopes, basalt outcrops, sparsely vegetated woodland openings or edges; usually with grasses 1,200-1,800 meters.			D
Lomatium ravenii	Scablands, lithosols. Openings in mixed or ponderosa pine forests. Flats, slopes, or ridges. Often with stiff sage, in openings in juniper or pine woodlands. Moderate elevations.	D	S	S

D: documented within the national forest, S: suspected to occur within the national forest.

Affected Environment – Talus, Cliffs, and Rock Outcrops

Talus is accumulated boulders and cobbles at the base of cliffs or on steep slopes. Because these habitats are largely composed of bedrock or accumulations of rock, they are assumed to be in good condition with a stable trend. The nature of this habitat group means it is resistant to management activities or has been avoided with most management activities, with the exception of road construction and rock quarries. Species that occupy talus, cliffs and rock outcrops are listed in table 352.

Environmental Consequences – Talus, Cliffs, and Rock Outcrops

Indirect Effects

Talus, cliffs, and rock outcrops are expected to be impacted to a relatively small degree. Outside wilderness areas, this habitat type is likely to be the least affected by forest and rangeland management activities. This is because talus, cliffs, and rock outcrops support scant vegetation that does not support or attract grazing livestock or possess sufficient fuel to carry a prescribed fire. Road construction and rock quarries are apt to be the only management activities with potential to affect these sites. Impacts associated with road construction activities would be addressed with guideline PL-TES-9, which directs that new road construction avoid sensitive plants with a minimum 25-foot buffer. Impacts associated with rock quarries would be addressed with guideline PL-TES-11, which requires mining operations to avoid sensitive plants to the greatest extent possible. Although some individual plants may be impacted, the guidelines are expected to maintain populations of sensitive plants. The action alternatives do not vary in the biological evaluation finding: may impact individuals or habitat, but will not likely contribute to a trend towards federal listing or cause a loss of viability to the population or species.

Table 352. Talus, cliffs, and rock outcrops habitat group description for each species

Scientific Name	Habitat Description	MAL	UMA	WAW
Anastrophyllum minutum	Grows on peaty soil at relatively high elevations (greater than 5,500 feet). In the *Tsuga mertensiana* zone, the colonies of *Anastrophyllum minutum* are typically associated with other bryophytes in tight mats on ledges or at the base of cliffs. Wallowa County.			D
Anthelia julacea	On rock surfaces, wet rock surfaces, and dry soil. In arctic-alpine areas of northern North America. Wallowa County.			D
Arabis hastatula	Basalt outcrops, cliffs, and scree. Rocky outcrops and mountain ridges.			D
Asplenium trichomanes-ramosum	Wet, shady, limestone cliffs. Grows in moss and crevices. Basic rocks in talus slopes. Zero-4,000 meters.			D
Barbilophozia lycopodioides	Organic soil to rock, less often on tree bark. Not necessarily on mineral soil. Reported by Hong (1976), Anthony Lakes area, Baker County. Damp outcrops at higher elevations.	S	S	D
Bolandra oregana	Moist rocky seeps, springs, waterfalls. Grows from wet crevices and moss.		D	
Cheilanthes feei	Rocky outcrops, usually calcareous.	S	S	D
Cryptogramma stelleri	Sheltered calcareous cliff crevices and rock ledges, typically in coniferous or boreal forest; 0-3,000 meters. On wet cliffs, and ledges, along streams, under waterfalls. Limestone substrate. Shady sites. Usually north-facing aspects.			D
Encalypta brevipes	Soil on ledges and in crevices on cliffs, reported from both igneous and siliceous substrates.	S	S	S
Geum rossii var. turbinatum	Granitic cliffs and ledges, in cirque basins. Talus slopes, rocky ridge tops, and rocky soil. Basalt, granite, or loose granodiorite substrate. Sub-alpine high elevation sites.			D
Hackelia diffusa var. diffusa	Shaded areas, cliffs, *talus, wooded flats and slopes.* Occurs with *Symphoricarpos albus, Philadelphus lewisii, Osmorhiza occidentalis, Acer glabrum, Fritillaria pudica, and Erysimum occidentale.* Elevation of populations in Washington is around 1,000 feet.		D	
Lophozia gillmanii	Peaty soil on cliff ledges; strict calciphile. Above 6,500 feet.	S	D	D
Luina serpentina	Open, rocky sites with poor soil development. Usually on steep slopes, above small tributaries. Aldrich Mountains.	D		
Pellaea bridgesii	Rocky slopes and cliffs, on granitic substrate; 1,200-3,600 meters. Talus slopes, scree, rocky outcrops; often on argillite in Blue Mountains. Southerly aspects.	S	D	D
Phlox multiflora ssp. depressa	Basalt cliffs, rocky outcrops, rocky openings in dry forest. Wooded rocky areas as well as in openings in the forest. Loose substrate rather than exposed hard rocks.		S	D
Suksdorfia violacea	In moss on wet cliffs, cracks of moist talus slopes, on basalt. Habitat sometimes is only wet in the spring.		S	S

D: documented within the national forest, S: suspected to occur within the national forest.

Affected Environment – Aquatic and Riparian Dependent Species Habitats

Species dependent on aquatic and riparian habitats (aquatic areas, fens and bogs, seeps and springs, riparian areas, intermittent streams, moist meadows, and wet meadows) are listed in table 353 to table 359. Because the forest plan manages these habitats under direction for Riparian Management Areas (RMAs), the effects to species dependent upon these habitats will be addressed together following the tables.

Affected Environment – Aquatic Habitats

Aquatic habitat supports plants that are free-floating or rooted at the bottom of ponds, lakes, streams and rivers. Species that depend on aquatic habitats are displayed in the following table.

Table 353. Aquatic habitat group description for each species

Scientific Name	Habitat Description	MAL	UMA	WAW
Elatine brachysperma	Plants submerged to terrestrial on muddy shores and shallow pools.	S	D	S
Potamogeton diversifolius	Shallow ponds; edges of reservoirs and small catchment ponds, and shallow, slow running creeks.	S	S	S
Rotala ramosior	Moist sites, drying edges of ponds, springs and streams.	S	S	S
Utricularia minor	Ponds, lakes, slow-moving streams.	S	D	S
Utricularia ochroleuca	Loose, floating vegetation mat or openings in dense vegetation mats.		S	

D: documented within the national forest, S: suspected to occur within the national forest.

Affected Environment – Peatlands

Peatlands are a type of wetland that accumulates partially decayed plant matter (peat) (Mitsch and Gosselink 2007, USDA Forest Service 2011). Peat is partially decayed plant material that accumulates under saturated conditions where there is little oxygen to facilitate decomposition (USDA Forest Service 2011). Two major types of peatlands are fen and bog. Fen, the main type of peatland in the Blue Mountains, is fed by groundwater or mineral-rich surface water, has neutral to alkaline pH, and supports relatively rich marsh-like vegetation. Fen is distinguished from marsh, which is a wetland on mineral soil (USDA Forest Service 1998). A bog receives water entirely from precipitation, accumulating sufficient peat to raise the surface layer above the influence of the water table (USDA Forest Service 1998), and are very acidic in pH. Bogs form under a climate where precipitation exceeds evapotranspiration, a condition not present in the Blue Mountains. Bogs are thus not expected to be found in the Blue Mountains, except possibly as hummocky microsites within fens.

Peatlands can be found on each national forest in the plan area, but are unique habitats, not common in the Blue Mountains. This is due, in part, to a climate that does not favor their extensive development. Peatlands form stable plant communities that are self-perpetuating in the absence of disturbance. The combination of habitat rarity, stability, and extreme conditions in peatlands engenders a distinctive flora with high concentrations of rare species (USDA Forest Service 1998). Species that depend on peatland habitat are displayed in the following table.

Table 354. Peatlands habitat group description for each species

Scientific Name	Habitat Description	MAL	UMA	WAW
Botrychium crenulatum	Local in marshy or springy areas, 1,200-2,500 meters. Moist meadows, riparian zones, moist roadsides, openings in cold forests. Often in calcareous soils, but not necessarily.	D	D	D
Carex diandra	Bogs and fens; floating peat mats, lakeshores, springs, and seeps.	S	S	S
Carex gynocrates	Wet, peaty ground, usually in openings in coniferous swamps and conifer-hardwood stands, less often in poor fens, boggy swales, and alder thickets, also subalpine meadows, tundra, outwash gravel and seepage areas, usually calcareous substrate zero-3,100 meters.			D
Carex lasiocarpa var. americana	Sedge meadows, fens, bogs, lakeshores, stream banks, usually in very wet sites and sometimes forming floating mats. Dominant of boreal wetlands, often forming huge stands zero-1,300 meters.	S	S	S
Epilobium oreganum	Fens and bogs; affinity for serpentine soils, but not strictly so.		S	
Gentiana prostrata	Alpine bogs and meadows at high elevations.			S
Harpanthus flotovianus	Bogs and fens. According to Hong (1993), it “occurs on moist humus, soil covered rocks and decaying wood in forests, and is frequently associated with *Cephalozia bicuspidata* and *Scapania undulate*.	S	D	D
Helodium blandowii	Bogs, fens, wet meadows, and stream sides. Shady sites to full sun.	D	D	S
Meesia uliginosa	Fens.	D	S	S
Platanthera obtusata	Mesic to wet coniferous forest, forested fens, sphagnum bogs, streambanks, tundra, moist roadsides; zero-3,500 meters. Sometimes found growing on top of rotting logs. Often with Engelmann spruce, or sub-alpine fir.			D
Pseudocalliergon trifarium	Forming lawns or inconspicuously intermixed with other bryophytes in medium to rich montane fens where it grows submerged to emergent in pools or on saturated ground, usually in full sunlight.			S
Splachnum ampullaceum	Forming green sods on old dung of herbivores, or on soil enriched by dung, in peat lands or other wetlands.	S	S	S
Tomentypnum nitens	Forming loose or dense sods or intermixed with other bryophytes in medium to rich montane fens where it favors slightly elevated sites, such as logs, stumps, or hummocks, formed by *Vaccinium uliginosum* and *Betula glandulosa*.	D	S	S

D: documented within the national forest, S: suspected to occur within the national forest.

Affected Environment – Seeps and Springs

Springs are points where groundwater emerges and flows. Groundwater also feeds seeps, but seeps do not produce perennial flow. Springs and seeps are typically small, but are well distributed on all three forests in the plan area. Species that inhabit seeps and springs are displayed in the following table.

Table 355. Seeps and springs habitat group description for each species

Scientific Name	Habitat Description	MAL	UMA	WAW
Encalypta intermedia	In permanent seep, on thin soil over calcareous rocks. 8-19-1996, D. Wagner. Goodrich Lake, Baker Ranger District.			D
Entosthodon fascicularis	Occurring as individual plants or forming small sods on seasonally wet, exposed soil in seeps or along intermittent streams.	S	S	S
Jungermannia polaris	In permanent seep, on thin soil over calcareous rocks. 8-19-1996, D. Wagner. Goodrich Lake, Baker Ranger District.	S		D
Peltolepis quadrata	In permanent seep, on thin soil over calcareous rocks. 8-19-1996, D. Wagner. Goodrich Lake, Baker Ranger District.	S		D
Preissia quadrata	In permanent seep, on thin soil over calcareous rocks. 8-19-1996, D. Wagner. Goodrich Lake, Baker Ranger District.			D
Thelypodium eucosmum	Under and around western Juniper, in canyons, seasonal creek drainages, and seeps/springs. Also found in vernally moist areas in ponderosa pine forests and in sage steppe areas. Known sites are 1,800-5,000 feet.	D	D	S
Trollius laxus ssp. *Albiflorus*	Open, wet places, more or less acidic soils, montane to alpine; 1,200-3,800 meters. Seeps, springs, and vernally wet swales in spruce/fir forest.	S	S	S

D: documented within the national forest, S: suspected to occur within the national forest.

Affected Environment – Intermittent Streams

Species that occupy intermittent stream channels are displayed in the following table.

Table 356. Intermittent streams habitat group description for each species

Scientific Name	Habitat Description	MAL	UMA	WAW
Mimulus evanescens	Vernally moist sites and fluctuating banks of intermittent streams or pools in sagebrush-juniper zone. Amid heavy gravel and boulders at one site. 1,200-1,700 meters. Historic site on Bear Valley Ranger District.	H	S	S
Muhlenbergia minutissima	Open, more or less disturbed, sandy, gravelly drainages, rocky slopes, flats, roads.	S	S	S
Schistidium cinclidodonteum	Rocks along watercourses of intermittent and seasonal streams. Union County. Reported for calcareous rocks.	S	S	D

D: documented within the national forest, S: suspected to occur within the national forest.

Affected Environment – Riparian Areas

Riparian areas are the ecotone between rivers or streams and uplands. They are seasonally or perennially moist. Species that inhabit riparian areas are displayed in the following table.

Table 357. Riparian areas habitat group description for each species

Scientific Name	Habitat Description	MAL	UMA	WAW
Carex capillaries	Mesic to moist tundra, seeps on cliffs, rocks, and slopes, fens, meadows, shores, prairie sloughs, edges of sphagnum mats, moist woods zero-3,500 meters.			D
Carex crawfordii	Pond margins that are wet in spring and other seasonally wet spots.	S	S	S
Carex media	Forest openings, meadows, bog margins; 100-1,800 meters. Riparian areas, seeps, moist meadows. In WA, is found near perennial streams and ponds, and in moist meadows at elevations of 4,900-7,120 feet.			D
Carex retrorsa	Swamps, wet thickets, often along streams, marshes, sedge meadows, shores of streams, ponds, and lakes zero-1,900 meters.	S	S	D
Carex saxatilis	Lake shores, fens, bogs at high elevations.			D
Lycopodium complanatum	Dry open coniferous or mixed forest alpine slopes; zero-2,000 meters. Coniferous forest, with thick duff. Often on rotting logs, moist forest, riparian areas. Also in meadows and on open ridgetops.	S	S	D
Ptilidium pulcherrimum	Perennially moist tree bases, rotten logs, and on rocks. Baker County.	S		D
Ribes oxyacanthoides ssp. Irriguum	Riparian conifer forest: PIPO-PSME; associated with *Amelenchier alnifolia, Crataegus douglasii, Ribes cereum, Symphoricarpos albus*.		D	
Rorippa columbiae	Near all types of bodies of water, including along the Columbia River, intermittent snow-fed streams, permanent lakes, snow-fed lakes, wet meadows, irrigation ditches, and roadside ditches. Sandy soils.	S	D	S
Schistostega pennata	Mineral soil in crevices and sheltered portions on underside of rootwads of fallen trees.	S	S	S
Tetraphis geniculata	On cut or broken ends or lower sides of logs, decay class III-V, greater than 15 inches.	S	S	S
Trifolium douglasii	Moist or mesic meadows, prairie remnants, along riparian areas along streams. In swales, along intermittent streams, and in vernally wet areas.		D	D

D: documented within the national forest, S: suspected to occur within the national forest.

Affected Environment – Moist Meadows

Moist meadows are typically saturated in the spring, but by mid to late summer the water table has fallen below the soil surface. Species that inhabit moist meadows are displayed in the following table.

Table 358. Moist meadows habitat group description for each species

Scientific Name	Habitat Description	MAL	UMA	WAW
Botrychium campestre	Prairies, dunes, grassy railroad sidings, and fields over limestone. 50-1,200 meters. Moist meadows, riparian zones, roadsides, openings in cold forests. Occurs in dry to mesic, sunlit habitats, often on till or moraines. Does not need direct sunlight.		S	D
Botrychium hesperium	Grassy mtn. slopes, snow fields, and road ditches, w/willows, and sand dunes, 200-2,800 meters. Moist meadows, riparian, moist roadsides, openings and edges of forests. Often on calcareous soils. Sometimes found in roadside ditches and at edges of lakes.	S	D	D
Botrychium lineare	Moist meadows, riparian zones, moist roadsides, openings and edges of cold forests. Sometimes in limestone, but not always.	S	S	D
Botrychium lunaria	Open fields, occasionally forest in southern occurrences; 0-3,700 meters. Moist meadows, riparian zones, moist roadsides, openings and edges of cold forests.	S	D	D
Calochortus longebarbatus var. peckii	Grassy margins of wet meadows, and under pines; 1,600-1,800 meters. Wet to moist meadows. Along stream edges. Often partially shaded by ponderosa pine.	D		
Carex idahoa	Riparian moist meadows, 2,000-2,600 meters. Driest communities of moist meadows, swales, and moist, low ground around streams and lakes, and on prairies and high plains as well.	D	S	S
Eleocharis bolanderi	Fresh, often summer-dry meadows, springs, seeps, stream margins; 1,000-3,400 meters. Wet places, low to mid-montane. In vernally wet swales. Along intermittent streams, moist meadows.	D	D	S
Gentianella tenella ssp. Tenella	*Gentianella tenella* appears to favor disturbed sites in subalpine to alpine meadows. Associated with high levels of sheep dung and bare ground. Around but not on hummocks.		D	
Listera borealis	In moist, rich humus of mossy coniferous forest, swamps, often along cold streams, acidic soils. Most known sites in WA are in older forests. Associated tree species include spruce, true firs, and Douglas-fir. Moderate elevations.	D	S	D
Phacelia minutissima	Moist meadow and seep edges, or on vernally wet open meadows and barren slopes. Reported to occur with aspen.	D	S	D
Ranunculus populago	Moist meadows, stream terraces, riparian corridors, open areas along the edge of shrubs, and adjacent to a perennial streams and bogs, at 4,480 to 5,920 feet (1,366-1,804 meters) elevation. Associated species at one or more sites include green false hellebore (*Veratrum viride*), Gray's licorice root (*Ligusticum grayi*).		D	
Tauschia tenuissima	Grassy openings in moist-wet meadows, river floodplains and streambanks. 2580 to 3200 feet in WA. Assoc. spp: *Potentilla gracilis*), straight-beaked buttercup (*Ranunculus orthorhynchus*), wild strawberry (*Fragaria virginiana*), and blue-eyed grass (*Sisyrinchium inflatum*).		D	

D: documented within the national forest, S: suspected to occur within the national forest

Affected Environment – Wet Meadows

Wet meadows are saturated throughout the growing season with the water table at or slightly below the soil surface. Species that inhabit moist meadows are displayed in the following table.

Table 359. Wet meadows habitat group description for each species

Scientific Name	Habitat Description	MAL	UMA	WAW
Antennaria corymbosa	Wet meadows, moist meadows; at mid elevations.		D	
Botrychium montanum	Dark, coniferous forests, usually near swamps and streams; 1,000-2,000 meters. Wet meadows, saturated soils. Often growing in a bed of mosses. This species tends to grow in wetter sites than the other *Botrychium* species.	D	D	D
Carex atrosquama	Subalpine and alpine meadows, river gravels, shorelines. Wet meadows to dry open slopes.			D
Carex capitata	Wet or seasonally wet meadows, often alpine or lower in cold air drainages; sandy, acidic soils.		D	S
Carex comosa	Marshes, lake margins, wet meadows, bogs and wet thickets.		S	
Carex subnigricans	Moist rocky slopes, alpine meadows, high elevation only; above 2,500 meters.			D
Heliotropium curassavicum	Wet ground, saline flats, alkaline soils. Low elevations.	S	S	S
Juncus albescens	Peat bogs, peaty riparian areas. In the Wallowa Mountains, on a peaty creek bank in limestone drainage. High elevations.			D
Ophioglossum pusillum	Open fens, marshes edges, pastures, grassy shores and roadside ditches, 100-2,000 meters. Wet meadows, damp sand, grassy swales, seeps/springs. In pastures, old fields, and flood plain woodlands in seasonally wet, rather acid soil.	S	S	D
Pleuropogon oregonus	Open, wet meadows, marshes, and riparian areas. Grows in areas of standing or flowing water early in season. Known sites are not near forested habitats. Sluggish water in depressions and sloughs.	S	S	S
Salix farriae	Wet meadows, streambanks, moderate to high elevations. Sites in the Wallowa Mountains are in calcareous soils.	S	D	D
Thalictrum alpinum	Wet meadows, damp rocky ledges and slopes, and cold (often calcareous) bogs in willow-sedge, lodgepole pine, and spruce-fir forest; zero-3,800 meters. High elevations here.			D

D: documented within the national forest, S: suspected to occur within the national forest

Environmental Consequences – Aquatic and Riparian Habitat Dependent Species

Indirect Effects

The riparian habitats listed previously would be managed as riparian management areas (RMAs) where aquatic and riparian-dependent resources receive primary emphasis and where special management direction applies. RMAs encompass lands adjacent permanently flowing streams, ponds, lakes, wetlands, seeps, springs and intermittent streams. RMAs will have minimum widths but are designed to extend to the outer edge of riparian vegetation, or to the outer extent of the 100-year floodplain, whichever is greater. RMAs are managed to maintain and restore the riparian dependent plant and animal species, enhance habitat conservation for organisms that depend on the transition zone between the upland and riparian areas, and provide for greater connectivity within and between watersheds for both riparian and upland species. Table 360 displays minimum widths for RMAs.

Table 360. Riparian management area widths

Category	Minimum RMA Width*
Fish bearing streams	300 feet slope distance on either side of stream or to outer edge of 100-year floodplain, whichever is greatest
Permanently flowing non-fish-bearing streams	150 feet slope distance on either side of stream or to outer edge of 100-year floodplain, whichever is greatest
Constructed ponds, reservoirs and wetlands greater than one acre	150 feet slope distance from the outer edge of wetland or from the maximum pool elevation, whichever is greatest
Lakes and natural ponds	300 feet slope distance
Seasonally flowing intermittent and ephemeral streams; wetlands smaller than 1 acres, and unstable areas	100 feet slope distance

*Additional delineation criteria apply, as described in the glossary

Within riparian areas, management activities would be designed to maintain properly functioning conditions or improve conditions in areas not functioning properly. Standards and guidelines direct management activities for a variety of activities, including wildland fire, fuels, timber, silviculture, range, domestic livestock grazing, roads, recreation, minerals, and land ownership (hydropower) to accomplish desired conditions. Most standards and guidelines seek to minimize impacts from land management activities. For example, guideline MA 4B RMA-FOR-3 directs new landings, designated skid trails, staging or decking for timber operations to be located outside RMAs, unless no reasonable alternatives exist, in which case they should (1) be of minimum size, (2) be located outside the active floodplain, and (3) minimize effects to large wood, bank integrity, temperature, and sediment levels. Several guidelines are specific to sensitive plants whether or not plants are located within the RHCA: PL-TES-5, -6, -7, -8, -9, and -10, which would protect populations of sensitive plants using avoidance buffers. PL-TES-10 would require mining activities to avoid sensitive plant species to the greatest extent possible.

The major difference between alternatives B, D, E, and F and alternative C concerns range management guideline MA 4B RMA-RNG-2, where the maximum percent utilization of herbaceous vegetation within the greenline riparian zone is reduced from 40 percent (B, D, E, and F) to 10 percent (alternative C). Woody vegetation utilization is reduced from 40 percent to 25 percent within the guideline. Residual stubble height and bank alteration standards remain the same between all alternatives. Recreation management guidelines MA 4B RMA-REC-1 and MA 4B RMA-REC-2 for alternatives B, D, E, and F become standards for alternative C. There is no substantive change in their wording. Where aquatic and riparian dependent habitat is occupied by sensitive species, herbaceous utilization is further reduced to 30 percent under alternatives B, E, and F. Riparian management areas within bull trout spawning and rearing reaches would be grazed to 25 percent utilization, providing slight additional benefits to sensitive plants inhabiting the riparian areas of these reaches.

For alternatives B, E, and F, guideline PL-TES-3would prevent grazing of sensitive species that occur in peatlands. Sensitive species occupying springs and seeps would benefit from the desired condition designed specifically to conserve these unique groundwater dependent ecosystems. Although some sensitive plants would be impacted, the majority of plants, as well as the overall integrity of the spring or seep, would be maintained.

