Sawtooth National Forest
Land and Resource Management Plan
Appendix A

Appendix A.
Vegetation

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Changes to Appendix A between the 2003 Forest Plan and the Amended 2012 Forest Plan

Appendix A of the Forest Plan was reformatted, and in some cases modified to clarify how this appendix relates to the WCS. Changes to Appendix A integrate several key conservation concepts (Table 1-1) – desired conditions for coarse filter and mesofilter vegetation elements, emulating natural disturbance, desired vegetative diversity, and patchworks. A Vegetation Restoration Prioritization and Spatial Map was added to this appendix.

INTRODUCTION

Appendix A contains the mapping criteria, classification descriptions, and desired condition tables for vegetation outside of designated wilderness areas. Separate tables and/or narratives relate to desired conditions for 3 vegetation types: 1) components of forested vegetation; 2) woodland and shrubland; and 3) riparian vegetation, including vegetation in Riparian Conservation Areas (RCAs). Desired conditions do not represent a static state; they are dynamic because the ecosystems are dynamic. The desired conditions will not be evident on every acre of the Sawtooth National Forest (Forest) at every point in time; spatial and temporal variability will always exist. However, Forest management's long-term goal is to achieve desired conditions distributed across the planning unit. Tree size class, canopy cover, and species composition will be evaluated north-end wide for the north end of the Forest (Fairfield Ranger District, Ketchum Ranger District, and Sawtooth National Recreation Area) and by division on the Minidoka Ranger District. Spatial pattern will be evaluated at the 5th field hydrologic unit (HU) and snags and coarse woody debris will be evaluated at the activity area scale. Desired conditions for tree size class, canopy cover class, and species composition will be evaluated through the *Sawtooth National Forest Land and Resource Management Plan* (Forest Plan) monitoring. This evaluation process may result in Forest Plan amendments that will guide future project development. Snags and coarse woody debris are evaluated during project planning. Watershed or activity-area scales of analysis may be used where a different reference is more appropriate to identify opportunities for specific treatments.

The Historical Range of Variability (HRV) was used as a basis for developing desired conditions. The HRV has been suggested as a framework for coarse-filter conservation strategies (Hunter 1990) and is described as an appropriate goal for ecological conditions (Landres et al. 1999). Presumably, if a variety of historically functioning ecosystems are produced or mimicked across the landscape, then much of the habitat for native flora and fauna should be present. The desired conditions described below fall within a portion of the HRV and are balanced with social and economic desired conditions.

In many areas, current conditions deviate strongly from desired conditions; this deviation may create opportunities for managing vegetation. However, even under careful management, these areas may take several decades to approach desired conditions. During that time, managers will have to choose between several approaches to maintain progress toward desired conditions. There may be many different paths to a common endpoint that meet different management objectives, and each path has its own trade-offs. Navigating these paths and trade-offs will be the challenge of ecosystem management in trying to achieve desired vegetative conditions. As we move forward with vegetation management and learn more from monitoring and scientific research, desired conditions may change, or we may alter the paths we chose to achieve them. For these reasons, describing a completely prescriptive approach to desired conditions is impossible. We can only offer guidance on how to achieve desired conditions.

Exceptions to the desired vegetative conditions may exist, possibly as a result of management direction in other resource areas or undesirable site-specific conditions. In some cases, Management Area Direction may have different goals and objectives that would override the Forest-wide desired conditions. Each Management Prescription Category (MPC) may also have a different theme regarding how to achieve desired conditions. All of these differences need to be considered when we design our projects.

The desired conditions are general conditions that can be modified at the local or project level based on site-specific biophysical conditions. Some examples of projects where desired conditions could deviate from those in this appendix include restoring rare plant habitat or considering the needs of a threatened or endangered species where the Forest-wide desired conditions would not provide the site-specific conditions appropriate to the plant community. The rationale for deviating from desired conditions in this appendix would be documented through project-level analysis to help develop alternate desired conditions.