The Livestock Grazing and Rangeland Vegetation section describes general indirect effects to riparian vegetation. Alternative C is expected to result in the most rapid short-term recovery of riparian and wetland areas. Alternatives B, E and F are expected to have upward trends for riparian and wetland areas. Under alternative A, riparian integrity would remain similar to the present, with a slow but steady rate of recovery. Sensitive plants benefitting from reduced riparian greenline vegetation utilization standards belong to the Aquatic and Riparian habitat groups. Reduced greenline utilization would mean livestock would spend less time in these areas, and there would be less opportunity to compact soils or damage plants from herbivory or trampling. Species benefiting from reduced trampling are small, fragile plants, particularly members of *Botrychium* and aquatic plants rooted in shallow or drying shorelines: *Rotala ramosior*, *potamogeton diversifolius*, and *Elatine brachysperma*. One species, *Ribes oxyacanthoides* ssp. *irriguum*, a shrub growing in riparian areas in coniferous forest of ponderosa pine and Douglas-fir, would directly benefit from alternative C from a reduced standard for woody vegetation utilization to 25 percent of the current year’s growth.

The alternatives vary also in the number of grazing animal unit months (AUMs) for each national forest. Presumably, how the AUMs vary by alternative would not matter because overall vegetation utilization standards would still apply, regardless of the number of livestock allowed in to graze in any area. However, for alternative C there would be a beneficial affect achieved through a combination of a reduction in AUMs by 75 to 80 percent and a reduction in the acres designated suitable for grazing by about 65 percent. With fewer acres available for grazing and much reduced utilization levels, sensitive species impacted by grazing, even at levels that would sustain their populations, would benefit. The desired condition: “the natural range of habitats of… plant species… is of adequate quality, distribution, and abundance to contribute to maintaining native and desired nonnative species diversity,” would be achieved more easily with alternative C compared to other alternatives. Although some individual plants may be impacted, the guidelines specific to sensitive plants are expected to maintain populations for alternatives B, E, and F. These three alternatives would provide greater protection than alternatives A and D. Alternative C would provide protection to riparian and wetland dependent sensitive plants largely through a reduction in livestock AUMs and a reduction in land area deemed suitable for grazing. Even so, the action alternatives do not vary in the biological evaluation finding: all alternatives may impact individuals or habitat, but would not likely contribute to a trend towards Federal listing or cause a loss of viability to the population or species.

Cumulative Effects - Aquatic and Riparian Habitat Dependent Species

Because of the expected life of the plan, cumulative effects to rare plants would arise mainly from reasonably foreseeable future actions or events occurring beyond the plan area whose effects might extend to within the plan area. These effects would originate from actions on adjacent public (BLM), state, county, or private lands. Private lands comprise the largest proportion of adjacent lands followed by public (BLM), state, and county lands. The actions or events outside the national forest most likely to contribute to cumulative area invasions by nonnative plants and wildfires. Trespass by livestock is possible, but is expected to be infrequent with minor cumulative effects. The effects of climate change also contribute potential cumulative effects to rare plants.

Non-native Invasive Plants – Cumulative effects from invasion by nonnative plants would arise from lands nearby the plan area. The plan addresses these effects in the same manner as effects from nonnative plants spreading from sites within the plan area. These effects are discussed in the Non-native Invasive Species section.

Wildland Fire – Wildfires arising from adjacent lands then spreading to within the plan area mainly threaten rare plants located within 5 to 10 miles of the national forest boundary. Rare plants in the conifer forest habitat group are at the greatest risk of lethal effects from wildfire. Wildfires with severe or perhaps even moderate intensities would likely kill plants in this habitat group. Following severe wildfire, suitable habitat for species in the conifer habitat group may not return for several decades. Species in the aquatic, peatlands, and wet meadows habitat groups would probably be least affected from wildfire because these groups are expected to withstand the effects of wildfire, suffering damage only to crowns of graminoid plants, but not the basal meristem tissues of the root crown. Species occupying the grasslands habitat group are largely adapted to periodic wildfire, and may benefit from them. Increases in nonnative exotic plants, such as cheatgrass, may increase fire frequencies in the grasslands habitat group favoring increase in exotic species cover to the detriment of native bunchgrasses, though this pattern, widely reported from the basin and range, has not been observed in the Blue Mountains. Alpine fellfields and subalpine parkland are not expected to be frequented by wildlife, though it is possible. Any cumulative effects from wildlife to this habitat group are expected to be minor. In sagebrush shrubland, some species (*Astragalus tegetariodes*, *Camissonia pygmaea*) may benefit from the presence of wildlife while *Castilleja flava* var. *rustica* may experience decline because sagebrush may be a necessary host plant for this hemiparasite. Although wildfire is possible in the basalt lithosol habitat group, any effects are expected to be minor due to light fuel loads. On the other hand, species inhabiting the talus, cliffs, and rock outcrops habitat groups are threatened by wildfire. These species' strategy of avoidance by occupying areas with light, discontinuous fuels is not foolproof as wind driven wildfires spot through these habitats. Many species occupying this group have no inherent defenses for fire, particularly the cryptic nonvascular plants that grow on peaty soil on ledges and in crevices. Mat-forming plants such as *Geum rossii* var. *turbinatum* and *Luina serpentina* would be consumed and killed by fire. Species occupying the seeps/springs, riparian, and intermittent stream habitat groups could either survive or be killed by wildfires, depending on fire severity. Most species occupying moist meadows are not expected to be significantly impacted by wildfire.

Climate Change – Climate change is affecting the Pacific Northwest. Projections are for the climate to warm 0.2 to 1 degree Fahrenheit per decade for the foreseeable future (OCCRI 2010). Precipitation levels may be more difficult to predict, but there is some confidence to expect decreases in winter snowpack, earlier spring snowmelt, earlier initiation of growing seasons, increase in growing season length, but under drier conditions, and increases in extreme weather events. Gradual warming and drying is expected to change species composition and community structure, possibly resulting in a decline in biodiversity. The most significant effects of climate change on biological diversity are expected to be in response to increasing summer temperatures (Currie 2001), although there is too much uncertainty about potential climate change effects on rare plant populations to confidently distinguish differences between the alternatives.

Species occupying the alpine fellfields and subalpine parkland habitat group are most at risk from climate change as this habitat has been and will continue to decline in the next century. Species dependent on snow melt basins or other moist micro sites (*Carex vernacula*, *C. micropoda*, *Lomatium erythrocarpum*, and *Saxifraga adscendens* ssp. *oregonensis*) are also at risk, as these habitats may decline first. Species or habitats dependent on snowmelt runoff, such as the cottonwood habitat group, may decline in abundance. Cottonwoods depend on period flooding and sediment deposition for seedling germination (Rood and Mahoney 1995). With reduced peak spring streamflows, cottonwood seedlings may not have proper conditions to germinate on floodplains. Where germination has been successful, reduced late summer discharge may not provide sufficient moisture for seedlings to survive through the first growing season and establish (Naiman et al. 2005). Many other species within the plan area are endemic to small ranges or comprise disjunct populations beyond the species' contiguous range, regardless of their habitat group. These species are at risk of local extinction due to factors cited earlier.

The assessment of current environmental conditions in the affected environment incorporates the combined effects of past action. Ongoing and reasonably foreseeable future actions are addressed under the analysis in environmental consequences. Because the forest plan has an anticipated lifespan of 15-20 years, this analysis incorporates the effects of reasonably foreseeable future actions. When forest plan activities are considered within a context of climate change, an additional factor is added to the cumulative effects analysis. Reid and Lisle (2008) identified two issues regarding cumulative impacts and climate change:

1. Human-induced climate change is itself a cumulative impact of multiple human activities. Prediction of the local magnitude, style, and timing of climate changes will require an understanding of how the many influences on climate interact.
2. Outcomes from this episode of climate change will differ from those of previous episodes in part because of interactions with environmental changes that humans have already caused—outcomes will be a cumulative effect. For example, Pleistocene climate changes resulted in elevational and latitudinal shifts of ecosystem boundaries. However, ecosystems now are highly fragmented by land-use activities, so climate change is more likely to result in extirpations than in the past because incremental shifts along a gradient may no longer be possible. In addition, geomorphic and ecosystem processes have been extensively modified by land-use activities, impairing some systems' mechanisms for resilience and thereby increasing their sensitivity to change.

One option for management recommended by Reid and Lisle is to incorporate adaptive management, whereby management actions are administered as experiments, along with a monitoring program to evaluate the efficacy of each action, such that management may be redesigned as appropriate to improve future actions.

Nonnative Invasive Species

Invasive species are recognized as a major threat to native plant and animal communities, as well as to social and economic conditions. The effects of invasive species can cause economic loss and reductions in the long-term productivity of the land, disrupt recreational use, and reduce resource production. A wide range of species can be invasive, including vascular and nonvascular plants, terrestrial and aquatic animals, and pathogens, such as white pine blister rust and white-nose syndrome.

Invasive aquatic plants and animals are not yet widespread in the headwater streams and lakes in the Blue Mountains. However, many highly invasive aquatic species are well established in neighboring states, in the Columbia River, and in the lower reaches of major tributaries adjacent to the national forests. Streams and springs on the national forests are at risk of invasion by detrimental invasive organisms, such as New Zealand mudsnails and Asian clams. Lakes and reservoirs are at risk of invasion by zebra mussels, hydrilla, and other highly undesirable introduced plant and animal species. Because the distribution of invasive aquatic plants and animals in the Blue Mountains is not well understood, the analysis will focus on invasive terrestrial plant species. Invasive insects and pathogens of conifers are addressed in the vegetation section.

Invasive plants are defined as “nonnative plants whose introduction do or are likely to cause economic or environmental harm or harm to human health” per Executive Order 13112. The Chief of the Forest Service declared invasive species as one of the four main threats to ecosystem health (USDA Forest Service 2004). The threat is considered serious because invasive plants have the potential to displace or change native plant communities and can increase wildfire hazard, degrade fish and wildlife habitat, eliminate rare and endangered plants, impair water quality and watershed health, and adversely affect a wide variety of other resource values, such as recreational opportunities.

The area affected by invasive plant species has increased throughout the Interior Columbia Basin during the last 100 years. The same trend has occurred in the Blue Mountains during the last 20 years. A large portion of the Blue Mountains is characterized as being susceptible to invasive plants (Quigley and Arbelbide 1997). The susceptibility is most prevalent in vegetation types that many invasive plants are adapted to: areas dominated by dry forest, dry grass, dry shrub, and cool shrub types.

This section discusses the analysis of how well invasive plants forest plan components (objectives, standards, and guidelines) would achieve the desired condition. The existing condition describes the current infestation of invasive plants for each national forest and describes the 1990 forest plan direction for managing invasive plants.

Affected Environment – Nonnative Invasive Species

Invasive plants occupy thousands of acres within the Umatilla and Wallowa-Whitman National Forests, but far fewer acres are inventoried within the Malheur National Forest. The Malheur National Forest is thought to have more acres of invasive plants than what is currently mapped but is not likely infested to the same degree the Umatilla or Wallowa-Whitman National Forest is infested. Table 361 displays the known infested acres for each national forest. Within the Malheur National Forest, 30 species infest 2,160 acres; within the Umatilla National Forest, 37 species infest 27,755 acres; and within the Wallowa-Whitman National Forest, 37 species infest 20,352 acres.

Other infestations that have not been inventoried are likely to occur on each national forest. In addition, annual grasses and other invasive plants that are considered naturalized are not included in this total.

Table 361. Acres and percent of National Forest System (NFS) lands infested by invasive plants

National Forest	Current Infestation (acres)	Total NFS lands* (acres)	NFS Lands Infested by Invasive Plants (%)
MAL	2,160	1,709,047	0.13%
UMA	27,755	1,404,246	2.0%
WAW	20,352	1,777,596	1.1%

*For the Wallowa-Whitman National Forest, values exclude the HCNRA.

In 2005, the regional forester amended the 1990 forest plans with the record of decision (ROD) for the Preventing and Managing Invasive Plants FEIS (USDA Forest Service 2005). This amendment added management direction for invasive plants to the 1990 forest plans, including goals, objectives, standards and a monitoring framework. Appendix A displays the goals, objectives, and standards from the R6 2005 ROD. Current forest plan direction for managing invasive plants would continue for the no-action alternative and all action alternatives.

Forest plan components have not been developed specifically for invasive aquatic plants and invasive animals (aquatic or terrestrial vertebrates and invertebrates). National forests in the Blue Mountains would follow strategies outlined in the National Strategy and Implementation Plan for Invasive Species Management and the Regional Aquatic Invasive Species Strategy and Management Plan (2011) for prevention and early detection/rapid response. Emphasis would likely be placed on coordination programs with Oregon and Washington to increase public awareness of exotic pests, especially where visitors have the potential to spread organisms, and to monitor water resources for the presence of invasive aquatic organisms. Exotic insect infestations and diseases that threaten conifer forests are addressed in the vegetation section.

All alternatives were assessed for their predicted ability to meet the desired condition and by the degree to which ground disturbance could lead to conditions that would increase the invasive species spread rate.

Current and ongoing management direction has the potential to meet this desired condition. The Preventing and Managing Invasive Plants FEIS (USDA Forest Service 2005) disclosed that the adopted invasive plant management direction had a “moderate to high potential to reduce rate of spread,” and concluded that effective treatment of the existing populations along with prevention measures applied to land uses and activities could reduce the current 8 to 12 percent rate of spread to about 4 to 6 percent (ibid). Thus, to meet the desired condition, both current infestations and new infestations need to be contained, controlled, or eradicated.

Table 362 displays the average annual acres that have been treated during a three-year period (2009-2011) on the three national forests compared to the acres that would hypothetically need to be treated each year to make progress toward achieving the desired condition for invasive plants containment, control, and eradication. The objectives are for a five-year period because of the time it takes to control invasive plants given the existing soil seed bank, the typical need for retreatment, weather, and funding. To effectively control invasive plants, treatments (manual, mechanical, herbicide, or biological) are often repeated for several years. Subsequent treatments usually require fewer resources, e.g., labor or herbicides, because each treatment effectively reduces the density or size of the target population. The acreage needed to be effectively treated annually in table 362 was adjusted to account for need for retreatment (each entry is assumed to be 80 percent effective) (Desser 2006).

Table 362 displays that invasive plant treatments need to be increased from current levels to meet 5-year objectives for all alternatives. Forest plan management direction is intended to facilitate effective treatments over time.

Table 362. Annual acres of invasive plants treatments necessary to make progress towards achieving the desired condition for each national forest

National Forest	Average Acres Treated Annually (2009-2011)	5-year Benchmark (acres contained, controlled, eradicated)	Average Acres Effective Treatments Needed
MAL	266	2,270 to 3,470	570 to 868
UMA	5,029	33,770 to 48,913	8,433 to 12,228
WAW	4,533	24,760 to 35,870	6,190 to 8,968
Totals	9,828	60,800 to 88,253	15,193 to 22,064

Environmental Consequences – Nonnative Invasive Species

Indirect Effects

The environmental consequences of the alternatives relative to nonnative invasive species are similar since all alternatives retain existing management direction. There are no direct impacts. However, since invasion and dominance by invasive plants is highly correlated to soil disturbances (Cox 1999), the greater the potential extent and intensity of timber harvest, fuels reductions, recreation, livestock grazing, mining operations, road maintenance and prescribed fire, the greater the potential for indirect effects from soil disturbances (e.g., conditions favorable to invasive plants).

To compare alternatives, an index was created to display the relative amount of soil disturbing activities (timber harvest and associated actions, fuels reductions, and AUMS for livestock grazing) for each alternative for each national forest. The index equals the sum of annual projected acres of soil disturbing activities divided by the sum of these values for alternative B. The index value for alternative B is 1.

The index values for alternatives C, D, E, and F are displayed relative to alternative B in table 363. There is no standard for measuring soil disturbance as a predictor of nonnative plant invasion, either as an observable measurable value or as a percent of managed lands. The index serves only to compare alternatives and suggest which alternatives are more or less likely to create conditions favorable to the invasion of nonnative invasive plants. In fact, the management direction for invasive species requires that each project prevent or minimize potential for invasive species introduction, establishment, and/or spread.

Table 363. Index values for soil disturbing actions that favor invasion by nonnative plants for each of the action alternatives for each national forest

National Forest	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F
WAW	1	0.29	1.48	1.07	1.02
UMA	1	0.37	1.51	1.16	1.04
MAL	1	0.37	1.22	1.08	1.02
Averages	1	0.34	1.39	1.09	1.02

Compared to the proposed action, alternatives E and F would have slightly more projected activities that would provide opportunities for nonnative invasive plants to establish (the indices for E and F are less than 10 percent more than alternative B). Alternative D, with nearly 40 percent projected activities that would provide opportunities, would have the most widespread favorable conditions for establishing invasive plants. Projections for alternative C are about one-third of projections for alternative B and would likely result in the least area of conditions favorable to the spread of invasive plants. All management activities would be designed to include measures to help prevent invasive plant spread.

Cumulative Effects

Cumulative effects may arise from the introduction of invasive species from lands adjoining the plan area. These lands consist of other Federal (BLM), tribal, state, county, or largely, privately owned lands. The plant invasion process occurs in three phases: introduction, establishment, and spread. Invasive species are introduced via vectors, such as wind, water, or wildlife, in addition to the actions of people, which move seeds or plant fragments from one location to another. Wind and water, in particular, are major natural dispersal agents. For example, windblown seed of rush skeleton weed can be carried up to 20 miles (USDA Forest Service 2005). Water is a primary aid in the dispersal of many species, including Japanese knotweed. Rivers and waterways have been identified as one of the biggest spread mechanisms for invasive plants (Sheley et al. 1995). Various wildlife species can contribute to the spread of invasive plant species by dispersing seeds in their dung, on their coats or feathers, or between their hooves. Ants even have been identified as one of the dispersal agents for the seeds of Scots broom (Parker, et al. 1998). Though invasive plant propagules (seeds or plant fragments capable of establishing) may originate from outside sources, the Forest Service does exert management control on conditions on the ground where they may be deposited. Therefore, the cumulative effects analysis area is the plan area for the Blue Mountains national forests.

People travelling to the national forests may transport invasive plant propagules from adjacent or even distant lands. This may be done through a variety of means: motor vehicles, clothing and footwear, pets, stock, etc. Motor vehicles, in particular, have been shown to pick up and move invasive species seeds that can be deposited along roads (Schmidt 1989 and Hodkinson and Thompson 1997). Roadside habitats are particularly susceptible to plant invasions for a number of reasons. Roads eliminate some of the physical and environmental barriers that help prevent invasion by increasing available light and dispersal opportunities. Disturbances associated with the use and maintenance of roads provide habitat easily exploited by invasive species, which can then seed themselves relatively swiftly along roadsides or be transported by animals or people (vehicles). Roads are primary vectors for the spread of invasive plants and the most likely vector for human transport of invasive plant propagules from outside the plan area.

Cumulative effects may be incurred from the transport and establishment of nonnative invasive plants from sources adjacent to the plan area. And, likewise, weeds from the National Forest System lands could spread to adjacent areas. However, these effects are expected to be small compared to the anticipated spread from invasive plants sites within the plan area. While the forest plan addresses invasive plant spread via prevention standards, invasive plants would continue to move freely across borders, to and from ownerships, because the movement of seeds and propagules via wind, water, or wildlife are largely beyond the control of the Forest Service.

Cumulative effects may also result from climate change. Much of the research on invasive species interactions with climate change has contributed to the growing body of evidence that global warming has enabled invasive species to expand to areas where they were not previously able to persist (Dukes and Mooney 1999, Weltzin et al. 2003, Thuiller et al. 2007, and Walther et al. 2009). Some researchers have modeled range expansions for some invasive species (*Centaurea solstitialis* and *Tamarix*) while predicting reduced invasion risk and significant range contractions for others (*Bromus tectorum*, *Euphorbia esula*, and *Centaurea biebersteinii*) by the year 2100 (Bradley et al. 2009). As the climate changes, the ranges of invasive species will change: some species may become less invasive, and others may become more invasive. Given their adaptive traits, invasive plants may be able to outcompete native species in the migration process to new suitable habitat (Hellman 2008). Compared to a stable climate, the degree to which global warming has contributed to the current spread of invasive plants is unclear.

The forest plan responds to the challenges of increased risk of invasion from invasive plants, whether or not introduced from external sources and whether or not climate change may influence their spread, by incorporating standards to prevent the transport and establishment of invasive plant propagules and by including objectives to reduce the area infested by invasive plants over time. The cumulative effects do not add significantly to effects expected from each alternative. Cumulative effects, when added to indirect effects of the alternatives, would be similar to the effects described previously.

Social Environment

Tribal and Treaty Resources

The legal responsibilities of the Federal government to American Indian tribes are clarified in statutes, executive orders, and case law enacted and interpreted for the protection and benefit of federally recognized American Indian tribes. The Forest Service honors American Indian treaty reserved rights to hunt, fish, gather, and graze on present-day national forests through consultation, coordination, and agreements with the affected Indian tribes. The agency maintains a government-to-government relationship with federally recognized tribal governments. The Forest Service and the tribes take time to meet to gain an understanding of each other’s rights, responsibilities, and interests. Through these relationships, the Forest Service and the tribes build and enhance a mutual understanding, as well as pursue cooperative and partnership initiatives and efforts.

Numerous laws, executive orders, and regulations govern the relationship between American Indian tribes and the Federal government, which is represented here by the three national forests. In project planning and implementation, the Forest Service complies with these laws and regulations, and, in doing so, meaningfully consults with tribal governments.

In addition, numerous laws, regulations and policies govern the use and protection of forest resources that may be of tribal interest or covered under tribal reserved rights. Activities authorized or implemented by the Forest Service must comply with these laws, regulations, and policies that are intended to provide general guidance for the implementation of management practices, and for protection of resources, including those of interest to the tribes.

In the plan area, a significant portion of lands ceded by the tribes in the various treaties was designated as part of the National Forest System by the Organic Administration Act of June 4, 1897. Lands were ceded though the Treaties of 1855 by the Confederated Tribes of the Umatilla Indian Reservation, Confederated Tribes of Warm Springs, Nez Perce Tribe, and Confederated Tribes and Bands of the Yakama Indian Nation of the Yakama Reservation. The treaty with the Klamath Nation of 1870 ceded lands extending into the Malheur National Forest. These treaties are known for their specific language recognizing certain reserved rights of the tribes in aboriginal use areas. The Burns Paiute Tribe, Shoshone-Paiute Tribes of the Duck Valley Reservation, Fort McDermitt Paiute and Shoshone Tribes, Fort Bidwell Indian Community of Paiute Indians, and the Confederated Tribes of the Colville Reservation (through the Joseph Band of the of the Nez Perce Tribe) are federally recognized American Indian tribes that also have interests in the management direction and project planning of the Blue Mountains national forests.

Tribes and Forest Plan Revision

As a Federal agency, the Forest Service’s legal responsibilities are identified in treaties and clarified in statutes, executive orders, and case law enacted and interpreted for the protection and benefit of federally recognized tribes. In meeting these responsibilities, the Forest Service consults with the tribes whenever proposed policies or management actions may affect their interests.

While Federal laws apply to all federally recognized tribes, each tribe is different and is recognized as a separate and unique government. Treaty rights and the historic relationships between the tribes and the lands differ and there are cultural differences between them. In some cases, several tribes may each have legitimate interests in the same lands because they each may have occupied or otherwise used those lands during different historic periods or jointly during the same period. In other cases, a tribe or a group of tribes has a Memorandum of Understanding with the Forest Service. These factors and others combine to make each Forest Service tribal consultation relationship unique.

The Forest Service sent letters regarding the Blue Mountains forest plan revision to interested tribal governments in 2004, 2006, 2007, 2009, 2010, and 2013. Numerous meetings were held with the Confederated Tribes of the Umatilla Indian Reservation, Nez Perce Tribe, and Confederated Tribes of the Warm Springs between 2002 and 2009. These include government-to-government and staff-to-staff meetings. During this period, the Blue Mountains forest plan revision team has received formal comments from Confederated Tribes of the Colville Reservation (2007), the Nez Perce Tribe (2007), and the CTUIR (2007, 2008, 2011). No comments from any tribes were received during the formal scoping period.

Further details of tribal consultation are included in chapter 1 of this DEIS and in the project record.

Culturally Significant Foods

The tribes are concerned about the availability and protection of treaty resources, including culturally significant foods. These culturally significant foods are plants, animals, and fish that are used for both ceremonies and subsistence needs. According to the tribes, the protection of culturally significant foods includes the protection of habitats, upon which those resources depend, and use and access to traditional cultural sites. Adequate availability of these resources allows harvest in sufficient quantities to satisfy the subsistence needs of tribes while still providing for the conservation needs of the resources. Adequate access that would not compromise cultural practices at traditional, cultural, or spiritual places is a concern to the tribes.

Traditional foods in the Pacific Northwest include salmon, game (such as elk and deer), roots (such as cous, camas, and bitterroot), and berries (such as huckleberries and chokecherries). These plants and animals, as well as others, have cultural significance. They also provide nutrition to many tribal people. Culturally significant foods are especially important and provide critical subsistence given the high incidence of poverty in Native American communities.

Affected Environment – Tribal and Treaty Resources

The affected environment includes the treaty reserved resources the tribes utilize within the Blue Mountains national forests. The affected environment, including the current conditions of treaty resources, is discussed in the related resource sections of chapter 3. The affected environment for indirect effects is the lands administered by the Malheur, Umatilla, and Wallowa-Whitman National Forests.

Environmental Consequences – Tribal and Treaty Resources

Management direction for tribal treaty reserved rights and interests is included in all alternatives for the three national forests and can be found in greater detail in appendix A.

Key Issues for Tribal Treaty Reserved Rights, Interests, and Culturally Significant Foods

Consultation, collaboration, and coordination with tribal communities would continue to inform on overall resource condition, however the following selected measures are indicators of resource condition that are of tribal interest. The key issues for tribal concerns are access, vegetation management, and watershed function. The following indicators are relevant to tribal and treaty rights but detailed analysis of effects for these indicators between alternatives is available in the respective sections.

Effects Common to All Alternatives

Forest plan direction for resource management, such as heritage, vegetation, soils, water, riparian, aquatic, and wildlife for all alternatives, is designed to provide for the protection of cultural resource sites or traditional cultural properties. All alternatives would also provide protection for habitat and watershed conditions that would contribute to species viability at sustainable and harvestable levels. Invasive species would be managed to avoid encroachments on culturally significant foods. Monitoring of resource conditions would also occur.

Effects Common to Alternatives B, C, D, E, and F

Alternatives B, C, D, E, and F would result in the following common conditions. The following are desired future conditions that are common to all action alternatives.

Access

The access issue includes the impacts on tribal governments and tribal practices from resource management activities including road building or other modifications of the landscape. The forest plans would include the desired condition that "the need for tribal access to traditional sites is acknowledged and supported." While the tribes need access to traditional sites, there are some sacred sites where American Indians conduct ceremonies that require privacy. Building roads to or near such sites may lead to increased visitation that could affect ceremonies and undermine cultural practices. Roads or extraction activities may also alter the character and diminish the value of historic or cultural places. Adequate access should not compromise cultural practices at traditional, cultural, or spiritual places.

The indicators for access are:

- Percent suitable for summer motor vehicle use
- Number of miles open motor vehicle routes in excess of the desired conditions

Access will vary by alternative due to the desired road density. Road density would be highest to lowest in the following order: A, D, B, E, F C respectively.

Refer to the Access section for detailed discussion on these indicators. Alternatives with higher road densities would provide for greater tribal access but may also result in greater impacts to resources of value to the tribes such as culturally significant foods which are dependent on terrestrial and aquatic habitats. Alternatives with lower road densities would slightly impact accessibility, particularly for elders, of forest resources for tribal accessibility. While there may be some variation between the alternatives for access, tribal treaty rights will be protected in all alternatives from impacts from access.

Culturally Significant Foods and Vegetation Management

The availability of culturally or traditionally significant foods is one aspect of vegetation management that is of particular importance to the tribes. Culturally significant foods are plants, animals, and fish that are used for both ceremonies and subsistence needs. According to the tribes, the protection of culturally significant foods includes the protection of habitats upon which those resources depend. Adequate availability of these resources allows harvest in sufficient quantities to satisfy the subsistence needs of tribes while still providing for the conservation needs of the resources.

The following indicator is used to assess vegetation management:

- Acres of annual timber harvest
- Acres of annual fuels treatment

Vegetation management activities would be designed to move the forested landscape closer toward the historic range of variability (HRV). These indicators are appropriate because forests that are closer to their HRV support more culturally significant foods. Refer to the Forest Vegetation, Timber Resources, and Wildland Fire section for detailed information on annual acres treated.

The amount of annual acres of timber harvest and prescribed burning varies between alternatives, however the following desired future conditions are common to all action alternatives and can be found in appendix A.

The amount of acres of annual forest vegetation treatments vary by alternative. In general, alternatives that have more acres treated would result in larger areas of the forested landscape returning to the Historic Range of Variability, which support more culturally significant foods. Alternatives with lesser amount of vegetation treatments may also return the forested landscape to the HRV, but at slower pace and scale. The Forest Vegetation, Timber Resources, and Wildland Fire section provides detailed analysis of these indicators.

Watershed Function

The availability of clean water is important to the tribes. Some tribes also consider clean water a culturally significant food. Clean water is part of the watershed function issue. The indicators of clean water are:

- Aquatic species viability
- Watershed condition class: number of watersheds in improved condition

Culturally significant foods and watershed function are both related to ecological resiliency. The tribes are particularly concerned about ecological resiliency. Some of the tribes have participated in planning efforts aimed at improving elk and big game habitat as well as partnered with the Forest Service for the removal of culverts impacting fish passage. The tribes are interested in ecological resiliency as it relates to ecological restoration projects for aquatic and terrestrial resources including salmon and big game. The indicators listed above for vegetation management and watershed function are also useful for determining progress toward ecological resiliency. Refer to the Aquatic and Watershed sections for detailed discussion on the indicators for each alternative.

The number of watersheds with improved conditions varies by alternative. Alternative C improves the largest number of watersheds, alternatives D, E, and F represent an intermediate amount, and alternative B improves the least. Alternatives with more watersheds in improved condition are beneficial for water quality and aquatic species viability, each considered resources of tribal interest. See the Watershed Function, Water Quality, and Water Uses section for detailed analysis of this indicator.

Environmental Justice

Environmental justice is discussed in the Economic and Social Well-being section. The desired future conditions are consistent for all action alternatives.

American Indian populations would not be disproportionately impacted by any alternative. Environmental justice as it relates to tribes is analyzed in detail in the Economic and Social Well-being section.

Cumulative Effects

The affected environment for cumulative effects includes lands administered by the three national forests and lands of other ownerships both within and adjacent to these national forest boundaries. The indirect effects of forest plan implementation would be 20 years. Future actions within these spatial and temporal boundaries would meet the stated desired conditions for all action alternatives for tribal and treaty resources. While there is variation between alternatives within the current analysis, all alternatives would contribute to the exercise of treaty reserved rights, interests, and cultures in a manner that should promote sustainability of the ecosystem. The need for tribal access to traditional sites would be acknowledged and supported for all alternatives for all National Forest System lands administered by the Malheur, Umatilla, and Wallowa-Whitman National Forests.

Recreation

The Malheur, Umatilla, and Wallowa-Whitman National Forests are important local and national recreation destinations. Recreation and related tourism, especially during hunting season, is a major component of the rural economy in northeastern Oregon. The planning area includes all National Forest System lands within a portion of the Ochoco, and all of the Malheur, Umatilla, and Wallowa-Whitman National Forests, with the exception of the Hells Canyon National Recreation Area. The 2009 National Visitor Use Monitoring survey (NVUM) recorded more than one million recreation visits to the three national forests.

National forest recreation provides a wide range of opportunities in a natural setting to meet the needs and desires of visitors. People have always enjoyed relatively un-restricted vehicle access and opportunities in Federal public lands. There are also areas of national forests that have only been accessible by foot, horseback, and bike. Local lifestyles and economics are closely linked to the type and amount of recreation that is occurring in the Blue Mountains, with a majority of the visitors coming from within two hours of the national forest in which they recreate. The climate and demographics in the Blue Mountains national forests sustain a summer and fall recreation program; and, elevation and snow conditions sustain a strong winter recreation program in much of the project area.

Each national forest has established use patterns, with a large percent of users coming from the counties that are associated with each of the national forests. Wallowa-Whitman National Forest visitors are predominately from Union and Baker counties. Umatilla National Forest visitors are predominately from Walla Walla and Umatilla counties. Malheur National Forest visitors are predominately from Grant and Harney counties. However, considering the distances that are involved, there is a considerable amount of visitation from major metropolitan areas, such as Portland and Seattle, and most importantly secondary population centers that have very high growth rates. Examples of these areas, such as the Tri-Cities area (Benton and Franklin counties in Washington), Bend (Deschutes county in Oregon), and Boise (Ada County in Idaho), have high population growth rates with a large percent of the population desiring to take advantage of outdoor recreation opportunities in the nearby national forests. These large populations and high growth rate areas will have an increasing effect on recreation opportunities and demands within the Blue Mountains national forests. The following table displays visitation rates by county (top three counties) (NVUM 2009), the percent of population from that county that visited each national forest (NVUM 2009), and the county populations and growth rates (2010 Census).

Table 364. Recreation visitation by county for each national forest

County in each National Forest	State	Percent Visitation	County Population	Change in Population 2000 to 2010
Malheur National Forest				
Grant	Oregon	31.9%	7,445	-6.2%
Harney	Oregon	6.4%	7,442	-2.5%
Deschutes	Oregon	3.7%	157,733	36.7%
Umatilla National Forest				
Walla Walla	Washington	21.0%	58,781	6.5%
Umatilla	Oregon	16.6%	75,889	7.6%
Benton	Washington	6.4%	175,177	23.0%
Wallowa-Whitman National Forest				
Union	Oregon	8.8%	25,748	5.0%
Baker	Oregon	7.1%	16,134	-3.6%
Ada	Idaho	1.1%	392,365	30.4%

As displayed in table 364, the rural counties for all three national forests have the highest visitation and the lowest growth rates, and in some cases population losses. The metropolitan centers have a low percent of visitation, but the population is large and growing at a much greater speed then the national average. The Umatilla National Forest has the greatest potential for increasing visitation due to the higher rural population and the higher metropolitan population, both growing at a greater rate than the other two forests.

Within the planning area for the Blue Mountain national forests, congress has designated 11 wild and scenic river segments and 6 wilderness areas. In addition, there are four designated scenic byways, including the Hells Canyon All-American Road. An extensive road system is used by recreation visitors for recreation pursuits that include hunting, fishing, accessing motor vehicle and nonmotorized trail systems, camping, picking huckleberries, viewing wildlife, driving for pleasure, and riding over-the-snow vehicles in the winter. Winter recreation is popular, with three downhill and Nordic ski areas and extensive miles of groomed snowmobile routes.

The Forest Service initiated and developed a framework for sustainable recreation entitled, "Connecting People with America's Great Outdoors: A Framework for Sustainable Recreation" (USDA Forest Service 2010). The framework affirms the USDA forest service mission and concludes:

> Despite changes in population and fluctuations in visitor patterns, it is obvious that outdoor recreation on the National Forests and Grasslands is a traditional part of the American way of life, and will remain so in the years ahead. There are numerous challenges to providing quality recreation experiences and tourism opportunities while protecting the land. But, through the strength of our partnerships . . . we can meet these challenges of a sustainable future for the benefit of American society.

The purpose of sustainable recreation is to create recreation and tourism programs and services that directly contribute to the long-term ecological, social, and economic health in a specified area by building partner relationships between visitors, communities, and providers. Sustainable recreation is currently defined as the set of recreational opportunities, uses and access that, individually and combined, are ecologically, economically, and socially sustainable, allowing the responsible official to offer recreation opportunities now and in the future.

During the past two years, additional funds have been allocated through the American Recovery and Reinvestment Act of 2009 to reduce the backlog of maintenance issues for numerous recreation facilities. This funding has been particularly effective for trail maintenance and developed recreation facilities, with the Forest Service receiving a different mix of funds for each national forest:

- $1.7 million to focus on correcting recreation facilities maintenance issues and accessibility upgrades within the Malheur National Forest
- $1.6 million to address 1,400 miles of wilderness area and Hells Canyon National Recreation Area trails maintenance within the Wallowa-Whitman National Forest
- $1.7 million to correct recreation facilities maintenance issues and $2.8 million to replace trail bridges and to accomplish heavy trail maintenance within the Umatilla National Forest

It is anticipated that this additional funding will have a positive effect on the Blue Mountains national forests recreation and trails facilities over the next decade.

An additional diversity of recreation settings has also been provided with special area designations in the 1990 forest plans. These special areas have specific management direction for their designation, and while many provide a motor vehicle or nonmotorized recreation setting, they are designated for other purposes, such as historical significance or preservation of unique ecosystem components. Where motor vehicle use is deemed suitable, it is because that recreation activity does not interfere with the purpose for which the area was designated. See the Special Areas section for more discussion.

Affected Environment – Recreation

Recreation Settings

Recreation Setting Suitability

Key indicators for recreation setting suitability are:

- acres of back country motor vehicle, backcountry nonmotorized, and wilderness/recommended wilderness
- acres of winter motor vehicle access
- acres available for motor vehicle and nonmotorized hunting access

For each recreation setting, there is a table depicting the results of the most recent National Visitor Use Monitoring survey data (NVUM 2009). After identifying their main recreation activity, visitors were asked how many hours they spent participating in that main activity during the national forest visit. Because most national forest visitors participate in several recreation activities during each visit, it is more than likely that other visitors also participated in this activity, but did not identify it as their main activity. For example, in one national forest, 39 percent of visitors identified viewing wildlife as a recreational activity that they participated in during the visit; however, only 1.3 percent identified that activity as their main recreational activity.

The demographic results from the National Visitor Use Monitoring survey indicate that the average visitor to the Blue Mountains national forests is male (67 percent of respondents), between 50 and 69 years old (35 percent of respondents), and white (99 percent of respondents). The majority of visitors come from counties contiguous or adjacent to the three national forests. The national forests serve as federal “backyards” to moderate population areas for activities that are not often available in the private sector (viewing scenery and wildlife, developed and primitive camping, hiking, and walking).

Existing Condition of Developed Recreation

High to moderate use levels occur at well-maintained recreation sites. Developed sites across the national forests, including campgrounds, picnic areas, boating sites, and ski areas, continue to provide varied recreation facilities. Developed recreation sites act as a central hub of activity, with many people recreating on roads, trails, creeks, lakes, and rivers near the site. Continued access to developed sites is of central importance, while maintaining access to these nearby attractive locations is of equal importance. About one-third of the visits to the Blue Mountains national forests are to developed sites: 23 percent visit day use areas and 11 percent visit overnight camping areas (NVUM 2009). This equates to about 400,000 visits to developed sites in the three national forests.

A recreation facility analysis has been completed for all three of the national forests to determine a program of work for facilities management. As a general observation across the three forests, the use of facilities within all three forests was determined to be below capacity, so additional facility construction is not anticipated. However, in certain locations which are particularly popular or near towns where facilities are not meeting user expectations or use is at full capacity, additional recreation facilities may be constructed in suitable areas (Malheur National Forest Recreation Site Facility Master Plan, May 2006, Wallowa-Whitman National Forest Recreation Site Facility Master Plan June 2006, Umatilla National Forest Recreation Site Facility Master Plan, October 2007).

Table 365. Percent of developed site recreation visits

National Forest	Participated or Primary Visit	Developed Camping	Resort Use	Nature Center	Historic Sites	Picnicking
Malheur	Participated	16.2	0.2	0.9	3.6	22.3
	Primary	5.9	0.1	0.0	0.0	0.8
Umatilla	Participated	14.2	0.5	1.2	5.7	16.7
	Primary	5.1	0.1	0.0	0.2	2.7
Wallowa-Whitman	Participated	13.4	3.7	12.1	17	15.7
	Primary	1.9	0.3	0.2	0.5	1.4

Source: NVUM 2009

The forest plan revision team has addressed the importance and special need for management of developed sites by allocating developed recreation sites to the same management area as administrative sites (MA 5). In the existing condition, alternative A, there are a total of 12,680 acres in MA 5. Approximately 50 percent of these acres are associated with recreation facilities, and the remaining acres are associated with administrative use by the Forest Service. For action alternatives, additional acres would be allocated to MA 5, and this allocation would be the same for each of the action alternatives.

Table 366 displays the acres currently allocated to developed recreation and administrative sites for each of the Blue Mountains national forests. For this analysis, developed recreation and administrative areas will not be used as an indicator, as they will not vary by alternative and would not contribute to a comparison of the alternatives.

Table 366. Existing condition displaying acres of developed recreation and administrative site setting

National Forest	Acres of Developed Recreation and Administrative Site Settings
Malheur	650
Umatilla	4,920
Wallowa-Whitman	7,110

Existing Condition of Dispersed Backcountry Motor Vehicle Recreation Areas

Table 368 displays the current acres within the dispersed backcountry motor vehicle for each forest.

Table 367. Percent of motor vehicle dispersed and backcountry recreation visits

National Forest	Participated or Primary Visit	Primitive Camping	Relaxing	OHV Use	Motor Vehicle Trail	Driving for Pleasure	Motor Vehicle Water Activity	Other Motor Vehicle Activity
MAL	Participated	37.8	38.3	14.9	13.2	54.5	0.0	0.3
	Primary	8.2	3.6	0.0	0.0	7.6	0.6	0.0
UMA	Participated	4.7	31.8	5.6	12.2	42.6	1.0	0.1
	Primary	0.1	4.0	1.9	1.9	11.3	0.0	0.0
WAW	Participated	9.2	39.4	2.6	3.1	30.0	11.5	0.1
	Primary	0.2	5.7	1.5	0.1	11.2	3.1	0.0

Source: NVUM 2009

Table 368. Existing condition acres of dispersed backcountry motor vehicle setting

National Forest	Acres of Dispersed Backcountry Motor Vehicle Setting
Malheur	650
Umatilla	4,920
Wallowa-Whitman	7,110

Existing Condition of Dispersed Backcountry Nonmotorized, Proposed Wilderness, And Wilderness Recreation areas

Low to high use can occur in many backcountry and wilderness sites, depending on the location, and especially depending on proximity to water. Frequently, the pristine nature of a setting becomes the primary reason it is attractive to the exclusion of other sites that may be easier to access, but are much less pristine. The desire to get away from others for a remote or pristine recreation opportunity can create a crowded situation at desirable and relatively easily accessed sites, or a situation where those seeking a pristine setting must look to locations farther away to achieve the desired recreation experience. Pristine recreation settings are at a premium and can be difficult to maintain from the manager’s standpoint.

Hiking, walking, horseback riding, mountain biking, snowshoeing, cross country skiing, nature study, and viewing wildlife have been and continue to be popular backcountry activities, as reflected in table 369. Backcountry recreation users usually do not support any change to the way they have been accessing an area. They know they have to hike, ride horses, or ride bikes (in nonwilderness areas) into the area, and they would like it to remain that way. Frequently, for an area to be considered pristine by recreation users, avoidance of the sights and sounds of others or of motor vehicles is necessary. This can be difficult to achieve as motor vehicle sounds can carry a long way.

Table 369. Percent of nonmotorized backcountry wilderness area recreation visits

National Forest	Participated or Primary Visit	Hiking/ Walking	Back-packing	Horse-back Riding	Bicycling	Other Nonmotorized Activity	Nature Study	View Natural Features
MAL	Participated	47.3	1.1	2.5	3.3	1.6	5.3	39.3
	Primary	10.0	0.2	2.2	0.1	0.5	0.0	1.3
UMA	Participated	32.6	0.6	4.3	1.1	3.7	4.8	37.9
	Primary	4.7	0.4	4.0	0.2	1.6	0.4	8.6
WAW	Participated	46.5	12.9	1.8	1.5	2.5	7.0	49.9
	Primary	15.3	6.6	1.0	0.4	0.3	0.3	13.3

Source: NVUM 2009

In some areas, there are management goals that are associated with fish, wildlife, and water that may also be beneficial to nonmotorized recreation experiences. Areas may also have other resource management goals that are associated with excluding motor vehicle activities from an area. These areas will be considered as suitable for nonmotorized backcountry recreation for the purposes of this analysis.

There are management areas in alternative A where this type of recreation activity is provided and for which the area is managed. These include MA 1A Congressionally Designated Wilderness Areas, MA 1C Wilderness Study Area, and MA 3A Backcountry (nonmotorized use). Acres of Blue Mountains national forests currently allocated to these management areas are displayed in table 370 and table 371. There are no proposed wilderness areas in the 1990 forest plans.

Table 370. Existing condition acres of dispersed backcountry nonmotorized setting

National Forest	Acres of Dispersed Backcountry Nonmotorized Setting
Malheur	47,500
Umatilla	29,800
Wallowa-Whitman	0

Table 371. Existing condition acres of designated wilderness areas

National Forest	Acres of Designated Wilderness
Malheur	82,557
Umatilla	304,173
Wallowa-Whitman	372,900*

* Wallowa-Whitman National Forest private inclusions are included in the acre totals for congressionally designated wilderness areas in the existing condition

Existing Condition of Winter Recreation

Winter recreation occurs in all of the areas described previously. Due to the increased difficulty, challenges of access, and need for specialized equipment and clothes designed for winter activities, winter recreation in the Blue Mountains is far less common than summer recreation. However, winter recreation has significant tourism effects for the communities of the Blue Mountains because non-local visitors predominately use local lodging and restaurants. In addition, downhill and cross-country ski areas have a disproportionately large daily visitation compared to all other developed sites in the national forests. As reflected in table 372, snowmobiling has the most extensive participation and is the most widely distributed winter activity in the national forests. Visitors travel great distances to ride in deep snow in wide-open high-elevation areas. Snowmobiling is a controversial topic, with parties interested in maintaining or expanding snowmobiling, and other parties seeking to restrict or eliminate it. In alternative A, snowmobiling is identified as a suitable use and is allowed in approximately 1,575,500 acres within the Malheur National Forest, in approximately 1,061,700 acres within the Umatilla National Forest, and in approximately 1,369,200 acres within the Wallowa-Whitman National Forest.

Table 372. Percent of winter recreation visits

National Forest	Participated or Primary Visit	Downhill Skiing	Cross Country Skiing	Snowmobiling
MAL	Participated	0.0	0.0	8.0
	Primary	0.0	0.0	8.0
UMA	Participated	9.3	3.3	3.0
	Primary	9.1	3.2	1.4
WAW	Participated	5.6	2.8	0.8
	Primary	5.1	1.9	0.5

Source: NVUM 2009

The following table is repeated from the “Access” section.

Table 373. Areas suitable for winter motor vehicle use (existing condition/1990 forest plans)

National Forest	Acres Suitable for Winter Motor Vehicle Use	Percent of National Forest
MAL	1,575,500	93%
UMA	1,061,700	76%
WAW	1,369,200	78%

Existing Condition of Hunting and Fishing

Table 374 includes the National Visitor Use Monitoring (2009) survey information gathered for visitors participating in fishing, hunting, viewing wildlife, and gathering forest products. The national forests of the Blue Mountains maintain a reputation as one of the best places to hunt big game in the Pacific Northwest. Hunting continues to be a featured recreation activity and, in some areas, the single most important recreation activity. Hunting access is a complex topic, as some hunters prefer a high amount of motor vehicle access while others prefer large reductions in motor vehicle access. Regardless, minimal road systems have been proven desirable to manage habitat of the big game species that are hunted. As additional roads are closed to improve big game habitat, there will be a reduction in the easy access afforded by those roads.

Table 374. Percent of Hunting and fishing recreation visits

National Forest	Participated or Primary Visit	Fishing	Hunting	Viewing Wildlife	Gathering Forest Products
MAL	Participated	11.0	49.7	39.3	6.5
	Primary	1.5	40.7	1.3	1.8
UMA	Participated	12.6	12.2	42.6	28.2
	Primary	7.5	9.7	3.0	16.7
WAW	Participated	24.7	11.2	46.8	8.5
	Primary	13.2	8.7	3.5	1.2

Source: NVUM 2009

Nationally, hunting has seen a declining trend. During the last two decades, participation rates of Oregon residents in hunting and angling have declined significantly. Even though Oregon’s population has expanded by nearly a million people, the number of licensed resident hunters has declined in absolute numbers, and the number of licensed resident anglers has not increased. Of the adjacent states of California, Idaho, Nevada, and Washington, only Nevada and Idaho hunters have not declined in numbers. For the same adjacent states, anglers have increased in all four states (Staff Report, Oregon Department of Fish and Wildlife, Review of License Sales Trends, Chris Carter, Harry Upton).