This appendix provides the foundation for coarse-filter forestland, woodland, shrubland, and grassland ecosystems and associated functions and processes. It also provides desired conditions for fine-filter elements, such as snags and coarse woody debris, and sets a context for riparian areas, wetlands, and alpine communities. Desired conditions are defined as ranges rather than as an “average” or “target” to provide for a diversity and variety of conditions within and across landscapes. The desired conditions are framed by the HRV and fire regimes and—though presented in terms of tangible attributes of structure, patch, and pattern—embody intangible attributes of function and process. These intangible attributes, particularly disturbance processes that contribute to ecosystem structure and function, are generally captured as Forest-wide goals and in the desired conditions for spatial pattern.

National Standards for Vegetation Classification

Ecosystem assessment and land management planning at national and regional levels require consistent standards for classifying and mapping existing vegetation. A standardized vegetation classification system provides a consistent framework for cataloging, describing, and communicating information about existing plant communities. The net value of using standardized existing vegetation classifications and maps is improved efficiency; accuracy; and defensibility of resource planning, implementation, and activity monitoring. Appendix A represents a vegetation classification for existing vegetation that precedes U.S. Department of Agriculture (USDA) Forest Service policy and protocol for consistent standards for classification; the *Existing Vegetation Classification and Mapping Technical Guide* (Brohman and Bryant 2005) documents and establishes these standards. Our vegetation inventories and maps do not match these standards. However, as new inventories and maps are completed, these will be consistent with USDA Forest Service existing vegetation classification standards for dominant vegetation, size class, and canopy cover. At that time, this appendix will also be modified with desired conditions that are consistent with established classification standards.

Fire Regimes and Spatial Pattern

Recent advances in theory and empirical studies of vegetation and landscape ecology indicate that, to achieve long-term biological diversity across landscapes, management needs to consider the major disturbance processes, including variability and scale, which determine ecosystem components and their spatial pattern (Baker 1992; Baker and Cai 1992; Hessburg et al. 2007). Because fire was historically a major disturbance process in the West, historical fire regimes have been recommended to help set context for the individual components of the desired conditions (Wallin et al. 1996).

Fire regimes are summarized in Table A-1. Figure A-1 displays vegetative spatial patches and patterns that generally resulted from the historical fire regimes (i.e., fire disturbance that occurred on the landscape for approximately 500 years before European settlement [Hann et al. 2004]). Hann et al. (2004) states that appropriate landscapes for evaluating fire regimes are “relatively large-scale, contiguous areas big enough to exhibit natural variation in fire regimes and associated vegetation." They recommend basing the landscape size on the dominant historical fire regime within an area; appropriate landscapes can range from 500 to 300,000 acres in highly dissected topography. Spatial patterns are evaluated at the watershed landscape unit (5th HU) because, in most cases, this scale is large enough to represent the desired fire regime patch dynamics that created the largest patch sizes on the Forest (i.e., the lethal fire regimes). Much larger patches than would be appropriate to represent using a watershed context could be created from very large, stand-replacing fires. However, such fires, even within the historical range of lethal fire regimes, are generally inconsistent with current management given the complexity of management goals within national forests (Wallin et al. 1996; Cissel et al. 1999). Therefore, depending on the mix of fire regimes, a watershed may be dominated by a few or many patches. For example, a watershed dominated by nonlethal fire regimes may be primarily large tree size class with fine-grained patches of smaller size classes. A watershed dominated by mixed fire regimes may have numerous small-to-large patches of different size classes, while a watershed dominated by lethal fire regimes may have primarily smaller tree size classes with fine-grained patches of larger-sized trees.