Among the most important factors identified in the literature and hypothesized as causes of the trends are:

- Changing values/attitudes toward wildlife – shift from utilitarian/traditionalist attitude to protectionist attitude
- Urbanization (the social process in which the populations of cities and suburbs grow relative to the populations of rural areas)
- Residential stability has declined, reducing the number of people with a stable, rural background and decreasing the prevalence of individuals with both area knowledge and a utilitarian attitude
- Increasing difficulties in gaining access to fish and wildlife
- Increasing pace of life – not enough time, increasing work obligations, family obligations
- Declining conditions of some fish and wildlife populations
- A population with greater average age, composed of more persons with lower physical fitness and fewer persons with a traditionalist attitude
- Fee increases have caused some individuals to quit or become less frequent participants

The trend in county participation rates has similar negative implications. Oregon net in-migration represents the majority of population growth between the 1990 and 2000 Census. Most of the counties with the largest population gains from in-migration are more urban/suburban counties. Many of the counties associated with the Blue Mountains have had overall population decreases. Table 375 displays the change in annual hunter participation rates for each county by comparing the 2003 participation rate to the 1991 rate. For each county, participation rates have decreased.

Table 375. Relative difference in hunter participation rates by county (from 1991 to 2003)

County	Percent Change in Hunting Participation 1991 to 2003
Harney	-7
Wheeler	-15
Wallowa	-19
Malheur	-27
Morrow	-26
Baker	-26
Union	-5
Umatilla	-27

Fishing access is another complex topic. Fishing participation has increased nationwide, but has only held steady in Oregon in spite of population growth. Oregon state data indicates many of the counties within the project area have reduced participation rates. Some anglers prefer easy access to fishing sites, while others would like reductions in motor vehicle access and prefer to fish where there are no roads at all.

Table 376 displays the change in annual fishing participation rates for each county by comparing the 2003 participation rate to the 1991 rate. For each county, participation rates have decreased.

Table 376. Relative difference in fishing participation rates by county (from 1991 to 2003)

County	Percent Change in Fishing Participation 1991 to 2003
Harney	-12
Wheeler	-20
Wallowa	-14
Malheur	-33
Morrow	-24
Baker	-27
Union	-13
Umatilla	-23

Hunting and fishing is an important part of recreation activities in the Blue Mountains; however, it is difficult to determine benefits or losses to the activities based on the variability of factors. Many aspects of an enjoyable hunting and fishing experience are within the control of state fish and wildlife management agencies, including increases or decreases in game populations from year to year, difficulty or cost of obtaining tags, and locations where certain types of hunting or fishing may occur. One aspect of the hunting or fishing experience that could be affected by the forest plan revision is the availability of motor vehicle access.

The clear issue facing recreation managers is the ongoing conflict between motorized and nonmotorized access. The national forests provide two principle types of recreation: recreation at developed sites, where activities are dependent on constructed facilities, for example RV camping and downhill skiing; and dispersed recreation, where the activities are not dependent on constructed facilities, for example hunting, fishing, and off-highway vehicle use. Where there is a low road or motor vehicle trail density in a dispersed setting, the setting is considered backcountry.

Useful indicators of differences between alternatives within a dispersed or backcountry setting are the acres of land allocations suitable for motor vehicle use and the acres of land allocations suitable for nonmotorized use. This topic is also discussed in the Access section.

Table 377 and table 378 are repeated from the “Access” section of this chapter.

Table 377. Areas suitable for motor vehicle use (existing condition/1990 forest plans)

National Forest	Acres Suitable for Motor Vehicle Use	Percent of National Forest
MAL	1,428,050	84%
UMA	934,240	67%
WAW	1,315,750	75%

Table 378. Areas suitable for nonmotorized use (existing condition/1990 forest plans)

National Forest	Acres Suitable for Nonmotorized Use	Percent of National Forest
MAL	272,010	16%
UMA	460,150	33%
WAW	438,580	25%

Environmental Consequences – Recreation

This analysis considers the effects to recreation setting suitability that are associated with a motor vehicle use or a nonmotorized use designation for both summer and winter recreation.

Effects associated with changes in the road or trail system for either density or suitability are discussed in the access section.

Effects associated with a change in allocation to Preliminary Administratively Recommended Wilderness Areas are discussed in the wilderness area section.

Recreation Setting Suitability

The indicator for recreation setting suitability is:

- acres available for dispersed backcountry motor vehicle, dispersed backcountry nonmotorized, and wilderness/recommended wilderness

Effects from Alternative A on Recreation Setting Suitability

The 1990 forest plans for the Malheur and Umatilla National Forests include designations for areas for nonmotorized recreation that are primitive in nature, while the Wallowa-Whitman National Forest 1990 forest plan does not. There are areas within all three national forests that are designated for motor vehicle recreation that are primitive in nature, or classified as backcountry, with very low densities of motor vehicle roads. The Umatilla National Forest is closed to cross-country motor vehicle travel, unless posted open. In contrast, the travel management approach for the Malheur and Wallowa-Whitman National Forests has been that areas are open to cross-country motor vehicle travel unless closed by order. All three national forests have road density limitations as plan components, although they vary by national forest. Refer to the Access section for more information.

Developed Recreation

Effects from Alternative A on Developed Recreation

The Blue Mountains national forests 1990 forest plans have inconsistent approaches to developed recreation sites.

There is a management area designated specifically for developed recreation sites for the Malheur and Umatilla National Forests. Developed recreation sites are included in a management area with other administrative sites for the Wallowa-Whitman National Forest. For alternative A, there would be a variety of management areas within the three national forests where developed recreation would be appropriate and encouraged. For the purpose of this analysis, the management area designation developed in the proposed action will be used: MA 5 Developed Sites and Administrative Sites. To determine how this recreation setting is affected by proposals in each alternative, the total acres available in this allocation will be compared (table 379).

Table 379. Acres of recreation setting allocations, including acres from more than one management area, for each alternative for each national forest

Recreation Setting Suitability	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F
Malheur						
Developed recreation	650	2,200	2,200	2,200	2,220	2,220
Dispersed backcountry motor vehicle	1,428,100	1,533,000	876,000	1,591,500	1,543,500	1,543,500
Dispersed backcountry nonmotorized	47,500	59,300	643,200	0	53,556	53,556
Wilderness and recommended wilderness areas	82,600	83,700	166,400	82,600	113,002	113,002
Umatilla						
Developed recreation	4,920	3,700	3,700	3,700	3,700	3,700
Dispersed/ backcountry motor vehicle	934,200	1,004,000	507,000	1,019,100	884,599	884,599
Dispersed /backcountry nonmotorized	29,800	19,300	292,600	0	105,475	105,475
Wilderness and recommended wilderness areas	304,200	305,600	552,700	304,000	344,239	344,239
Wallowa-Whitman						
Developed recreation	7,110	7,700	7,700	7,700	7,700	7,700
Dispersed backcountry motor vehicle	1,315,800	1,289,000	606,000	1,305,100	1,182,500	1,182,500
Dispersed backcountry nonmotorized	0	0	543,700	0	104,450	104,450
Wilderness areas, recommended wilderness areas, and wilderness study areas	376,000	383,700	545,700	373,000	393,251	393,251

Effects from Alternatives B, C, D, E, and F on Developed Recreation

Administrative and recreation sites would be managed the same for all action alternatives. All three national forests would have slight changes to the developed recreation area allocation. The use of facilities within all three forests was determined to be below capacity, so additional facility construction is not anticipated. However, in certain locations which are particularly popular or near towns where facilities are not meeting user expectations or use is at full capacity, additional recreation facilities may be constructed in suitable areas.

The Malheur National Forest would increase acres allocated to developed sites and administrative sites (MA 5) for the action alternatives with an overall increase of 1,150 acres. The Umatilla would decrease acres allocated to MA 5 for the action alternatives with an overall decrease of 1,220 acres. The Wallowa-Whitman National Forest would have a slight increase in acres allocated to MA 5 for the action alternatives with an overall increase of 590 acres. It is expected that moderate to high use levels will continue to occur at well-maintained and varied recreation sites including campgrounds, picnic areas, boating sites, ski areas, and other developed recreation sites for all action alternatives

Dispersed Backcountry Motor Vehicle Use

Management areas that include a dispersed backcountry motor vehicle recreation setting include MA 3B Backcountry (limited motor vehicle use) and MA 4A General Forest.

The recreation setting for each national forest results from a composite of multiple factors and elements including the amount of acres allocated to each management area and the specific combination of management areas that comprise each of the four recreation settings. As an example, an alternative that allocates more acres to MA 3B and 4A and fewer acres to MA 3A (nonmotorized use) would have a comparative emphasis on dispersed backcountry motor vehicle recreation. Conversely, an alternative that allocates more acres to MAs 1B and 3A with lesser amounts to MAs 3B and 4A would have a comparative emphasis on dispersed backcountry nonmotorized recreation.

Effects from Alternative A on Dispersed Backcountry Motor Vehicle Use

Alternative A would not change the amount of land allocated to motor vehicle recreation.

For the Malheur National Forest, the amount of land allocated to dispersed backcountry motor vehicle recreation would not change. For dispersed backcountry motor vehicle use, alternative A allocates more acres for this use compared to alternative C, but less than alternatives B, E, F, and D.

For the Umatilla National Forest, the amount of land allocated to dispersed backcountry motor vehicle recreation would not change. For dispersed backcountry motor vehicle use, alternative A allocates an intermediate amount of acres for this use compared to other alternatives: alternatives E, F, and C each would allocate fewer acres for this use, and alternatives D and B would each allocate more.

For the Wallowa-Whitman National Forest, the amount of land allocated to dispersed backcountry motor vehicle recreation would not change. For dispersed backcountry motor vehicle use, alternative A allocates the largest amount of acres for this use compared to the action alternatives.

Effects from Alternative B on Dispersed Backcountry Motor Vehicle Use

Management areas that would provide a summer motor vehicle backcountry recreation setting component for alternative B include MAs 3B and 4A, and all three national forests would have open route density desired conditions for managing summer motor vehicle recreation in MAs 3B and 4A. Refer to the Access section for a detailed discussion.

All three national forests would have areas designated suitable for motor vehicle use. This would include areas where recreation is primitive in nature that would be allocated to MA 3B Backcountry (limited motor vehicle use). The Umatilla and Malheur National Forests would have areas where recreation is primitive in nature and designated unsuitable for motor vehicle use that would be allocated to MA 3A Backcountry (nonmotorized use). The Wallowa-Whitman National Forest does not have a management area equivalent to MA 3A for alternative B.

Within the Malheur National Forest, alternative B would allocate an intermediate amount of acres to dispersed backcountry motor vehicle use compared to other alternatives: alternatives D, E, and F each would allocate more acres for this use, and alternatives C and A would each allocate less.

Within the Umatilla National Forest, alternative B would allocate an intermediate amount of acres to dispersed backcountry motor vehicle use compared to other alternatives: alternative B would allocate more acres than alternatives A, E, F, and C, but fewer acres than alternative D.

Within the Wallowa-Whitman National Forest, alternative B would allocate an intermediate amount of acres to dispersed backcountry motor vehicle use compared to other alternatives: alternative B would allocate more acres than alternatives E, F, and C, but fewer acres than alternatives A and D.

Effects from Alternative C on Dispersed Backcountry Motor Vehicle Use

MA 4A would comprise the summer motor vehicle backcountry recreation setting for alternative C. All three national forests would have open route density desired conditions for managing summer motor vehicle recreation in MA 4A. Refer to the Access section for a detailed discussion.

In this alternative, the three national forests would not have areas designated for motor vehicle recreation that is primitive in nature. There would be no acres allocated to MA 3B as in the other alternatives.

In general, there would be a decrease in area suitable for summer motor vehicle use across the three national forests in alternative C. The overall decrease results from the combination of an increase in acres allocated to MA 3A Backcountry (nonmotorized use), no acres allocated to MA 3B Backcountry (limited motor vehicle use), and an increase of acres allocated to MA 1B, MA 3C, and MA 4C. Additionally, the amount of acres allocated to MA 4A General Forest would be reduced. Alternative C would result in a large increase in area suitable only for summer nonmotorized use and would enhance walking, hiking, horseback riding, and mountain biking opportunities and experiences. Conversely, this alternative would reduce and displace motor vehicle use and activity such as snowmobiling and riding off-highway vehicles or motorcycles.

For all three national forests, alternative C would allocate the least amount of acres to dispersed backcountry motor vehicle use compared to other alternatives.

Effects from Alternative D on Dispersed Backcountry Motor Vehicle Use

MAs 3B and 4A would comprise the motor vehicle dispersed and backcountry recreation setting. All three national forests would have open route density desired conditions for managing summer motor vehicle recreation in MAs 3B and 4A. Refer to the “Access” section for a detailed discussion. In general, alternative D would allocate the largest amount of acres to backcountry motor vehicle use across the three national forests, primarily through an increase in acres allocated to MA 4A for each forest and a similar increase in acres allocated to MA 3B. Alternative D would result in a large increase in area suitable for summer motorized vehicle recreation use and would enhance snowmobiling, off-highway vehicle, and motorcycle riding opportunities and experiences. Conversely, this alternative would reduce walking, hiking, horseback riding, mountain biking opportunities, and experiences that emphasize quiet recreation.

For both the Malheur and Umatilla National Forests, alternative D would allocate the largest amount of acres to dispersed backcountry motor vehicle use compared to other alternatives.

Within the Wallowa-Whitman National Forest, alternative D would allocate more acres to dispersed backcountry motor vehicle use compared to alternatives B, E, F, and C, but fewer acres than alternative A.

Effects from Alternatives E and F on Dispersed Backcountry Motor Vehicle Use

MAs 3B and 4A would comprise the motor vehicle dispersed and backcountry recreation setting for alternatives E and F. All three national forests would have open route density desired conditions for managing summer motor vehicle recreation in MAs 3B and 4A. Refer to the Access section for a detailed discussion. In general alternatives E and F would allocate a relatively large amount of acres to dispersed backcountry motor vehicle use across the three national forests compared to other alternatives.

Within the Malheur National Forest, alternatives E and F would allocate more acres to dispersed backcountry motor vehicle use compared to alternatives B, A, and C, but fewer than alternative D.

For both the Umatilla and Wallowa-Whitman National Forests, alternatives E and F would allocate more acres to dispersed backcountry motor vehicle use compared to alternative C, but fewer acres than alternatives D, B, and A.

Dispersed Backcountry Nonmotorized and Wilderness Area Recreation

Management areas that comprise a dispersed backcountry nonmotorized recreation setting would primarily include MA 1A Designated Wilderness, MA 1B Preliminary Administratively Recommended Wilderness, MA 3A Backcountry (nonmotorized use), MA 3C Wildlife Corridor, and MA 4C Old Forest. All of these management areas would support and enhance dispersed backcountry nonmotorized use.

Effects from Alternative A on Dispersed Backcountry Nonmotorized And Wilderness Area Recreation

Alternative A would not change the amount of acres allocated to nonmotorized recreation, and there are no allocations to MA 1B Proposed Administratively Recommended Wilderness Areas in this alternative.

Within the Malheur National Forest, the amount of acres allocated to dispersed backcountry nonmotorized recreation would not change. For dispersed backcountry nonmotorized use, alternative A allocates more acres for this use compared to alternative D, but less than alternatives C, B, E, and F.

Within the Umatilla and Wallowa Whitman National Forests, the amount of acres allocated to dispersed backcountry nonmotorized recreation would not change. For dispersed backcountry nonmotorized use, alternative A allocates an intermediate amount of acres for this use; alternatives C, E, and F each allocate more acres for this use; and alternatives B and D each allocate less.

Effects from Alternative B on Dispersed Backcountry Nonmotorized and Wilderness Area Recreation

Management areas that would comprise a summer nonmotorized backcountry recreation setting for alternative B include MAs 1A, 1B, 1C, and 3A.

For both the Malheur and Wallowa-Whitman National Forests, alternative B would allocate an intermediate amount of acres to dispersed backcountry nonmotorized recreation use. Alternatives C, E, and F would each allocate more acres for this use, and alternatives A and D would allocate less.

Within the Umatilla National Forest, alternative B would allocate more acres to dispersed backcountry nonmotorized recreation use than alternative D, but less that alternatives C, E, F, and A.

Effects from Alternative C on Dispersed Backcountry Nonmotorized and Wilderness Area Recreation

All three national forests would have areas designated for nonmotorized recreation in MA 3A Backcountry (nonmotorized use). This alternative also would include allocations to MA 3C Wildlife Corridors to increase habitat connectivity at the landscape level for wildlife and would contribute to providing opportunities for quiet recreation in roaded areas. Additional allocations would include MA 4C Old Forest and MA 1B Preliminary Administratively Recommended Wilderness Areas where motor vehicle use is generally unsuitable (see general suitability matrix table in appendix A). Future site-specific planning and decision making would need to consider the desired condition for open route density.

Management areas that would comprise a summer nonmotorized dispersed and backcountry recreation setting for alternative C include MAs 1A, 1B, 1C, 3A, 3C, and 4C.

For all three national forests, alternative C would allocate the largest amount of acres to backcountry nonmotorized recreation use compared to the other alternatives. Alternatives E, F, B, A, and D would each allocate fewer acres for this use

Effects from Alternative D on Dispersed Backcountry Nonmotorized and Wilderness Area Recreation

MAs 1A and 1C would comprise the nonmotorized backcountry recreation setting.

In this alternative, no MA 1B Preliminary Administratively Recommended Wilderness Areas (PARWA) would be designated. See the PARWA section for detailed information.

None of the three national forests would have areas designated for nonmotorized recreation that is primitive in nature (MA 3A in other alternatives), other than previously designated wilderness areas. All three national forests would have areas designated for remote motor vehicle experiences in MA 3B Backcountry (limited motor vehicle use).

For all three national forests, alternative D would allocate the least amount of acres to backcountry nonmotorized recreation use compared to the other alternatives. Alternatives A, B, F, E, and C would each allocate more acres for this use.

Effects from Alternatives E and F on Dispersed Backcountry Nonmotorized and Wilderness Area Recreation

MAs 1A, 1B, 1C, and 3A would comprise the nonmotorized backcountry recreation setting for alternatives E and F.

For all three national forests, alternatives E and F would allocate fewer acres to backcountry nonmotorized recreation use compared to alternative C, but more than alternatives B, A, and D.

Cumulative Effects to Recreation

The cumulative effects analysis timeframe for recreation is 15 years and the spatial bounds are the lands managed by the Blue Mountains national forests and those lands of other ownership that intermix with the three national forests. Recreational access across the Blue Mountain national forests is likely to be influenced by a variety of factors. The mixed land ownership (State lands, private, Bureau of Land Management) in and around the forests and the continuing management actions taken on these lands will likely continue providing quality recreation opportunities. It is anticipated that population changes, and changes in the types and intensity of recreation, will continue to influence management actions and responses to these changing factors.

The rural counties immediately adjacent to the Blue Mountain national forests have the highest percent visitation, but these areas have the lowest growth rates, and in some cases population loses. In contrast, the metropolitan centers, with generally further proximity from the national forests, have a low percent of visitation, but the population is large and growing at a faster rate than the national average. The Umatilla National Forest has the greatest potential for increasing visitation due to the combination of a relatively large rural population, a large metropolitan population, and a growth rate that is higher than the other two forests.

The Blue Mountain national forests have experienced significant changes in recreation since the forests were first established and conditions continue to change from those identified in the 1990 forest plans. Initially, recreation was light and concentrated in just several popular areas, with few campgrounds or other site development. A major boom in recreation occurred after World War II through the early to mid-1960s, as post-war populations were attracted to the national forest and placed additional demands on the quantity and quality of recreation facilities.

Since the 1970s, interest in and appreciation of the environment has increased national forest recreation visitation and has shifted activities and expectations. Technical advancements in motorized vehicles (all-terrain vehicles, motorcycles, snowmobiles, etc.) allow these types of vehicles to travel many places where they were unable to travel as recently as five years ago. The invention and advancement of the mountain bike has added a summer nonmotorized use that was not a prominent component of the 1990 forest plans. All of these issues, along with several others, have led to more crowded recreation experiences during peak use times, increasing levels and range of demands on natural resources and resource managers, and generated conflicts among the users themselves.

Continuing changes in equipment technology used for recreational purposes on the Blue Mountain national forests will have effects as new uses, or existing uses change the ease or areas where people recreate. These changes in uses may alter the recreational experience in some areas. Those who pursue nonmotorized recreation opportunities, such as hiking or backcountry skiing, will continue to be afforded widespread opportunities to experience activities that exemplify solitude, risk, challenge, and primitive recreation opportunities.

All alternatives emphasize a mix of recreation opportunities providing today’s recreationists with reasonable assurances of future motorized and nonmotorized recreational opportunities. Alternative D may provide more recreation opportunities toward the developed end of the recreation opportunity spectrum classes by accelerating development of the Blue Mountain national forests with a variety of management actions. Some values such as remoteness, solitude, and wildlife-related recreation opportunities may be reduced in alternative D. Alternative C proposes the least amount of forest management, thereby, emphasizing the primitive and semi-primitive classes of recreational opportunities, and potentially reducing developed and motor vehicle oriented recreation opportunities. Alternative B would emphasize a combination of active management and natural processes for restoring the landscape, a combination that would provide balanced opportunities across a recreational spectrum. Similarly, alternatives E and F would provide for a combination of recreational opportunities that would improve or enhance the qualities, quantities, and visitor use satisfaction of recreationists.

Special Areas

Introduction

Special areas on the national forests are managed to protect and where appropriate, foster public use and enjoyment of areas with scenic, historical, geological, botanical, zoological, paleontological, or other special characteristics. A special area must possess unusual recreation and scientific values, and it would be desirable that these values be available for public study, use, or enjoyment. These areas provide for conservation of representative, unique, or rare ecosystems or ecological components, as well as culturally significant components. Some of these areas provide natural reference areas to represent eco-regions within each state. Management emphasis is primarily focused on protecting or improving, and where appropriate, developing and interpreting the area's special characteristics for public education and enjoyment.

This section discusses five types of special areas: wild and scenic rivers, municipal watersheds, research natural areas, experimental forest, and special interest areas. Wilderness and recommended wilderness can be found in a separate report.

Acreages for all current special areas has been recalculated since distribution of the proposed action for public scoping by using the latest GIS technology, so although boundaries may not have changed, the acres reported may have. Changes are noted in the alternatives.

Special areas are formally designated either by congressional statute or by administrative action. Congressionally designated areas are established through a formal act of Congress, such as wilderness areas, wild and scenic rivers and national recreation areas. Administratively designated areas include research natural areas, and special interest areas (SIAs) such as historic areas, geologic areas, scenic areas, and botanical areas. These areas may be proposed in forest plans but are established through a separate process. SIAs exist for the protection and public enjoyment of areas of special characteristics. Once areas have been designated, either by Congress or agencies, the designation does not usually change. Areas recommended or proposed in forest plans may change. The following types of administratively designated areas occur on the Blue Mountains national forests: scenic areas, historical, geological, and botanical areas; research natural areas; municipal watersheds; scenic byways and nationally designated trails.

Many special areas have their own management plans, which supplement the direction in the forest plans.

Management Area Designations for All Action Alternatives

Special areas would be allocated to:

- MA 2A Designated, Eligible, and Suitable Wild and Scenic Rivers
- MA 2B Research Natural Areas
- MA 2C Botanical Areas
- MA 2D Geological Areas
- MA 2E Historical Areas
- MA 2F Scenic Byways and All-American Roads
- MA 2G Nationally Designated Trails
- MA 2H Scenic Areas
- MA 2I Starkey Experimental Forest and Range
- MA 2J Municipal Watersheds

Standards and guidelines specific to some of these management areas are available in appendix A. Management areas 2D, 2E, 2F, 2G, and 2H do not have specific standards or guidelines.

Special area management area allocations are the same throughout all action alternatives and will not be instrumental in displaying the differences between action alternatives.

Overlapping management areas: many special areas overlap with or are contained in other management areas, such as wilderness or riparian management areas. In this event, the more restrictive management applies.

Affected Environment – MA 2A Designated, Eligible, and Suitable Wild and Scenic Rivers

Congress enacted the Wild and Scenic Rivers Act in 1968 to preserve certain selected rivers for their free-flowing condition, water quality, and outstandingly remarkable values. The Wild and Scenic Rivers Act (WSRA), provides contrast to national policy of dam, construction, and water resources projects. To protect designated rivers' free-flowing character the Federal Energy Regulatory Commission (FERC) (which licenses nonfederal hydropower projects) is prohibited from licensing construction of dams, water conduits, reservoirs, powerhouses, transmission lines, or other project works on or directly affecting wild and scenic rivers. Other federal agencies may not assist by loan, grant, and license or otherwise any water resources project that would have a direct and adverse effect on the values for which a river was designated.

The Wild and Scenic Rivers Act directs that each river in the National Wild and Scenic Rivers System (National System) be administered in a manner to protect and enhance a river's outstanding natural and cultural values. It allows existing uses of a river to continue and future uses to be considered, so long as existing or proposed use does not substantially interfere with protecting river values. The Wild and Scenic Rivers Act also directs building partnerships among landowners, river users, tribal nations, and all levels of government.

Rivers may be identified for suitability studies by an act of Congress under Section 5(a), or through federal agency-initiated study under Section 5(d)(1). By the end of 2002, Congress had authorized 138 rivers for study. Section 5(d) (1) directs federal agencies to consider the potential of wild and scenic rivers in their planning processes; and its application has resulted in numerous individual river designations, and state and area-specific legislation.

Both Sections 5(a) and 5(d) (1) require determinations to be made regarding a river's eligibility, classification, and suitability. Eligibility and classification represent an inventory of existing conditions. Eligibility is an evaluation of whether a river is free-flowing and possesses one or more outstandingly remarkable value. If found eligible, a river is analyzed as to its current level of development and a preliminary classification determination is made as to whether it should be placed into one of three classes; wild, scenic, or recreational.

The potential classification of a river found to be eligible is based on the condition of the river and the adjacent lands as they currently exist. Section 2(b) of the Wild and Scenic Rivers Act (1968) specifies and defines these terms as follows:

> **Wild Rivers:** Wild river segments are free of impoundments and are generally inaccessible except by trail and or water trail; the shorelines are essentially natural appearing. Signs of human activity, including structures or evidence of resource use, are minimal. Visitors have the opportunity to interact with a natural environment with minimal sights and sounds of other

people. Wild rivers within designated wilderness areas meet the desired condition for MA 1A Congressionally Designated Wilderness Areas.

Scenic Rivers: Scenic river segments are free of impoundments; shorelines and viewing areas are largely natural appearing. Some recreation structures, evidence of timber harvest roads, and other evidence of human activity may be present but do not detract from the near natural appearance and scenic qualities of the immediate environment. A variety of water related recreational opportunities are available. The river may be accessible from roads in some places.

Recreational Rivers: Recreational river segments are free of impoundments and are readily accessible from roads. Some major public use facilities, such as developed campgrounds, administrative buildings, bridges, private residences, and commercial businesses, may be within the corridor. Considerable development and timber harvest may have occurred and may be evident near the river. A range of recreational opportunities is available in settings where visitors are likely to share their recreational experience with other individuals or groups.

The final procedural step, a suitability study, provides the basis for determining whether to recommend a river as part of the National System. A suitability study is designed to answer the following questions:

- Should the river's free-flowing character, water quality, and outstandingly remarkable values be protected; or are one or more other uses important enough to warrant doing otherwise?
- Will the river's free-flowing character, water quality, and outstandingly remarkable values be protected through designation? Is it the best method for protecting the river corridor? In answering these questions, the benefits and impacts of Wild and Scenic rivers designation must be evaluated and alternative protection methods considered.
- Is there a demonstrated commitment to protect the river by any nonfederal entities that may be partially responsible for implementing protective management?

Rivers authorized for suitability studies by Congress are protected under the Wild and Scenic Rivers Act: Section 7(b) prevents the harmful effects of water resources projects; Section 8(b) withdraws public lands from disposition under public land laws; Section 9(b) withdraws locatable minerals from appropriation under mining laws; and Section 12(a) directs actions of other federal agencies to protect river values. These protections last through the suitability study process, including a three-year period following transmittal of the final suitability study report by the President to Congress. The integrity of the identified classification must also be maintained during the protection period.

The identification of a river as eligible through the forest planning process does not trigger any protections under the Wild and Scenic Rivers Act. To manage the river for its potential inclusion into the National System, the administering agency applies existing authorities (such as the Clean Water Act and Endangered Species Act) to protect its free-flowing character, water quality, outstandingly remarkable values, and preliminary or recommended classification. Rivers identified as eligible are managed to maintain eligibility until suitability is determined.

The Forest Service completed two environmental impact statements on the suitability for 11 eligible river segments within the Wallowa-Whitman National Forest. The Wild and Scenic River Study Report and Final Legislative Environmental Impact Statement for Eight Rivers (1997), and Dutch Flat Creek, Killamacue Creek and Rock Creek Wild and Scenic River Study Report (1996) recommended 3 of the 11 rivers as suitable. In three alternatives, these two documents will be used to complete the suitability process for Dutch Flat Creek, East Eagle Creek, and Five Points Creek.

The Blue Mountains forest plan revision will not include analysis of the suitability for all rivers that have been determined eligible. Only the 11 rivers considered in the two EISs for the Wallowa-Whitman National Forest were analyzed and will be discussed here. When a suitability recommendation is deferred, the forest plan must provide management direction for protecting the outstandingly remarkable values until a suitability recommendation is reached. To provide realistic protection, the appropriate classification for each segment of each eligible river has been established and is listed by river segment with classification in table 380.

Table 380. Suitable wild and scenic rivers Wallowa-Whitman National Forest*

River Name	Wild	Scenic	Recreational	Outstanding Remarkable Values
Dutch Flat Creek	5.3	0	0	Scenery, recreation, geological, hydrological, botanical
East Eagle Creek	9	2.1	4.5	Scenery, recreation, fisheries, hydrological, geological, cultural
Five Points Creek	0	12.1	0	Scenery, fisheries, wildlife
Totals	**14.3**	**14.2**	**4.5**	

*These rivers have been determined suitable in Dutch Flat Creek, Killamacue Creek and Rock Creek Wild and Scenic River Study Report (1996) and Wild and Scenic River Study Report and Final Legislative EIS for Eight Rivers (1997).

Environmental Consequences – MA 2A Designated, Eligible, and Suitable Wild and Scenic Rivers

Effects from Alternative A (No-action Alternative)

For this alternative, management direction from the management plans that were written for each of the designated wild and scenic rivers remains in place. For this alternative, no additional rivers would be added as eligible.

For alternative A only those rivers already designated by Congress as part of the Wild and Scenic Rivers System are included in MA 2A. There are 10,807 acres in this management area within the Malheur National Forest, 6,926 acres within the Umatilla National Forest, and 21,936 acres within the Wallowa-Whitman National Forest.

While the eligible rivers in listed in appendix A must be managed to retain their eligibility, they will be managed under their current management area designations which vary by national forest set by the 1990 forest plans.

Effects from Alternatives B and C

For these alternatives, MA 2A includes congressionally designated rivers, and those rivers that have been determined to be eligible for designation and warrant further study that may lead to suitability, and ultimately to congressional designation. Management direction from the management plans that were written for each of the designated wild and scenic rivers remains in place. There would be 12,100 acres in this management area within the Malheur National, 44,600 acres within the Umatilla National Forest, and 88,400 acres within the Wallowa Whitman National Forest.

Effects from Alternatives D, E, and F

Malheur and Umatilla National Forests

For these alternatives, MA 2A includes congressionally designated rivers and those rivers that have been determined to be eligible for designation and warrant further study that may lead to suitability, and ultimately to congressional designation. Management direction from the management plans that were written for each of the designated wild and scenic rivers remains in place. MA 2A acres would be the same as alternatives B and C for the Malheur National Forest at 12,100 acres and the Umatilla National Forest at 44,600 acres.

Wallowa-Whitman National Forest

For these alternatives, MA 2A includes congressionally designated rivers and those rivers that have been determined to be suitable as components of the National Wild and Scenic River System. The EISs associated with the three rivers listed as suitable will serve as the environmental documentations needed to request congressional review of the suitability determination. MA 2A would be 52,900 acres for the Wallowa-Whitman National Forest. For alternatives D, E, and F, the eight rivers identified as not suitable for National Wild and Scenic River System designation would be considered ineligible. This finding is documented in the Wild and Scenic River Study Report and Final Legislative Environmental Impact Statement. Please refer the management area maps for the locations of MA 2A for each of the alternatives.

Specific Management Direction for MA 2A

Standards and guidelines for MA 2A are available in appendix A. Some are specific to particular rivers or river segments due to a correlation with the comprehensive river management plan for that river and are being incorporated from those plans for all alternatives.

Affected Environment – MA 2B Research Natural Areas

Research natural areas are natural areas established by Federal agencies. For the Blue Mountains national forests, the Pacific Northwest Research Natural Area Committee oversees the criteria and process for designating and managing these areas in conjunction with the Natural Heritage Programs of the states of Oregon and Washington.

Research natural areas form a network of ecological reserves for research and education purposes and for the maintenance of biodiversity. The purposes of research natural areas are: (1) to preserve examples of all significant natural ecosystems for comparison with those influenced by man, (2) to provide educational and research areas for ecological and environmental studies, and (3) to preserve gene pools of typical and endangered plants and animals.

Federal agencies identify areas that have unrepresented plant associations or other elements identified in the Oregon or Washington Natural Area Plan. These areas are evaluated by staff, boundaries are proposed, alternatives are examined, and a site and its boundaries are selected through the planning process. An establishment record is created for each research natural area. These reports include the justification for establishment, legal boundary descriptions, maps, distinguishing ecological features, environmental analyses, and management issues and guidelines. Research natural areas become officially established once an establishment record is completed and signed by the regional forester with concurrence from the Forest Service Pacific Northwest Research Station director.

Research, study, observation, monitoring, and educational activities that are nondestructive and nonmanipulative are generally allowed within research natural areas. While research natural areas are generally unsuitable for livestock grazing, some incidental use by livestock could occur within these areas as administrative boundaries are typically not fenced.

The desired condition for MA 2B is that established and proposed research natural areas exhibit natural conditions with minimal human intervention. Ecological processes prevail. Under some circumstances (i.e., when there is an approved establishment record that includes a management plan for Research Natural Areas), deliberate manipulation may occur to maintain the ecosystem or the unique feature(s) for which the research natural area was established.

Established and proposed research natural areas within the Blue Mountains national forests are displayed in table 381.

Effects from Alternative A (No-action Alternative)

For this alternative, no new proposed research natural areas would be allocated to MA 2B (see table 381 for research natural area acres). The forest plan would not recognize additional areas for their special or unique characteristics. These areas would continue to be managed as part of their current management area allocations, which may or may not protect the characteristics for which the additional proposed research natural areas are designated.

Effects from Alternatives B, C, D, E, and F

The total acres of research natural areas would increase within the Malheur and Wallowa-Whitman National Forests as displayed in table 381. Acres of research natural areas within the Umatilla National Forest would have a slight decrease. Refer to the following discussion for the rationale for the proposed changes.

Additional Proposed Research Natural Areas for Alternatives B, C, D, E, and F

Since the approval of the existing forest plans, Forest Service ecologists have formally proposed additional research natural areas to help fill missing ecological representations in the natural areas network as published by the Natural Heritage Programs of Oregon and Washington.

Malheur National Forest

Strawberry Mountain: this proposed research natural area would serve as the representative for whitebark pine in the southern Blue Mountains.

Umatilla National Forest

No new research natural areas are proposed.

Wallowa-Whitman National Forest

Clear Creek Ridge: this proposed research natural area contains green fescue communities of high value to future research.

Nebo: this proposed research natural area in the Eagle Cap Wilderness is the site of historic benchmark areas for early grazing studies in the Tenderfoot Basin. Since 1938, the green fescue communities in this proposed research natural area have been relatively unimpacted from domestic grazing. The area contains extensive green fescue grasslands in relatively late seral stages.

Table 381. Acres of research natural areas in each alternative for each national forest

Research Natural Area Name	Alt. A	Alts. B, C, D, E, and F	Status	Change
Malheur National Forest				
Baldy Mountain	2,591	3,861	Proposed	Boundary update
Canyon Creek	738	738	Established	NA
Dixie Butte	86	335	Proposed	Boundary update
Dry Mountain	2,260	2,260	Established	NA
Dugout Creek*	908	908	Established	NA
Shaketable	375	385	Established	Boundary update
Silver Creek	802	802	Proposed	NA
Stinger Creek	354	1,663	Proposed	Boundary update
Strawberry Mountain	0	107	Proposed	New
Totals	**8,114**	**11,059**		
Umatilla National Forest				
Birch Creek Cove	411	411	Proposed	NA
Kahler Creek Butte (formerly Kelly Creek Butte)	84	84	Proposed	NA
Mill Creek	7,702	7,486	Proposed	Boundary Update**
Pataha Bunchgrass	63	63	Established	NA
Rainbow Creek	570	570	Established	NA
Vinegar Hill	424	424	Proposed	NA
Wenaha Breaks (formerly Elk Flats-Wenaha Breaks)	1,970	1,970	Established	Boundary update
Totals	**11,224**	**11,008**		
Wallowa-Whitman National Forest				
Clear Creek Ridge	0	637	Proposed	New
Craig Mountain Lake	172	172	Proposed	NA
Glacier Lake	102	102	Proposed	NA
Haystack Rock	425	425	Proposed	NA
Horse Pasture Ridge	338	338	Proposed	NA
Indian Creek	1,003	1,003	Established	NA
Johnson (formerly Cougar Meadow)	131	131	Proposed	Name change
Lake Fork*	224	224	Proposed	Boundary update
Mount Joseph	705	705	Proposed	NA
Nebo*	0	1,695	Proposed	New
Point Prominence	365	365	Proposed	NA
Standley	0	742	Proposed	New
Gerald S. Strickler (formerly Government Meadow)	195	195	Established	Name change
Sturgill	0	139	Proposed	New
Tenderfoot Basin	0	891	Proposed	New
Vance Knoll	190	190	Established	NA
West Razz Lake	47	47	Proposed	NA
Totals	**3,897**	**8,001**		

* The Lake Fork and Nebo proposed research natural areas are partially in the HCNRA. Acreage only for the portions outside the HCNRA is displayed in this table.

** This research natural area is also a designated watershed.

Standley: this proposed research natural area was prominent in early rangeland sampling and investigation into green fescue use and succession. It continues to provide permanent monitoring opportunities.

Sturgill: this proposed research natural area contains green fescue communities of high value to future research.

Tenderfoot Basin: this proposed research natural area is another historic area of early rangeland sampling and investigation into green fescue community use and succession.

Acreage Changes for Proposed and Established Research Natural Areas for Alternatives B, C, D, E, and F

Malheur National Forest

Baldy Mountain: This proposed research natural area would be increased from 2,591 to 3,861 acres. The boundaries have been modified to include the complete range of ecological significant serpentine plant communities on Baldy Mountain.

Dixie Butte: This proposed research natural area would be increased from 86 to 335 acres. The boundaries have been modified to encompass the spatial extent of a nonforested vegetation mosaic of subalpine shrub steppe and grassland plant communities.

Stinger Creek: This proposed research natural area would increase from 354 to 1,663 acres to include sagebrush scabland/dry pine-mountain mahogany mosaic that is needed for the ponderosa pine-mountain mahogany element.

Umatilla National Forest

Mill Creek: this proposed research natural area would decrease from 7,702 acres to 7,486 acres. The boundaries have been modified to exclude existing National Forest System roads from the southwest portion of the proposed research natural area.

Wallowa-Whitman National Forest

No acreage changes are proposed.

Effects from Research Natural Area Designation for Alternatives B, C, D, E, and F

Research natural areas listed in table 381 are either established or proposed, as identified in the “Status” attribute column. Of the proposed research natural areas, there is additional distinction between those proposed research natural areas that were included in the 1990s forest plans—and have yet to be formally designated—and those proposed after the 1990 forest plans that too have yet to be formally designated.

The research natural areas that were proposed and included in the 1990 forest plans as candidate research natural areas have been managed to preserve their unique values and qualities. These areas have been managed to exhibit natural conditions with minimal human intervention, and to maintain prevalent ecological processes. A change from proposed status to designated status for those research natural areas included in the 1990 forest plans would have no effect on either the research natural area itself or surrounding area. Previous management actions conserved the research natural area’s unique value and characteristics; and those past management objectives align with the current management allocation to MA 2B. It is expected that formal designation will not have any effect on those lands within the proposed research natural areas or the surrounding area.

The research natural areas that have since been proposed subsequent to the 1990 forest plans represent new, unique areas and the effects of allocation to MA 2B are discussed below by forest.

Malheur National Forest

A total of nine research natural areas are listed for the Malheur National Forest. Of this total, four are formally designated through establishment records, and five are proposed. Of the five that are proposed, four were included in the 1990 forest plan as candidate research natural areas, where the areas were subsequently managed to conserve the natural qualities and characteristics that make them eligible for inclusion in the research natural area program.

The remaining proposed research natural area, Strawberry Mountain, would serve as the representative for whitebark pine in the southern Blue Mountains. The proposed research natural area is situated wholly within the designated Strawberry Mountain Wilderness. It is expected that changing the research natural area's status from proposed to designated would have no effects on the lands contained within the proposed research natural area or to the surrounding area. Both areas would continue to be managed to conserve their respective unique qualities within the framework of the forest plan and adhere to standards and guidelines for all alternatives.

Umatilla National Forest

A total of seven research natural areas are listed for the Umatilla National Forest (see table 381 above). Of this total, three are formally designated through establishment records, and four are proposed. All four of the proposed research natural areas were included in the 1990 forest plan as candidate research natural areas. As noted above for the Malheur National Forest, it is expected that changing the research natural areas' status from proposed to designated (through formal designation) would have no effects on the lands contained within the proposed research natural area or the surrounding areas. Past management of these proposed research natural areas would align with the management objectives and standards and guidelines presented in the current forest plan revision.

Wallowa-Whitman National Forest

A total of 17 research natural areas are listed for the Wallowa-Whitman National Forest (see table 381 above). Of this total, three are formally designated, and the remaining 14 are proposed. Of the 14 that are proposed, nine were included in the 1990 forest plan as candidate research natural areas, where the areas were subsequently managed to conserve the natural qualities and characteristics that make them eligible for inclusion in the research natural area program.

The remaining five proposed research natural areas were proposed after the 1990 forest plan, and each is described below.

Clear Creek Ridge: This proposed research natural area is situated along the southern boundary of the Eagle Cap Wilderness; only a relatively small, northern portion of the proposed research natural area overlaps with the designated wilderness. For alternatives B, D, E and F the management area surrounding the proposed research natural area would be comprised of MA 3B (Backcountry—limited vehicle motor use). For alternative C, the proposed research natural area would be entirely contained within MA 1B, preliminary administratively recommended wilderness. For all alternatives, formal designation of the proposed research natural area would likely have no effect, as the lands contained within the proposed research natural area and the surrounding area are generally managed to conserve these special and unique features for which the area is eligible.

Nebo: This proposed research natural area is situated partially within the Eagle Cap Wilderness (MA 1A), partially within the Hells Canyon National Recreation Area (outside of the current planning area), and partially within general forest allocation (MA 4A). For alternatives B and C, the land management allocations located along the northern portion of the proposed research natural area would be MA 2A, designated and eligible wild and scenic river. For alternatives D, E and F the surrounding allocation would be comprised of general forest (MA 4A). For all alternatives, formal designation of the proposed research natural area would likely have no effect, as the lands contained within the proposed research natural area are managed to conserve these special and unique features for which the area is eligible, and the surrounding areas are similarly managed to preserve these conditions.

Standley, Sturgill, and Tenderfoot Basin: These proposed research natural areas are situated wholly within the designated Eagle Cap Wilderness. It is expected that changing the research natural area status from proposed to designated would have no effect on the lands contained within the proposed research natural areas or to the surrounding area. Both areas would continue to be managed to conserve their respected unique qualities through forest plan standards and guidelines that would preserve these natural features.

Affected Environment – MA 2C Botanical Areas

Botanical areas have special values and unique natural characteristics. Botanical areas contain specimens, groups of plant colonies, or plant communities that are significant because of form, color occurrence, habitat location, life history, ecology, variety, or other features. While botanical areas are generally unsuitable for livestock grazing, some incidental use by livestock could occur within these areas as administrative boundaries typically are not fenced. The network of established or proposed botanical areas on the national forests of the Blue Mountains is displayed in table 382.

Effects from Alternative A (No-action Alternative)

The Malheur National Forest has two botanical areas totaling 123 acres. The Umatilla National Forest has four botanical areas totaling 828 acres. There are no botanical areas within the Wallowa-Whitman National Forest.

For this alternative, no new botanical areas would be allocated to MA 2C and boundaries would not change. Botanical areas proposed for alternatives B, C, D, E, and F would continue to be managed as part of their current management area allocations, which vary by national forest.

Effects from Alternatives B, C, D, E, and F

Botanical areas within the Malheur National Forest would not change; however, updated mapping recognizes that the Cedar Grove Botanical Area is 116 acres instead of the currently reported 94 acres. For the Umatilla National Forest, an addition would be made to the Charley Creek Botanical Area and three new botanical areas would be added (see table 382). Botanical areas within the Umatilla National Forest would increase from 828 to 2,437 acres.

Table 382. Botanical areas (acres) for each alternative for each national forest

Botanical Area	Alt. A	Alts. B, C, D, E, and F	Change
Malheur National Forest			
Fergy Spruce Grove	29	29	NA
Cedar Grove	94	116	Mapping correction
Totals	**123**	**145**	
Umatilla National Forest			
Charley Creek	50	111	Increased acres to protect unique values
Ruckel Junction	5	9	NA
Karl Urban	500	500	Name changed from Sheep Creek Falls Botanical Area
Shimmiehorn Canyon	197	197	NA
Sourdough	0	1,511	Proposed
Farr Meadows	0	12	Proposed
Elk Flats Meadow	0	97	Proposed
Teal Springs	61	0	Removed
Woodward Campground	15	0	Removed
Totals	**828**	**2,437**	
Wallowa-Whitman National Forest			
None	NA	NA	NA

Affected Environment – MA 2D Geological Areas

Geological areas have outstanding formations or unique geological features of the earth's development, such as caves, fossils, dikes, cliffs, or faults. These areas are protected or enhanced, and where appropriate, public use and enjoyment is fostered. The established geological areas within the Blue Mountains national forests are displayed in table 383.

Table 383. Geological areas (acres) for each alternative for each national forest

Geological Area Name	Alt. A	Alts. B, C, D, E, and F	Change
Malheur National Forest			
Magone Lake	40	185	Mapping correction
Tex Bridge	1	1	NA
Totals	**41**	**186**	
Umatilla National Forest			
Big Sink	416	416	NA
Wallowa-Whitman National Forest			
None	NA	NA	NA

Effects from Alternative A (No-action Alternative)

The Malheur National Forest has two geological areas totaling 41 acres. The Umatilla National Forest has one geological area totaling 416 acres. There are no geological areas within the Wallowa-Whitman National Forest.

For this alternative, no new geological areas would be allocated to MA 2D and boundaries would not change. The geological areas proposed under alternatives B, C, D, E, and F would continue to be managed as part of their current management area allocations, which vary by national forest.

Effects from Alternatives B, C, D, E, and F

Geological areas within the Malheur National Forest would increase to 185 acres at Magone Lake, and include Tex Bridge, which is 1 acre. No changes are proposed for Big Sink Geological Area within the Umatilla National Forest.

Affected Environment – MA 2E Historical Areas

Historical areas have historic sites, buildings, or objects of significance. The network of established historical areas within the Blue Mountains national forests is displayed in table SA7. Historical areas are protected or enhanced, and, where appropriate, public use and enjoyment is fostered.

Table 384. Historical areas (acres) for each alternative for each national forest

Historical Area Name	Alt. A	Alts. B, C, D, E, and F	Change
Malheur National Forest			
Sumpter Valley Railroad	13	444	NA
Depression ERA CCC Buildings	0	11	New
Early and Intermediate Period Buildings	0	4	New
Historic Lookouts	0	7	New
Malheur Headwaters National Register District	0	4,950	New
Camas Oven Site	0	10	New
Pre-Mazama Site	0	10	New
Arch Rock Site	0	2	New
Historic Mining Districts	0	598	New
Obsidian Source Archaeological Complex	0	28,000	New
Totals	**13**	**34,036**	
Umatilla National Forest			
Greenhorn	90	90	NA
Olive Lake-Fremont Powerhouse	1,000	1,000	NA
Target Meadows	83	83	NA
Totals	**1,173**	**1,173**	
Wallowa-Whitman National Forest			
None*	NA	NA	NA

* The Sumpter Valley Railroad, the Oregon Trail, portions of the Camp Carson and Granite Mining Districts, and the Starvation Springs archaeological site are being considered for designation.

Effects from Alternative A (No-action Alternative)

The Sumpter Valley Railroad site (13 acres) is the only historical areas within the Malheur National Forest. There are three historical areas totaling 1,173 acres within Umatilla National Forest. There are no designated historical areas within the Wallowa-Whitman National Forest.

Effects from Alternatives B, C, D, E, and F

Nine additional historical areas within the Malheur National Forest with a total of 33,605 acres are proposed for designation. No changes are proposed for the Umatilla National Forest.

While no proposals are being made at this time, the Forest Service is considering the following designations for the Wallowa Whitman National Forest: Sumpter Valley Railroad, the Oregon Trail, portions of the Camp Carson and Granite Mining Districts, and the Starvation Springs archaeological site.

Affected Environment – MA 2F Scenic Byways and All-American Roads

The national scenic byways program is a part of the U.S. Department of Transportation. The program is a grassroots, collaborative effort established to help recognize, preserve, and enhance selected roads throughout the United States. The U.S. Secretary of Transportation recognizes certain roads as all-American roads or national scenic byways based on one or more archeological, cultural, historic, natural, recreational, or scenic quality.

The purpose of the scenic byways program is to create a distinctive collection of American roads, their stories, and treasured places by creating a unique travel experience and enhanced local quality of life through efforts to preserve, protect, interpret, and promote the intrinsic qualities of designated byways. Table 385 displays the miles of designated scenic byways within the Blue Mountains national forests. Each of the scenic byways has additional mileage outside of national forest boundaries.

Table 385. Scenic byways within the Blue Mountains National Forests (miles) for each alternative for each national forest

Scenic Byway Name	Alt. A	Alts. B, C, D, E, and F	Change
Malheur National Forest			
Journey Through Time Scenic Byway	0	13	New
Umatilla National Forest			
Blue Mountain Scenic Byway	0	48	New
Elkhorn Scenic Byway	0	3	New
Totals	**0**	**51**	
Wallowa-Whitman National Forest			
Blue Mountain Scenic Byway	0	2	New
Hells Canyon Scenic Byway*	0	10	New
Journey Through Time Scenic Byway	0	21	New
Elkhorn Scenic Byway	0	52	New
Totals	**0**	**85**	

* A portion of the Hells Canyon Scenic Byway, an All-American Road, is within the HCNRA.

Effects from Alternative A (No-action Alternative)

There are no scenic byways or all-American roads allocations in the 1990 forest plans.

For this alternative, no scenic byways or all-American roads would be allocated to MA 2F. The scenic byways and all-American road allocations proposed for alternatives B, C, D, E, and F would continue to be managed as part of their current management area allocations, which vary by national forest.

Effects from Alternatives B, C, D, E, and F

Thirteen miles of scenic byways within the Malheur National Forest, 51 miles of scenic byways within the Umatilla National Forest, and 85 miles of scenic byways and all-American roads within the Wallowa-Whitman National Forest would be allocated to MA 2F. Through collaboration with multiple partners, a management plan has been developed for each scenic byway.

Additional routes are recognized locally by state or local governments, or by special interest groups for scenic or historic values, but are not recognized by forest plans.

Affected Environment – MA 2G Nationally Designated Trails

The National Trail System Act (1968) authorized the creation of a national trail system comprised of National Recreation Trails, National Scenic Trails, and National Historic Trails. These trails are included in the listing of specially designated areas because of their scenic, recreational, and historic value. Table 386 displays the trails that are designated within the Malheur, Umatilla, and Wallowa-Whitman National Forests.

Table 386. Designated trails (miles) for each alternative for each national forest

Trail Name	Alt. A	Alts. B, C, D, E, and F	Change
Malheur National Forest			
Arch Rock National Recreation Trail	0	0.3	New
Cedar Grove National Recreation Trail	0	1	New
Malheur River National Recreation Trail	0	8	New
Totals	**0**	**9.3**	
Umatilla National Forest			
Jubilee Lake National Recreation Trail	0	3	New
North Fork John Day National Recreation Trail	0	22.9	New
South Winom Creek National Recreation Trail	0	4	New
Totals	**0**	**29.9**	
Wallowa-Whitman National Forest			
Elkhorn Crest National Recreation Trail	0	23	New
High Wallowa National Recreation Trail	0	2	New
Oregon Trail National Historic Trail	0	8.3	New
Totals	**0**	**33.3**	

* The following designated trails are within the HCNRA and are not included in this table: Nez Perce-Nee Me Poo National Historic Trail and the Western Rim/Summit Ridge, Heaven’s Gate, and Snake River National Recreation Trails.

Effects from Alternative A (No-action Alternative)

No nationally designated trails are recognized by the 1990 forest plans.

For this alternative, no nationally designated trails would be allocated to MA 2G. The nationally designated trails proposed for allocation to MA 2G in alternatives B, C, D, E, and F would continue to be managed as part of their current management area allocations, which vary by national forest.

Effects from Alternatives B, C, D, E, and F

The 9.3 miles of nationally designated trails within the Malheur National Forest, 29.9 miles of nationally designated trails within the Umatilla National Forest, and 33.3 miles of nationally designated trails within the Wallowa-Whitman National Forest would be allocated to MA 2G.

Affected Environment – MA 2H Scenic Areas

Scenic areas are places of natural variety where unique physical characteristics provide pleasing views and dispersed recreational opportunities. Scenic areas are designated to protect or enhance, and, where appropriate, foster public use and enjoyment of areas with special landscapes noted for their natural beauty. There are three designated scenic areas within the national forests of the Blue Mountains. The network of established scenic areas on the national forests of the Blue Mountains is displayed in table 387.

Table 387. Scenic areas (acres) for each alternative for each national forest

Name	Alt. A	Alts. B, C, D, E, and F	Change	Establishment
Malheur National Forest				
Vinegar Hill-Indian Rock Scenic Area	12,835	12,385	NA	Established in 1966 by regional forester
Silver Creek Scenic Area	1,572	1,572	proposed	Proposed established scenic area addition
Totals	**14,407**	**14,407**		
Umatilla National Forest				
Vinegar Hill-Indian Rock Scenic Area	21,956	21,956	NA	Established in 1966 by regional forester and amended in 1978 by adding the Desolation Unit
Grande Ronde Scenic Area	9,158	9,158	NA	Established in 1979 by regional forester
Totals	**31,114**	**31,114**		
Wallowa-Whitman National Forest				
None	NA	NA	NA	

Effects from Alternative A (No-action Alternative)

The Vinegar Hill-Indian Rock Scenic Area is the only scenic area within the Malheur National Forest (12,800 acres). The scenic area is shared with the Umatilla National Forest (21,900 acres). In addition, Silver Creek Scenic Area, a 1,500 acre area that was treated in the past forest plan as a scenic area, has not had formal designation. The Umatilla has an additional 9,100 acre scenic area. There are no scenic areas within the Wallowa-Whitman National Forest.

For this alternative, no new scenic areas will be allocated to MA 2H and boundaries would not change. The scenic areas proposed for alternatives B, C, D, E, and F would continue to be managed as part of their current management area allocations, which vary by national forest.

Effects from Alternatives B, C, D, E, and F

The Silver Creek Scenic Area within the Malheur National Forest would be formally designated. No additional scenic areas are proposed for the Umatilla and Wallowa-Whitman National Forests.

Scenery Resources

The Blue Mountains national forests are known for their scenic value. The scenic qualities of the national forests represent the backdrop for the communities of the Blue Mountains and encompass the attractive recreational aspects of living in eastern Oregon and southeastern Washington. The way the Malheur, Umatilla, and Wallowa-Whitman National Forests are managed plays an integral part in the high quality scenery of this region. The high quality scenic environment is vital to the communities that use and support the three national forests.

Scenic attributes, including identifiable patterns, distinct color, texture, form, and elements, such as aspen stands and rock formations, are derived from specific geological features and functioning ecosystems. These features provide a scenic identity and image that is valued as a backdrop for the activities and experiences that create memories and meet expectations of national forest visitors (Bacon et al. 1974, Ryan 2005). People visiting or recreating in the area value the scenery of the Blue Mountains for the natural beauty, undeveloped or undisturbed scenes, and rural western setting. There are many opportunities to view historic structures and traditional uses, such as historic mining operations, ranching facilities, Civilian Conservation Corp structures, pole fences, and historic ditches. Mountains and canyons present dynamic vertical change, plant communities that are present at differing elevations, and geological features, such as rock outcrops and peaks. Water features create strong visual images that are highly valued. All of these attributes and many more create patterns and mosaics that contribute to the scenery of the Blue Mountains.

No significant issues related to scenic resources were identified during scoping or the need for change analysis process. At least one-third of the landscape within the three national forests has been altered by human developments and activities as well as recent disturbance events, such as large-scale fires. Some of these alterations are not obvious to casual viewers because the landscapes present natural-appearing scenery. This is especially true when looking at some of the vegetation conditions that have resulted from fire exclusion and prescribed fire. Another third of the national forest landscape is less altered by human activities, but roads and trails allow visitors access to these areas. The area seems to be predominately natural and is very attractive to visitors given the easy access. The last third is largely natural and is designated wilderness areas or backcountry. Access to these areas is much more difficult, but the visitor is rewarded with scenery that appears natural. However, many backcountry areas have been manipulated by fire suppression and may have looked much different had natural processes prevailed, but it would be hard for the casual observer to detect this. Results from the 2009 National Visitor Use Monitoring (NVUM) report indicates that visitors found scenery and condition of the environment to be highly satisfactory and highly important to their recreation experience across the Blue Mountains.

Affected Environment – Scenery Resources

Scenery is inventoried and placed into one of seven scenic classes with Scenic Class 1 being highly valued and distinctive and Scenic Class 7 being nondistinctive and valued the least. Each classification is determined by the combination of scenic attractiveness, viewpoint, viewing distance, and duration along with the frequency and/or number of viewers (USDA Forest Service 1995). Determining this range of scenic classes allows managers to understand the social acceptability of any change in scenery. Table 388 shows the distribution of scenic classes as inventoried for each national forest.

Table 388. Percent distribution of scenic classes for each national forest

Scenic Class	MAL	UMA	WAW
1	15	37	46
2	45	37	36
3	32	18	14
4	2	1	NA
5	6	7	4
6	NA	NA	NA
7	NA	NA	NA

Scenic integrity and scenic stability are two indicators used to evaluate the condition of scenery resources. Scenic integrity addresses human caused disturbances and development that may detract from the desired scenic character. Scenic stability addresses the relative stability of the valued scenic character and its scenic attributes. Further in depth scenic character descriptions can be found in the project record.

Scenic Integrity

Scenic integrity was developed to measure the amount of visual disturbance that contrasts with and/or detracts from the natural or socially valued appearance in a landscape. It provides a contextual measurement of the presence, intensity and dominance of human-caused visual disturbances in the landscape. Within a natural resources setting, these visual disturbances can include timber harvest, road construction, mining, utilities development, recreation facilities, ski areas, and other special uses.

Scenic integrity also applies to extreme scenic disturbances caused by natural events whenever these events are outside the historic range of variability (HRV) for the landscape. Large scale or high intensity events, such as catastrophic wildfires, insects and disease disturbances, and wind or ice storms that exceed the HRV are considered negative visual disturbances to the valued landscape character, while those within the HRV are considered neutral elements.

Scenic Integrity Levels

Very High Integrity

The valued scenery appears natural or unaltered. Only minute visual disturbances to the valued scenery, if any, are present. When used as a standard or guideline, this level should be achieved immediately upon project completion.

High Integrity

The valued scenery appears natural or unaltered, yet visual disturbances are present; however, they remain unnoticed because they repeat the form, line, color, texture, pattern, and scale of the valued scenery. When used as a standard or guideline, this level should be achieved as soon after project completion as possible but within no more than 3 years.

Moderate Integrity

The valued scenery appears slightly altered. Noticeable disturbances are minor and visually subordinate to the valued scenery because they repeat its form, line, color, texture, pattern, and scale. When used as a standard or guideline, this level should be achieved as soon after project completion as possible but within no more than 3 years.

Low Integrity

The valued scenery appears moderately altered. Visual disturbances are co-dominant with the valued scenery and may create a focal point of moderate contrast. Disturbances may reflect, introduce, or borrow valued scenery attributes from outside the landscape being viewed (such as the size, shape, edge effect, and pattern of natural openings, vegetative type changes, or socially valued architectural styles). Scenery attributes borrowed from outside the viewed landscape appear compatible with or complimentary to those within. When used as a standard or guideline, this level should be achieved as soon after project completion as possible but within no more than 3 years.

Very Low Integrity

The valued scenery appears heavily altered. Disturbances dominate the valued scenery being viewed, and may only slightly borrow from, or reflect valued scenery attributes within or beyond the viewed landscape (due to their size, shape, edge effect, and pattern). However, disturbances must be shaped and blended with the natural terrain (primary landforms) so they do not dominate the overall composition when viewed as background (beyond 3 to 4 miles). Such disturbances might include unnatural appearing openings, roads, landform modifications, or structures. If used as a standard or guideline, this level applies immediately upon project completion. However, its use as a management objective or standard or guideline is strongly discouraged; its primary use should be to inventory existing scenic integrity.

No Integrity

The valued scenery appears extremely altered. Disturbances are excessively dominant regardless of viewing distance and borrow little if any form, line, color, texture, pattern or scale from the valued scenery within or near the vicinity. Scenery at the unsuitable level needs rehabilitation. This level should only be used to inventory existing scenic integrity and never as a management objective or standard or guideline.

The existing impacts to scenic integrity are predominately related to harvest activities dating before 1980. More recent harvest activities were designed to blend with natural appearing settings. Within the Blue Mountains, approximately15 percent of the landscape has a low or very low scenic integrity level, where visual disturbances detract from the valued scenic character. An example is a vegetation harvest unit that appears distinctly geometric and unnatural. Twenty percent of the area has a moderate scenic integrity level, where openings in the vegetation are largely out of scale, but the edges are blended or shaped in a manner that appears somewhat natural. Fifty percent of the area has a high scenic integrity level, and 12 percent very high, where the valued scenic character appears intact with no detracting visual disturbances. The distribution of existing scenic integrity level for each national forest is summarized in table 389.

Table 389. Distribution of existing scenic integrity levels (percent) for each national forest

National Forest	Existing Integrity Level	Scenic Class 1	Scenic Class 2	Scenic Class 3	Scenic Class 4	Scenic Class 5	Scenic Class 6	Scenic Class 7
MAL	High	41	54	56	75	68	88	75
	Low	15	11	8	4	8	11	19
	Moderate	28	34	35	20	24	1	5
	Very high	16	0	0	0	0	0	0
	Very low	1	2	1	0	1	0	0
UMA	High	31	60	53	55	54	75	69
	Low	15	17	15	9	13	4	3
	Moderate	6	21	30	35	31	20	27
	Very high	47	0	0	0	0	0	0
	Very low	1	2	2	1	2	1	1
WAW	High	44	62	63	73	64	93	86
	Low	11	13	13	8	15	2	2
	Moderate	12	24	23	18	21	5	12
	Very high	33	0	0	0	0	0	0
	Very low	0	0	0	0	0	0	0

Scenic Stability

Scenic stability is an indicator for the Scenery Management System (SMS), introduced to specifically identify the ecological sustainability of the valued landscape character and its scenery attributes. Scenic stability is a consideration of the condition of valued scenery attributes identified in the landscape character description and an evaluation of whether or not the condition is within the historic range of variability (HRV). The condition of forested vegetation-related scenery attributes (pattern, stand structure and density, species composition, etc.) gives an indication of whether or not the ecosystem is functioning properly and if the vegetation components of valued scenery can be sustained. If conditions are outside of HRV or are trending away from that range, then it is likely that scenery attributes are at greater risk of decline or loss. The distribution of existing scenic stability classes are summarized in table 390 for each national forest.

Scenic Stability Levels

Very High Stability

All dominant and minor scenery attributes of the valued landscape character are present and are likely to be sustained.

High Stability

All dominant scenery attributes of the valued landscape character are present and are likely to be sustained. However, there may be scenery attribute conditions and ecosystem stressors that present a low risk to the sustainability of dominant scenery attributes.

Moderate Stability

Most dominant scenery attributes of the valued landscape character are present and are likely to be sustained; a few may have been lost or are in serious decline.

Low Stability

Some dominant scenery attributes of the valued landscape character are present and are likely to be sustained. Known scenery attribute conditions and ecosystem stressors may seriously threaten or have already eliminated the others.

Very Low Stability

Most dominant scenery attributes of the valued landscape character are seriously threatened or absent due to their conditions and ecosystem stressors, and are not likely to be sustained. The few that remain may be moderately threatened but are likely to be sustained.

No Stability

All dominant scenery attributes of the valued landscape character are absent or seriously threatened by their conditions and ecosystem stressors. None are likely to be sustained, except relatively permanent attributes, such as landforms

In many areas, the long-term stability of scenery resources is at risk of large scale impacts due to conditions exacerbated by past wildfire suppression and timber harvest practices. The resultant conditions of homogenous, overly dense forests of non-fire-resistant species heavily laden with fuels put scenery resources at risk from uncharacteristically large, stand-replacing wildfires, and insects and disease disturbances.

Table 390. Existing scenic stability by scenic class for each national forest (percent)

Scenic Class	National Forest	Unstable	Very Low	Low	Moderate	High	Very High
1	MAL	0.54	10.75	39.27	49.17	0.19	0.08
	UMA	0.42	18.98	44.66	35.92	0.03	0.00
	WAW	0.05	3.92	14.10	79.70	2.22	0.00
2	MAL	0.03	9.84	50.66	39.41	0.05	0.00
	UMA	0.30	12.92	47.36	39.39	0.04	0.00
	WAW	0.01	5.03	18.15	75.65	1.16	0.00
3	MAL	0.02	9.79	61.66	28.50	0.03	0.00
	UMA	0.11	21.22	50.05	28.61	0.00	0.00
	WAW	0.02	9.66	17.17	70.65	2.50	0.00
4	MAL	0.05	15.57	54.85	29.43	0.10	0.01
	UMA	0.48	14.26	38.21	46.74	0.26	0.05
	WAW	0.27	0.55	4.23	84.12	9.95	0.89
5	MAL	0.17	19.10	57.81	22.75	0.17	0.00
	UMA	0.03	24.44	44.11	31.27	0.15	0.00
	WAW	0.08	10.43	12.38	77.03	0.07	0.00
6	WAW	0.00	0.00	0.00	82.66	14.59	2.75
7	WAW	0.14	0.00	0.00	73.89	16.48	9.49

Sixty-three percent of scenic class 1 has moderate scenic stability, meaning that most dominant scenery attributes of the valued landscape are present but there are conditions that pose a threat to the stability of the attributes, such as large-scale wildfire or disturbance from insects and disease. Less than 5 percent of scenic class 1 has high scenic stability, meaning that the dominant scenery attributes are present and are likely to be sustained.

Environmental Consequences – Scenery Resources

Effects from Alternative A (no-action alternative)

Alternative A would continue the current visual management system including visual quality objectives (VQO) described in National Forest Landscape Management, Volumes 1 and 2. The 1990 forest plans include requirements (standards and guidelines) for limitations on the types and size of activities in visual foreground retention and partial retention areas. These areas are generally located along well-traveled routes.

No visual resource management areas are designated within the Wallowa-Whitman National Forest. The Umatilla National Forest includes several management areas (A3 and A4) where the visual resource is emphasized. The Malheur National Forest has approximately 190,000 acres allocated to MA 14 Visual Corridors.

No desired conditions would exist for scenic stability which would likely result in larger areas of National Forest System land in lower scenic stability than the action alternatives.

Effects Common to Alternatives B, C, D, E, and F

The desired conditions for scenery are common to all action alternatives. All action alternatives would result in activities on National Forest System land meeting the desired condition for scenic classes and provide the visual landscape character attributes that are valued by local communities and visitors of the national forests. Table 391 summarizes the desired condition for scenic integrity and stability. While all alternatives would meet desired conditions there would be variation in the speed at which scenic stability and integrity desired conditions are met as well as in the long and short term effects. Acres of vegetation management are the primary variable that would result in different effects between the action alternatives.

Specific scenic attributes are preserved across the Blue Mountains national forests. These include:

- Aspen groves
- Open ponderosa pine stands
- Civilian Conservation Corps era structures
- Historic mining structures
- Rock outcrops
- Water features
- Grassy meadows
- Component of western larch in stands
- Riparian hardwoods
- Herbland/timberland mosaic
- Homesteads
- Deciduous shrubs

Table 391. Scenic integrity levels and scenic stability levels (desired condition)

Scenic Class	Scenic Integrity Levels					Scenic Stability				
	Very High	High	Moderate	Low	Very Low	Very High	High	Moderate	Low	Very Low
1	x	x				x	x			
2	x	x	x			x	x	x	x	
3	x	x	x			x	x	x	x	
4		x	x	x		x	x	x	x	
5		x	x	x		x	x	x	x	
6		x	x	x		x	x	x	x	
7		x	x	x		x	x	x	x	

Effects from Vegetation Management on Scenery Resources

All alternatives include vegetation management. Vegetation management activities that result in conditions outside of the historic range of variability can result in adverse effects to scenic integrity and stability and conditions which do not meet scenery objectives. Lack of vegetation management can also result in conditions of further departure from the historic range of variability and as such lower scenic stability in the long term. Effects from vegetation management can result in adverse effects in foreground, middle ground and background viewing distance zones. Short term effects are typically limited to foreground visibility of vegetation management such as cut faces and tree spacing, which can be mitigated through design and project planning. Associated activities such as logging debris skid trails and landings can result in adverse effects to scenic integrity, primarily when viewed from foreground distances. Vegetation treatments that include burning may result in short-term effects that include patches of blackened forest, scorched tree crowns, hazy skies, and smoke concentrated in some areas. Activities associated with vegetation management can be designed to meet scenic integrity standard in most conditions within 2 to 5 years following implementation.

All action alternatives include guideline SCEN-1, which states that short term reductions to existing scenic integrity levels should be authorized only when needed to achieve the long-term restoration or rehabilitation of scenic integrity and/or scenic stability.

The majority of short term impacts to scenic integrity can be mitigated through project design, however this guideline would allow for flexibility to achieve longer term stability in scenic quality. Alternatives with more acres treated to return the forested landscape to historic ranges of variability would result in longer term stability of the valued landscape characteristics but would likely have more areas of short term reduction in scenic integrity as viewed from foreground positions. The effects from the alternatives apply to each national forest.

Effects from Vegetation Management on scenery Resources for Alternatives B, E, and F

The effects of these three alternatives are similar to each other, and the magnitude is in between that of alternatives C and D for acres treated. The level of vegetation treatment anticipated may result in improved scenic stability conditions in the long term due to the emphasis on reducing fuels and treating vegetation to move it toward the historic range of variability, but at a level less than anticipated for alternative D. Vegetation management would emphasize active management in the dry forest type, creating more open stands of trees with a park-like appearance. There would be more evidence of logging, including stumps visible from tree removal, skid trails, and debris piles, but at a level less than anticipated for alternative D.

Effects from Vegetation management on Scenery Resources for Alternative C

Low levels of vegetation management anticipated for this alternative may result in improved scenic integrity conditions in the long term due to the emphasis on nonmotorized use and protection of wilderness characteristics. However, there is indication that this alternative would create a greater fire risk, increasing the likelihood of uncharacteristic wildfire. This alternative would result in larger areas of lower scenic stability than other action alternatives due to larger areas of forest left untreated outside the historic range of variability.

Effects from Vegetation Management on Scenery Resources for Alternative D

The level of vegetation management anticipated for alternative D may result in an improved scenic stability condition in the long term due to the emphasis on reducing fuels and treating vegetation to move it toward the historic range of variability. However, this alternative may create a more managed and less natural appearing landscape. Vegetation management would emphasize active management in the dry forest type, creating more open stands of trees with a park-like appearance. There would be more evidence of logging, including stumps visible from tree removal, skid trails, and debris piles.

Long-term effects may include landscapes that appear more as they might have at the turn of the century, reduced brush density, and vistas available because of reduction of vegetation density.

Effects from Other Management Activities

Visual disturbances can include road construction, mining, utilities development, recreation facilities, ski areas, and other special uses. These types of activities generally would not improve scenic integrity or stability in the long term, unlike vegetation management activities. Scenic integrity and stability desired conditions would be common to all action alternatives. The level of development of these activities is anticipated to only have negligible variations between alternatives and not to an extent that would result in different scenic integrity or stability. While access is a key issue, little to no new road construction is anticipated for any of the alternatives. All new development would be evaluated at project level planning to achieve scenic integrity and stability desired conditions.

Cumulative Effects

The implementation of the forest plans would result in indirect effects to scenery within the greater region of the Blue Mountains including the surrounding communities and public travel routes off National Forest System land. Effects to scenery would last approximately 30 years, considering lasting effects of implementation of vegetation management activities beyond the anticipated life of the plan. Past actions have created the existing scenic integrity and stability conditions. Areas modified by timber harvest in the 1980s and 1990s may in some cases continue to appear highly managed during the next 10 to 15 years and scenic integrity will remain low to very low in those areas. Reasonably foreseeable future actions that would affect scenic quality that overlap within the time and space include timber harvests off National Forest System land, wildfire and other disturbances. Timber harvest that would occur on neighboring private, state, and public lands may influence overall scenic integrity within the greater plan area. Harvest that would occur in the wildland-urban interface as directed by the National Fire Plan may also add to these effects. Wildfire and other disturbance processes, if large enough in scale and intensity, may result in decreased scenic attractiveness for a few years in those areas affected by the disturbance. Driving for pleasure and other scenery dependent activities could be affected slightly by human disturbance to areas outside the national forests. Considering the type of activities and distances from communities, the scenic backdrop above the valleys would remain generally unchanged for all alternatives. The long-term effects of implementing the forest plan combined with ongoing and reasonably foreseeable future actions would result in conditions that continue to provide the valued and restorative qualities of the landscape to forest visitors and the surrounding communities.

Heritage Program

Introduction

Humans have inhabited the Blue Mountains for more than 12,000 years. As warming climatic conditions caused glacial retreat and population increased, early hunting and gathering societies diversified. American Indian cultures in the Blue Mountains adapted as needed to environmental fluctuations within a yearly rhythm of seasonal rounds. American Indians established villages along the drainages of major rivers and utilized seasonal camps for hunting, fishing, plant gathering, and other activities. Specific places for fishing, hunting, and gathering became important. Favored areas for berry picking, root gathering, hunting, and collection of other necessary materials offered continuity with the land and affirmed spiritual beliefs.

The Blue Mountains were not pristine wildernesses prior to the arrival of non-Indian emigrants, but ecological systems in which humans had been an active component. Harvest of fish, game, and plant resources was timed to ensure future availability. Plant gathering methods increased the productivity of the soil and increased the yield of food crops. The rivers provided salmon, steelhead, sturgeon, lampreys, suckers, and trout. American Indians employed low-intensity fire as a tool to manage vegetation and enrich forage for grazing for livestock and other large mammals, and to promote growth of berries for human and animal consumption. Fire was also used to signal other tribes or send warnings, and was used in ceremonial events.

American Indian cultures in the region remained generally stable until the effects of European colonization of North America reached the area as early as 500 years ago. Long before the arrival of non-Indian emigrants in the region, European diseases swept across the area and caused significant population loss and social disruption. Several tribes adapted the horse into their culture as early as 1700. In the 1850s and 1860s, most tribes entered into treaties with the United States in which they retained their sovereignty and access to critical resources.

The Lewis and Clark Expedition in 1804 is generally considered the beginning of the historic period in the Blue Mountains. American and Canadian fur trappers followed, and Oregon Trail migration began in the early 1840s. Gold was discovered in the Blue Mountains in the 1860s and Euro-American settlement began in earnest. Mines and settlements required timber, and logging became a big industry in the area in the 1880s. Grazing and farming increased as the population grew. Mining and logging required roads and the beginnings of today’s road systems were put in place. Mining and agriculture required water, and ditches were constructed to move it to where it was needed. As the population increased, more people began visiting the national forests for recreation. In the 1930s, the Civilian Conservation Corps constructed or improved many Forest Service recreation sites in the Blue Mountains. The Forest Service also established many fire lookout towers, along with cabins and other administrative sites.

Understanding the role of humans in past and present ecosystems provides a context for understanding contemporary landscapes and natural resource issues. Cultural resources have local, regional, and national scientific interest and significance, and are elements of worldwide patterns and processes. Beyond scientific value, these sites offer a tangible connection to history and culture as well as a sense of place. Cultural resource sites, objects, and areas have an intrinsic value to people whose ancestors used and occupied the lands. The heritage program ensures that significant archaeological and historical resources are identified, protected, and preserved for the inspiration and benefit of present and future generations.

Affected Environment – Heritage Program

Cultural resources are categorized into three broad types: prehistoric site, historic site, or traditional cultural property. A prehistoric site is one that was established before the advent of a continuous written record, or before approximately 1800 in this area. A historic site postdates this time. A traditional cultural property is associated with cultural practices or beliefs of a living community, is rooted in that community's history, and is important in maintaining the continuing cultural identity of the community.

Prehistoric and historic sites and traditional cultural properties that are eligible for listing on the National Register of Historic Places (NRHP) are considered historic properties under the National Historic Preservation Act (NHPA) and are managed and protected under that law. Cultural resources for which NRHP eligibility has not yet been determined are managed as historic properties until a determination is completed. The most significant and historic properties can be identified as priority heritage assets and would be proactively monitored and managed.

In order for a cultural resource to be eligible for listing on the NRHP, a district, site, building, structure, or object must meet at least one of four criteria. Sites that qualify for listing include sites:

A. That are associated with events that have made a significant contribution to the broad patterns of our history

B. That are associated with the lives of persons significant in our past

C. That embody the distinctive characteristics of a type, period, or method or construction, or that represent the work of a master, possess high artistic values, or represent a significant and distinguishable entity whose components may lack individual distinction

D. That have yielded, or may be likely to yield, information important in prehistory or history

Sites must also possess integrity of location, design, setting, materials, workmanship, feeling, and/or association.

More than one-third of all cultural resource sites identified on National Forest System lands within Oregon and Washington are located in the Blue Mountains national forests (table 392).

Prehistoric sites common to the Blue Mountains include quarries, tool manufacturing sites, hunting camps, fishing stations, plant gathering and processing sites, rock art sites, villages and sites resulting from other types of activities. Historic sites in the area include, but are not limited to homesteads, mines, railroads, cabins, corrals, lookout towers, and Forest Service administrative sites. Traditional cultural properties include sites, districts, buildings, structures or objects that are valued by human communities for the role they play in sustaining a community's cultural integrity and could include plant gathering sites, fishing stations, a rural community or a rodeo ground. The exact number and kind of cultural resources in the Blue Mountains is not known. Additional cultural resources will continue to be discovered and evaluated as surveys are completed for potential management activities.

Educational and volunteer projects, such as the Forest Service's Passport in Time program, foster public participation in identifying, understanding and protecting cultural resources.

Table 392. Identified cultural resource sites within the Blue Mountains national forests

National Forest	All Sites	NRHP Eligible Sites	NRHP Ineligible Sites	Unevaluated Sites	NRHP Listed Sites	Priority Assets	Interpreted Sites
MAL	5,125	2,274	399	2,433	19	207	8
UMA	1,914	691	122	1,100	1	7	3
WAW*	4,377	701	753	2,921	2	6	10

* Does not include sites in the Hells Canyon National Recreation Area.

Environmental Consequences – Heritage Program

Effects Common to All Alternatives

Potential risks to cultural resources include development, public use, looting and vandalism, management activities, timber harvest, cattle grazing, and mining, along with natural processes such as erosion by wind and water, weathering, and wildfire. Cultural resource surveys during the planning phase for site-specific projects and prior to ground disturbance can identify previously unknown cultural resources and require changes to the operating plan that mitigate potential damage. Potential effects to cultural resources from project activities are addressed through project-specific mitigation measures during the project planning process. Though the potential to effect cultural resources always exists, under all alternatives cultural resources are carefully managed to avoid or mitigate adverse effects whenever possible.

All alternatives would provide management direction for cultural resources in a manner consistent with the laws, executive orders, and regulations listed previously. Cultural resource inventories are part of the analysis process for management activities and known significant sites are protected during implementation of those activities. Though concerted efforts are made to avoid damaging cultural resources during Federal undertakings or authorized actions, in rare instances inadvertent impacts or damage may occur. Unanticipated indirect effects may occur in some instances, such as providing new or improved access to an area, which increases the potential for illegal collection of artifacts or vandalism, and modifying vegetative cover, which may increase the potential for damage due to erosion or decay.

The Heritage Program will be managed to national standard based on a national forest specific mix of the following seven indicators:

1. A Heritage Program plan would be developed and maintained by each national forest (FSM 2362.3).
2. Lands where cultural resources are most likely to occur would be surveyed (FSM 2363.03, 2363.1).
3. Legacy cultural resources would be evaluated for eligibility for listing on the National Register of Historic Places (NRHP) and historic properties would be nominated for NRHP listing (FSM 2363.2, 2364.41).
4. Condition assessments for priority heritage assets, including allocation to the appropriate management category, would be accomplished (FSM 2362.4, 2363.3, 2366).

5. Stewardship activities would preserve, protect, and enhance historic properties (FSM 2364.36, 2364.42).
6. Opportunities for study and appropriate public use of cultural resources including research, traditional use, and interpretation would be provided (FSM 2364.43, 2365.2).
7. Volunteer opportunities would be provided (FSM 2365.2).

By managing the Heritage Program for the Blue Mountains national forests to national standards, the Forest Service will work to ensure that cultural resources are identified and protected for future generations.

Effects Specific to Alternative A (No-action Alternative)

Management Direction

All 1990 forest plans have goals that provide for the identification, protection, interpretation and management of significant cultural resources consistent with the legal framework described previously. There are no management area allocations specific to cultural resources in any of the 1990 forest plans.

The Malheur National Forest 1990 forest plan includes the historic Sumpter Valley Railroad site in special interest areas along with geologic, botanical, and other unique sites.

The Umatilla National Forest 1990 forest plan includes the Greenhorn area, Olive Lake-Freemont Powerhouse area, and Target Meadows in special interest areas along with botanical areas, viewpoints, and other unique areas.

The Wallowa-Whitman National Forest 1990 forest plan does not recognize historic sites specific to any management area allocation.

Effects from Alternative A

Management direction would continue the inventory, documentation, evaluation, and protection of cultural resources at current levels. Additional sites would continue to be found as surveys are done during project analysis. The cultural resources identified as part of special interest areas would continue to be identified with areas that have other resource values.

Effects Specific to Alternatives B, C, D, E, and F

Management Direction

Historical areas have historic sites, buildings, or objects of significance. The specific areas identified for their historic or prehistoric value would be protected and enhanced, and, where appropriate, public use and enjoyment would be fostered. Historical areas would be added as a management area allocation (MA 2E) under these alternatives.

Effects from Alternatives B, C, D, E, and F

Indirect effects to cultural resources from alternatives B and F would be similar to alternative A. Alternatives D and E, due to the proposal of more intensive management, would have a greater likelihood of identifying additional sites, but the likelihood that those management activities would damage sites is greater, as described previously. Alternative C, due to the proposal of fewer management activities and likely lower use levels by the public, would have the lowest potential for damaging cultural resources, but also would have the lowest potential for identifying additional sites.

Effects from Other Resource Management Areas

Potential Effects from Aquatic Resources Management on Cultural Resources

Cultural resources generally benefit from management actions that improve the stability and functionality of watersheds. This reduces erosion and stabilizes stream banks. Cultural resources have a high probability of occurrence along streams. Management actions that require ground disturbance or the use of heavy machinery have the potential to adversely affect cultural resources.

All alternatives would allocate miles of riparian area improvement and vary by alternative. Effects to cultural resources from riparian area improvement would be greatest in alternatives A, B, and D (the least amount of restoration miles), are intermediate for alternatives E and F, and are the least for alternative C (largest amount of restoration). Effects to cultural resources from ground disturbance associated with restoration activities would be reduced, eliminated, or mitigated through project specific protection measures and mitigation.

Potential Effects from Wildfire Management on Cultural Resources

Fire suppression activities have a high potential to adversely affect cultural resources. Fire lines, helicopter landings, camp locations, and other fire suppression actions may adversely affect cultural resources. Wildfires have a high potential to adversely affect historic structures, such as ranches, homesteads, and mining structures. Prehistoric cultural resources, such as rock art, can be damaged by heat and smoke generated by wildfire, as well as by post-fire erosion. Post-fire management activities that promote rapid growth of ground cover can stabilize sites and reduce their visibility, thereby reducing their vulnerability to looting and vandalism.

The location of cultural resources related to vegetation type plays a role in the possible effects to sites. The temperature and duration of fire affects soil temperature, and buried archeological remains may be seriously affected by high temperatures and long fire duration. Fires in grasslands are generally of short duration and cooler temperatures, and have fewer effects. Fires in forested vegetation types are usually more intense and of longer duration than those in grasslands, and have the potential for greater effects.

Wildfire consists of unplanned ignitions. Although the occurrence is unplanned, mitigation measures to reduce the effects to cultural resources include a program of pre-incident survey of potential fuelbreaks and other fire suppression-related activity locations. Where heritage resources are found, programmatic agreement standard protection measures such as project redesign, relocation and monitoring would be used to protect the affected heritage resources. Inventories should also occur on those incident activities not previously inventoried prior to the completion of the incident. Effective treatment measures should be used to rehabilitate fire suppression-related ground disturbance.

Potential Effects from Preliminary Administratively Recommended Wilderness Areas Allocations on Cultural Resources

Wilderness areas are subject to far fewer land management activities than other multiple-use areas. Activities related to recreation use, such as dispersed camping, trail construction and maintenance, and hiking, along with livestock grazing and wildfire, can affect cultural resources in designated wilderness areas, but little other active management takes place in those areas. Few effects to known and unknown cultural resources would take place from these activities.

The majority of new cultural resource sites are identified during archaeological inventories conducted for proposed management activities, the majority of which are conducted in areas located outside of designated wilderness. In wilderness areas new sites are discovered during inventories that are often conducted for the sole purpose of identifying cultural resources. This type of inventory is generally conducted by the heritage program staff, often with the assistance of volunteers, using dedicated heritage program funds. The frequency and extent of surveys within wilderness is dependent on funding which varies annually, but generally is relatively limited compared to the number of surveys conducted for site-specific projects for identification purposes per Section 106 of the National Historic Preservation Act.

Alternative C would allocate the largest amount of area to preliminary administratively recommended wilderness (MA 1B), followed by alternatives E and F (equal amounts), and alternative B with the least amount. Both alternatives A and D do not allocate any acreage to MA 1B. In general, alternatives that allocate larger amounts of acreage to MA 1B would conserve cultural resources, but reduce the opportunity for identification, and may increase the potential for wildland fire to affect cultural resources. Conversely, those alternatives with either an intermediate or lesser amount of acreage allocated to MA 1B would still allow for cultural resource conservation achieved through applying cultural resource protection laws and programmatic agreements. The opportunity for identification through project specific undertakings may increase, and effects from wildland fire would likely remain at the same levels through all alternatives.

Potential Effects from Livestock Grazing on Cultural Resources

Domestic livestock can affect both historic and prehistoric cultural resources. Potential impacts include: removal of surface vegetation, compaction or compression of archeological deposits, alteration of soil chemistry, livestock trailing or cutting through archaeological deposits, destruction of historic structures by rubbing or trampling, and breakage of historic and prehistoric artifacts from trampling.

All alternatives would allocate acres suitable for permitted cattle and sheep grazing and vary by alternative. The number of permitted animal unit months also varies by alternative. Effects to cultural resources from livestock grazing would be greatest in alternative D, are intermediate for alternatives A, B, E, and F, and are the least for alternative C.

Potential Effects from Recreation And Access on Cultural Resources

Cultural resource vandalism and looting are potential impacts resulting from access and visitor use. Construction and maintenance of roads, trails, campgrounds, and other developed facilities may also impact cultural resources. Prehistoric and historic cultural resources are often found in optimum locations for developed recreation sites. Dispersed recreation may also impact cultural resources as modern camps are often located on prehistoric sites. Vandalism in the form of target practice or use for firewood often damages historic structures. Interpretation of these sites can reduce the adverse effects from recreation use.

Alternatives that provide for the greatest amount of road maintenance and the highest levels of access would have a greater effect on cultural resources. Effects to cultural resources from recreation and access would be greatest in alternative D, are intermediate for alternatives E and F, are slightly less than intermediate for alternatives A and B, and are the least for alternative C.

Potential Effects from Vegetation Management on Cultural Resources

Vegetation management involves ground disturbance ranging from minimal disturbance for some activities, such as noncommercial thinning and reforestation activities, to high disturbance for other activities, such as construction of access roads, skid roads, trails, and landings, and the felling of trees and the skidding of logs. Potential impacts to cultural resources include soil compaction, soil erosion, streambank erosion, surface mixing of soils, and damage to above- and below-ground features. These impacts are reduced, eliminated, or mitigated through project specific protection measures and mitigation.

Alternatives that contribute to the greatest amount of vegetation management would have the greatest potential to effect cultural resources. Effects to cultural resources from vegetation management would be greatest in alternative D, followed second by alterative E, and both alternatives F and B are similar and effects would be slightly less than alternative E. Alternative C would have the least effect.

Cumulative Effects

The cumulative effects analysis area includes all of northeastern Oregon, southeastern Washington, and western Idaho, including all of the Malheur, Umatilla, and Wallowa-Whitman National Forests, and the time period considered was the planning period. The Hells Canyon National Recreation Area (HCNRA), under the administration of the Wallowa-Whitman National Forest, contains thousands of prehistoric sites and historic sites. The HCNRA Comprehensive Management Plan (CMP), a part of the Wallowa-Whitman National Forest 1990 forest plan, includes added protections for these sites. All sites on all three national forests would be managed in accordance with laws, regulations, executive orders, and Forest Service policies and management direction.

Development of lands not protected by Federal or state cultural resource statutes and regulatory protection could decrease the regional resource base and lead to loss of resources. Cultural resources within the national forests could increase in value and significance as sites outside the national forests are developed or destroyed. Cultural resources are nonrenewable. Cumulative effects could occur through incremental degradation of the resource base on both public and private lands. Identification of significant cultural resource sites on public lands and the preservation and protection of those sites should reduce the downward trend of the cultural resource base and reduce the cumulative effects from management activities across the landscape.

Geology, Mining, Minerals, and Energy

Geologic resources in the Blue Mountains include leasable energy minerals, such as oil, natural gas, coal, and geothermal; saleable minerals, such as sand, gravel, and other rocks, used in the construction and landscaping industry; and locatable minerals, such as gold, silver, and other precious and base metals.

Oil and gas resources are known or suspected to occur in a deep sedimentary basin that underlies parts of the Malheur and Wallowa-Whitman National Forests, and all of the Umatilla National Forest. The potential extent of these resources has been estimated on a broad regional scale, but little interest or exploration has taken place to date near or within the National Forest System lands.

To date there has been very little coal development on National Forest System lands in the Blue Mountains. Coal deposits are known in the Troy and Flora areas, and west of Ukiah in the Arbuckle coal field. These coal deposits have been explored in the past, with little indication that the deposits on National Forest System lands are of economic value. There are no active, proposed, or anticipated coal mining or coal bed methane operations on National Forest System lands.

Geothermal resources exist throughout the Blue Mountains, revealed in numerous hot springs and warm water wells. This indicates the presence of a widespread shallow geothermal resource. This resource is not limited to surface manifestations, such as hot springs, but rather appears to occur throughout the area even where there are no surface indications. The potential for geothermal energy development in the Blue Mountains national forests area is rated as medium to high (DOE 2003).

Areas with potential for wind energy development have been mapped by the Department of Energy, and the most extensive areas with wind energy development potential occur outside the national forests rather than within them. Many areas outside of the forests have been developed in recent years. The areas with highest potential for development on National Forest System lands are generally found at higher elevation, on ridgelines or other open areas, and many of these areas are likely to be either legally excluded from development or within management areas with limited suitability for placement of wind towers and associated utility lines.

Saleable common variety mineral resources exist throughout the Blue Mountains. The over-abundance of volcanic basalt and andesite formations in many areas make this type of resource readily available, but there are some areas of the national forests where high quality materials for construction or road aggregates are rare and not locally available.

Locatable mineral resources occur on all three national forests, but are primarily concentrated in a broad linear path beginning southwest of John Day, and extending northeast through Sumpter, Granite, Unity, Baker City, across to Durkee, Halfway, through the Eagle Caps, and exposed in the bottom of Hells Canyon. These deposits are closely associated with Jurassic age intrusive rocks. Gold, silver, copper, chrome, zinc, and other metals have been produced from placer and lode mines this area.

Affected Environment

Mineral Resources

Leasable Minerals, Oil and Gas

Oil and natural gas resources are known to occur within Mesozoic-age sedimentary rocks in the Columbia basin of Oregon and Washington in areas overlain by up to three miles of Columbia River basalts. Parts of this resource (with a low to moderate potential for development) underlie the Malheur and Umatilla National Forests and parts of the Wallowa-Whitman National Forest. An assessment of the undiscovered gas resources in this basin was completed and documented in a 2008 report by the U.S. Geological Survey (USGS 2008). Based on that assessment, only about 10 percent of the total potential gas resources are located in a 22.2 million acre region that includes portions of the Blue Mountains National Forest System lands. The other 90 percent of potential gas is located in a much smaller (approximately 4 million acre) region located northwest of the Blue Mountains national forests in the Pasco Basin of eastern Washington. Based on that assessment, the potential for occurrence of gas oil resources on the Blue Mountains national forests is moderate to low, and the development potential is likely low to very low, although it is possible that this could change in the future.

The Oregon Department of Geology and Mineral Industries (DOGAMI) records indicate a number of exploratory permits have been issued in Grant, Harney, Baker, and Umatilla counties, mostly in the 1950s. For some of these sites the records are incomplete, but none of them are known to have been on National Forest System lands, or successfully developed into production wells. There are no current or pending leases for gas or oil exploration on the Blue Mountains national forests.

The Forest Service has made oil and gas leasing decisions for Umatilla and Malheur National Forests (USDA FS 1995), which categorized all of those lands as either (I) open to development subject to the terms and conditions of the standard oil and gas lease form, (ii) open to development but subject to additional constraints, or (iii) closed to leasing, distinguishing between those areas that are closed through exercise of management direction, and those closed by law, regulation, etc. (36 CFR 288.102 (c)), such as wilderness areas and wild river corridors.

For the Umatilla and Malheur National Forests, all lands classified no lease in the 1995 leasing analysis and record of decision should be classified as unsuitable for oil and gas development. All other lands would be classified as generally suitable, although more recent information suggests that development potential on these lands is likely low to very low. It should be noted that portions of the 1995 leasing decision may need to be revisited prior to leasing under that decision, due to potential significant new information or circumstances as defined in 40 CFR 1502.9 requiring further analysis (36 CFR 228.102(e)).

For the Wallowa¬-Whitman National Forest, all existing wilderness areas and wild river corridors would be classified as unsuitable for oil and gas development. Areas that are outside of these existing wilderness areas and wild river corridors would be classified as general suitability not determined because an oil and gas leasing decision for this forest has not yet been made. Leasing suitability may be determined in the future pending a leasing analysis and decision. New information suggests that development potential of lands within the Wallowa-Whitman National Forest is low.

Geothermal Resources

All areas of the Malheur, Umatilla, and Wallowa-Whitman National Forests have medium to high potential for geothermal resource development (USDOE, 2003). Some of the better known hot springs in the Blue Mountains national forests area include the Blue Mountain Hot Springs near Prairie City, Medical Springs east of North Powder, Hot Lake Springs near La Grande, Radium Hot Springs near Haines, Ritter Hot Springs near Ritter, Suplee Hot Springs near Weberg, and Lehman Hot Springs between Ukiah and La Grande. None of these hot springs are on National Forest System lands, but some are very close to the national forest boundaries, and Lehman Hot Springs is on a private inholding within the Umatilla National Forest. There are other known geothermal springs located on National Forest System lands but most are relatively low temperature sources, or warm springs rather than hot springs. Geothermal areas with known high temperature water (>90 degrees Celsius), either near the land surface or at depth may have higher development potential than other geothermal resources. In the vicinity of the Blue Mountains the areas mapped as having known or potential high temperature geothermal sources are near Vale, Oregon and Hot Springs Lake near La Grande, Oregon (NREL 2009). There are no other known high temperature geothermal areas in northeastern Oregon or southeast Washington.

The Oregon Department of Geology and Mineral Industries (DOGAMI) records indicate that two permits for geothermal exploration were issued in Union County in 1974. One was cancelled and the records for the other are incomplete, but neither of them are known to have been on National Forest System lands, or successfully developed into production wells. There have been many permits issued in eastern Oregon by DOGAMI since the 1990s, but all of those have been issued in Deschutes, Harney, Lake, and Klamath counties. There are no current geothermal leases within the Blue Mountains national forests, and none have completed a geothermal leasing analysis to date.

As with oil and gas, geothermal leasing of National Forest System lands can only occur with the consent of, and subject to conditions prescribed by, the Secretary of Agriculture. All lands administered by the Secretary of Agriculture (including all National Forest System lands) are subject to geothermal leasing (30 U.S.C. § 1002), subject to certain prohibitions which include wilderness areas, certain wilderness study areas, national recreation areas and wild river corridors of designated wild and scenic rivers. All of these lands would be classified as unsuitable. All other lands outside of these areas would be classified as general suitability not determined. Leasing suitability may be determined in the future pending a leasing analysis and decision.

Coal

To date there has been very little coal development on National Forest System lands in the Blue Mountains. Coal deposits are known in the Troy and Flora areas, and west of Ukiah in the Arbuckle coal field. These coal deposits have been explored in the past, with little indication that the deposits on National Forest System lands are of economic value. There are no active, proposed, or anticipated coal mining or coal bed methane operations on National Forest System lands.

Locatable Minerals

Historically, about 75 percent of all of the gold mined in Oregon has come from within broad zone extending from Canyon Creek, near John Day, Oregon, north across the Middle and North Forks of the John Day River to the vicinity of Granite, Oregon and east across the Elkhorn Mountains and the southern Wallowa Mountains to the Snake River. Placer mining has occurred in Canyon Creek, the Upper, Middle and North Forks of the John Day River, North Fork and lower Burnt River, Eagle Creek and Pine Creek, and the upper Grande Ronde River. Each of these areas is associated with, or downstream of major areas of past gold production (Ferns and Huber 1984). Gold mineralization in the Blue Mountains may have resulted from multiple geological sources, but many of the areas of gold mineralization are associated with late Jurassic and older granitic rocks (Ferns and Huber 1984).

Gold has been produced from placer deposits and hard rock or lode deposits within and outside of the National Forest System lands. Many claims were patented, whereby they became privately owned land within the national forest boundaries. Mining activity in this area became relatively large scale in the early 1860s, with the most active period between 1895 and 1908. There were in intervals where activity increased and decreased up until about 1954, after which production dropped of drastically. Exact figures were never recorded for early gold production from the Blue Mountains, as much of the gold was sent to a mint in San Francisco and was credited to California. But it has been estimated that approximately $23 million in placer gold and $5 million in lode gold had been produced from mining operations in Grant and Baker counties by 1900. The estimated dollar value for placer and lode gold produced from the area between 1900 and 1965 is $47 million (Orr and Orr 2000). Ferns and Huber (1984) gold production of 480,000 ounces from placer mining 1913 and 1954 with about 60 percent of that production coming from the upper Powder River.

Gold and silver are often found within the same ore deposits, and there was at least $2 million dollars of silver produced from within the Blue Mountains between 1900 and 1965. There has also been some production of copper, mostly from the Iron Dyke mine near Homestead, as well small amounts of chrome, zinc, and other metals from mines within the Blue Mountains national forests. There are also many isolated gold and other metal deposits, including mercury, which were discovered and mined outside of the main mineralized areas in the Blue Mountains. These isolated deposits include the Idol City Mining District northeast of Burns, the Roba-Westfall, Roba Brothers, and York and Rannels mercury mines southwest of John Day, and others.

Locatable mineral development is authorized under the US Mining laws. Locatable mineral development is precluded from lands withdrawn from mineral entry under the US mining laws, subject to valid existing rights. This means that locatable mineral development can occur in wilderness areas, wild river corridors, areas of unique and special characteristics, and other lands withdrawn from mineral entry, provided valid existing rights have been determined. Lands withdrawn from mineral entry would be classified as generally unsuitable for locatable mineral development, and all other National Forest System lands would be classified as generally suitable for locatable mineral development.

By law, individual lode claims must not exceed 1,500 by 600 feet, and placer claims cannot exceed 20 acres, with the exception that an association placer claim can be up to 20 acres per co-locater up to a maximum claim size of 160 acres.

Locatable mineral development is highly dependent upon global mineral commodity values, which greatly determines the number of claims and approved operations at any given timeframe. According to BLM records as of March of 2011, the Malheur National Forest had 84 locatable mineral claims, the Umatilla National Forest had 34, and Wallowa-Whitman National Forest had 748. Approved plans of operations are required on claims where significant disturbance to surface resources are proposed, and NEPA must be completed before the activities can proceed. As of March of 2011, the Malheur National Forest had 2 claims with plans of operations submitted, the Umatilla National Forest had about 18, and the Wallowa-Whitman National Forest had approximately 170. A large majority of the submitted plans of operations for the Umatilla and Wallowa-Whitman National Forests are pending NEPA decisions, and there are currently three environmental impact statements in progress for about 100 different operating plans on those national forests.

The number of current claims on the national forests is less than it was 10 years ago, at least partly because the BLM has increased the fees required to file a claim and keep it active. While it is not reasonable to try to predict how these numbers might change in the next 10 to 15 years, with the value of gold generally rising (greater than $1,600 per ounce in early 2012), the level of interest and inquiries by the public has increased substantially in recent years.

Saleable Minerals

Saleable or common variety mineral resources exist throughout the Blue Mountains. These are usually low unit value materials and typically need to be located both near existing transportation routes and the point of use to be economically viable. Usually basalt and andesite are the most desirable materials for use as construction materials and road aggregates. These rock types are abundant in many areas of the national forests but scarce to nonexistent in other areas, where other rock types may be used despite having less desirable qualities. There are also some deposits of sand, gravel, limestone, and rock suitable for landscape or building stone and limestone that occur within the national forests.

The national forests have an extensive network of common variety materials sources that were developed over time in conjunction with development of national forest transportation systems. The total number of these sources on the three Blue Mountains national forests probably exceeds 500, but many are considered inactive or have not been used for many years. Some of the sources are located near state and Federal highways or major county roads and have been used extensively by those agencies as well. Use of these types of sources is down dramatically compared to when the national forest transportation systems were being rapidly expanded. They are still used intermittently by the national forests for in-service uses, and a few sources are still used frequently by other government agencies, usually through issuance of free-use permits.

Common variety minerals are also available through the issuance of small free-use permits to individuals or sales to private parties for personal or commercial uses, but the amount of materials disposed of through these permits is usually relatively minor.

Sales, free use, or in-service use of mineral materials would not meet the management objectives of withdrawn National Forest System lands, RARE II roadless areas, and areas of unique or special characteristics. These lands would be categorized as unsuitable for mineral material development. All other lands would be classified as generally suitable. Some expansion of the boundaries or size of active common variety minerals sources is likely to occur in the next 10 to 15 years, but the development of new sources is expected to be relatively rare unless an unforeseeable demand should occur.

Other Energy

Wind Energy

The Energy Policy Act of 2005 encourages energy development in acceptable areas. Interest in wind energy development in the Pacific Northwest has increased greatly in the last 5 years. During that time, wind tower installation has proceeded rapidly at sites along the Columbia River in Oregon and Washington, in Baker Valley, and several other sites surrounding National Forest System lands in northeast Oregon and southeast Washington. If location and development of wind towers on National Forest System lands occurs in the future, it will be guided by provisions of the Forest Service Special Uses Handbook (FSH 2709.11, chapter 70). Specific provisions in FSH2709.11 for wind energy do not exist at the time of this writing. But some terms and conditions currently in chapter 50 of the Special Uses Handbook are likely to apply to wind energy development as are other agency regulations.

In general, the most extensive areas with potential for wind energy development occur outside of the national forests rather than within them. The areas with highest potential for development on National Forest System lands are generally found at higher elevation, on ridgelines or other open areas. Most sites with high wind potential are also likely to be within management areas with limited suitability for placement of wind towers and associated utility lines. Any development that may occur would require special use authorization and prior approval by the appropriate authority, either district ranger or forest supervisor. Even though specific terms and conditions for wind energy special use authorization have yet to be developed by the Forest Service, the general terms and conditions likely to apply are known and can be used accordingly.

Suitability for Wind Energy Development (All Alternatives)

High resolution wind energy potential maps are available from the Department of Energy, National Renewable Energy Laboratory (NREL). Not taking into account management area designations, areas with potential for development of wind energy total 388,500 acres on National Forest System lands on the three national forests (Malheur National Forest: 39, 114 acres; Umatilla National Forest: 168,500 acres; and Wallowa-Whitman National Forest: 181,000 acres). Wind energy development will be generally unsuitable on sites where development is incompatible with desired conditions, where unacceptable impacts cannot be mitigated, or in areas where development is legally excludes, such as in in Congressionally Designated Wilderness Areas. The following criteria are used to determine general suitability of particular management areas for wind development on National Forest System lands.

- Forested sites, areas with slopes greater than 20 percent, and valley bottoms generally do not have high wind exposure and will likely have low wind power classes. This information was used in the creation of the wind power class maps.
- Designated wilderness areas, proposed or potential wilderness areas, wild and scenic river corridors, and inventoried roadless areas are either legally excluded from wind energy development or are areas where wind energy development would be limited by available road access, and new road construction would be inappropriate.
- Areas with existing high scenic value within Scenic Classes 1, 2, and 3 are unsuitable due to the desire to maintain scenic integrity.
- Key watersheds may or may not be excluded due to a limitation on increasing road density above current levels.
- Municipal watersheds are guided by existing agreements between the agency and individual cities. Energy development would require approval by the cities and development could only occur under the provision that drinking water quality is protected.
- In some areas, for example in elk winter or summer range, motor vehicle access is limited during specific time periods. This limitation may not by itself determine suitability of a site for development, but may influence how sites are developed, and would place seasonal restrictions on motor vehicle access.
- Botanical areas are managed to preserve specific vegetative characteristics. Disturbance that would degrade these characteristics, including but not limited to siting of utility corridors or placement of high-voltage power lines, would not be a compatible use.
- Geological areas are managed to preserve specific geological features and development that could degrade these features would not generally be allowed.
- Motor vehicle use is generally not allowed within research natural areas and motor vehicle access would not be appropriate in the Starkey Experimental Forest and Range.
- Access or proximity to existing utility corridors and, more specifically, high-voltage power lines may be a prerequisite for development.

Wilderness areas (MA 1A), proposed recommended wilderness areas (MA 1B), wilderness study areas (MA 1C), wild and scenic rivers (MA 2A), and backcountry areas (MA 3A and 3B) would be generally unsuitable for wind energy development because such use would either conflict with the purpose for which an area was designated, or would be inconsistent with the intended uses of the area. Wind energy development in special areas (MA 2A through MA 2J) would normally be inappropriate, with few exceptions, as such development would likely be inconsistent with the intended use, or would be difficult to implement while still protecting the intended use of each area. Administrative sites may or may not be suitable sites for placement of individual wind towers but would likely not be suitable sites for commercial-scale wind farms.

Areas of the national forests that are likely to be suitable for wind development will generally be in MA 4A General Forest. Areas within MA 4A with wind power classes of 3 or higher include nearly 122,000 acres of National Forest System lands on the three national forests (Malheur National Forest: 9,505 acres; Umatilla National Forest: 79,104 acres; Wallowa-Whitman National Forest: 33,184 acres). Other considerations that may restrict the suitable area even further, include, but are not limited to:

- Cultural resource protection
- Protection of treaty and tribal trust resources
- Scenic integrity
- Protection of wildlife habitat
- Elk habitat, including summer and winter range, and elk calving areas
- Lookouts and communications sites
- Protection of threatened, endangered, and sensitive species
- Unstable sites
- Proximity to or ability to construct utility lines
- Road access

Sites with wind power classes of 3 and higher, are generally limited to MA 4A and comprise roughly 55 percent of National Forest System lands on the three national forests. It is possible, due to the scale of mapping that there are localized areas within wind power class 2, which could have potential for wind energy development. Protection measures for individual resources may exclude additional areas from consideration, based on project-level analysis. Oregon, Washington, Idaho, U.S. Fish and Wildlife Service, U.S. Bureau of Land Management, and U.S. Department of Energy all have siting criteria and other information that can be used in the assessment of wind energy projects.

Other Geologic Resources

Fossils

Invertebrate fossils and plants are found in sedimentary rocks and ash deposits within the National Forest System lands in the Blue Mountains national forests. Invertebrate marine fossils are common in some of the Jurassic and Triassic formations in sedimentary and meta-sedimentary rocks, typically ammonites, bivalves, and others. Only rarely have vertebrate fossils have been documented to have been found on National Forest System lands, notably an Ichthyosaur from the Triassic Martin Bridge Limestone near Eagle Creek within the Wallowa-Whitman National Forest, and the upper jaw of a Jurassic reptile, tentatively identified as a small crocodile, discovered in 2010 near Delintment Lake in a marine sandstone deposits within the portion of the Ochoco National Forest administered by the Malheur National Forest. While known discoveries of invertebrate fossils to date are rare within the Blue Mountains national forests, there has been relatively little paleontological research done in many areas which have geologic formations that are favorable for discovering more of these types of fossils.

The John Day Fossil Beds National Monument, which is located west of the Blue Mountains national forests, is famous for its plant and animal fossils from the Clarno and John Day formations, which include vertebrate fossils, such as dogs, cats, camels, rhinoceroses, horses, turtles, and others.

Current guidelines relative to fossils are based largely on the Organic Act of 1897, the Preservation of American Antiquities Act of 1906, NEPA, and the some recently proposed regulations for preservation of paleontological resources. These guidelines allow common invertebrate and plant fossils to be collected in small quantities by the public for noncommercial personal use without a permit, but those collecting activities are restricted to surface collection or use of small, non-powered hand tools that would result in negligible surface disturbance. Vertebrate fossils (bones, bone fragments, teeth, and/or tracks) are not available for collection by the public, and commercial fossil collection is not permitted on any National Forest System lands. Collection of vertebrate, invertebrate, plant, and/or trace fossils as part of scientific studies, mitigation or conservation efforts is allowed only by qualified researchers that have been issued permits for specific projects or research.

Petrified Wood

Petrified wood is known to occur in many localities on the Blue Mountains national forests, including within the Clarno Formation and in some formations with deep volcanic ash deposits. Portions of standing petrified trees have been discovered in a few locations. Petrified wood is defined as a mineral material with 1962 amendment to the Mineral Materials Act of 1947. With current regulations, no permit is required to collect petrified wood specimens for private purposes or use from National Forest System lands, providing that such collection does not result in any disturbance of any archaeological resource. The BLM does have a policy that limits free collection to “up to 25 pounds per day plus one piece, but no more than 250 pounds per year,” but the Forest Service does not have any national policy that regulates petrified wood differently than other common variety minerals.

Groundwater

Groundwater potential is largely unexplored and undeveloped in the National Forest System lands of the Blue Mountains national forests. The groundwater potential can be assumed to be highly dependent on the hydrogeological and geologic properties of local and regional formations. For example, metamorphic and the older volcanic formations would generally have low permeability aquifers with low hydraulic conductivities, and many wells in these materials would usually yield only a few gallons per minute. On the other hand, the younger volcanic rocks, and in particular the Columbia River Basalts, have been heavily developed on private lands around Hermiston, Pendleton, Athena, Milton-Freewater, Walla Walla and in the Grande Ronde Valley in Union County. Irrigation wells completed in each of these areas typically yield between 500 and 2000 gallons per minute. Withdrawal from the basalt aquifers in some areas of this formation have caused local water level declines up to or exceeding 300 feet (Snyder and Haynes 2010).

Groundwater resources have seen only very minor exploration and development on the National Forest System lands of the Blue Mountains national forests to date. Small volume wells for campgrounds and administrative sites are currently the most common uses of groundwater within the national forests. There are also a few wells that were drilled specifically for fire suppression and road construction and maintenance activities within the portion of the Ochoco National Forest administered by the Malheur National Forest. The Malheur National Forest currently has about 20 special use permits issued that allow spring developments on National Forest System lands for domestic water supplies, and there are numerous spring developments for stock watering as well.

Indirect and Cumulative Effects

Effects Common to all Alternatives

Energy and mineral development can have significant effects to physical and biological resources. Those effects are discussed in other sections of this document. The alternatives vary in their influence on mineral, geological, and energy resources primarily through differences in management area designation, as follows:

Leasable Minerals

Oil and Natural Gas. Approximately 1.2 million acres of the Umatilla National Forest and 1.35 million acres of the Malheur National Forest were identified as available for oil and gas leasing (USDA FS 1995). These lands are subject to one of four lease stipulations imposed to protect surface resources. Under the Federal Onshore Oil and Gas Leasing and Reform Act of 1987 (P.L. 100-203), identification of lands available for leasing is the first of four required stages, each requiring a separate environmental analysis, before energy production can occur on National Forest System lands. However, the lands identified in the 1995 analysis were not formally made available for lease; at least parts of that analysis would likely be redone using the management area designations of the selected alternative. In 1995, it was expected that there may be one application for permit to drill on each forest. This has not occurred and it is unknown if an application for permit to drill would be expected over the next 10 years, given the updated information now available on the potential occurrence of oil or natural gas. The potential for oil and gas resources beneath the Malheur and Umatilla national forests is now lower than it was believed to be in 1995, there is a low to moderate potential for development and it is still likely that no exploration interest in the resource will occur until a discovery is made in the area of the basin with the highest potential for occurrence (the Pasco Basin).

For rivers identified as eligible for inclusion in the national Wild and Scenic River system, any leases, licenses and permits under mineral leasing laws would be subject to the conditions necessary for the protection of the values of each identified river corridor in the event it is subsequently included in the national system. Eligible rivers may not be legally excluded from mineral entry (except for areas within ¼ mile of wild rivers once they are officially designated), but may be classed as areas in which no surface occupancy is allowed for mineral leasing. The rivers to which this would apply are listed in tables A-28 and A-29 in appendix A.

The acres of preliminarily administratively recommended wilderness areas on each forest are identified in tables A-22, A-23, and A-24 in appendix A. Total recommended wilderness acres for each forest are summarized by alternative in table A-25. No change in the status of these lands, or their availability for mineral leasing would occur until they are recommended, and officially designated as wilderness by Congress. At that time they may be legally excluded from leasing. There would be no effect from alternatives A or D, since they do not include any recommended wilderness acres. There would be no effect to the Wallowa-Whitman National Forest, because the resource is not known to exist within the boundaries of the forest. A total of up to 2,600 acres on the Umatilla and Malheur National Forests, would be legally excluded from oil and gas leasing under alternative B, 332,300 acres under alternative C, and 70,500 acres under alternatives E and F.

Geothermal Energy

No areas of high potential for geothermal development are known to occur on National Forest System lands in the Blue Mountains, even though there is some potential of occurrence throughout the analysis area. It is unlikely that there would be any effect to the potential for development of geothermal energy from any of the alternatives.

Locatable Minerals

All National Forest System lands are open to mining except those that are specifically withdrawn from mineral entry. The forests each have responsibility for identifying areas with resources values that could be affected by mining activities. A determination that resource values exceed the known or potential mineral value could result in a recommendation to withdraw an area from mineral entry.

For rivers identified as eligible for inclusion in the national Wild and Scenic River system, mineral entry would be subject to the conditions necessary for the protection of the values of each identified river corridor in the event it is subsequently included in the national system. New mineral entry would be prohibited on eligible wild rivers once those rivers are officially designated. The rivers to which this would apply are listed in tables A-27 and A-28 in appendix A.

No change in the status of lands identified as recommended wilderness, or their availability for mineral entry would occur until they are recommended, and officially designated as wilderness by Congress. At that time, the mineral potential of each designated area would be evaluated and withdrawn from mineral entry as directed by Congress.

Saleable Minerals

The disposal of saleable minerals may be allowed on eligible scenic or recreational rivers to protect the values for which individual rivers were deemed eligible, but would be prohibited within ¼ mile of eligible wild rivers once those rivers are officially designated. No eligible rivers are identified for alternative A. The miles of eligible rivers (3.3) are the same for all alternatives on the Malheur (3.3 - wild) and Umatilla (72 – wild; 42 – scenic or recreational) National Forests. On the Wallowa-Whitman National Forest there would be 140 miles of eligible wild rivers and 138 miles of eligible scenic or recreational rivers in alternatives B and C, and 6 miles of eligible wild rivers and 32 miles of eligible scenic rivers in alternatives D, E, and F.

Wind Energy

The suitability for development of wind energy on National Forest System lands varies primarily by management area designation. Because wind energy development would require a special use permit, the effects of a specific development would be evaluated once an application is made and the direct, indirect and cumulative effects would be evaluated in a project-level analysis before any permit would be issued.

Development potential in this analysis primarily based on wind power class as mapped by NREL. The suitability of management areas for wind energy development is displayed in tables A-44 through A-47 in appendix A. Before accounting for suitability of areas for energy development, an estimated 388,500 acres, of which 39,000 acres are within the Malheur National Forest, 168,500 acres are within the Umatilla National Forest, and 181,000 acres are within the Wallowa-Whitman national forest have potential for development based on wind power class alone. A preliminary analysis (Gecy 2010) suggests that as little as 2 percent of National Forest System lands, or 122,000 acres may be suitable for development based on the resource protection limitations of different management areas. For the most part, these areas are located in areas of high wind exposure, and are often on ridgelines. Forested areas, valley bottoms, and other areas with low wind exposure, by their nature, have low wind energy potential. Additional limitations could reduce the availability of potentially suitable areas further, but would not be determined until a specific project analysis is completed.

Fossil Collection

Collection of invertebrate and plant fossils for personal use is allowed on National Forest System lands, but the collection of vertebrate fossils is not allowed by Federal law. This will not change regardless of the alternative selected. The ability to access potential collection sites by motor vehicle would be most limited under alternative C because it has the highest number of acres of areas in which motor vehicle use would be restricted, but access to sites would otherwise not be limited under any of the alternatives.

Groundwater

Potential effects of the alternatives on groundwater uses are discussed in the “Watershed Function, Water Quality and Water Uses” section of this document.

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