Table A-1. Fire regimes

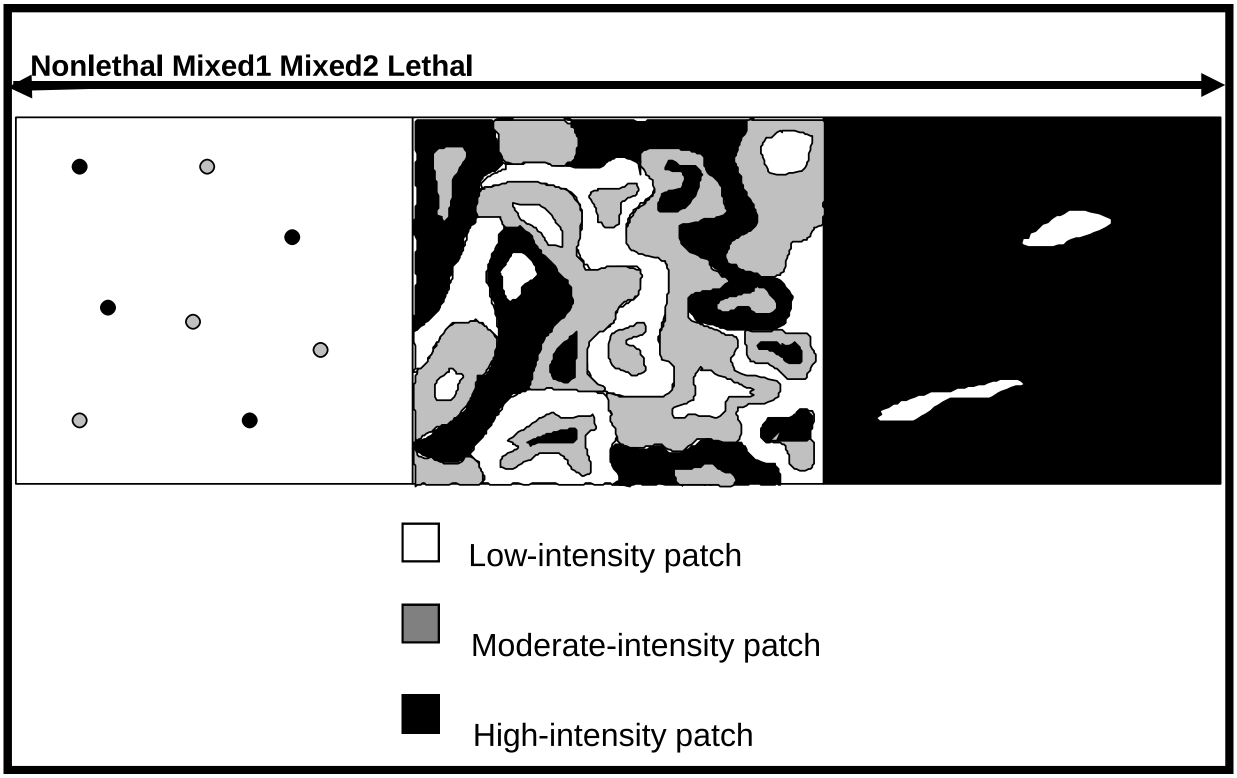
Fire Regime	Fire Interval	Fire Intensity	Vegetation Patterns (Agee 1998)
Nonlethal	5–25 years	≤10% mortality	Relatively homogenous with small patches generally less than 1.0 acre of different seral stages, densities, and compositions created from mortality.
Mixed1	5–70 years	>10–50% mortality	Relatively homogenous with patches created from mortality ranging in size from less than 1.0 to 600 acres of different seral stages, densities, and compositions.
Mixed2	70–300 years	>50–90% mortality	Relatively diverse with patches created by mixes of mortality and unburned or underburned areas ranging in size from less than 1.0 to 25,000 acres of different seral stages, densities, and compositions.
Lethal	100–400 years	>90% mortality	Relatively homogenous with patches sometimes greater than 25,000 acres of similar seral stages, densities, and compositions. Small inclusions of different seral stages, densities, and compositions often result from unburned or underburned areas.

Evaluating spatial pattern is a daunting task that requires both a conceptual framework to organize and simplify ecosystem complexity and knowledge of the details of particular systems (Spies and Turner 1999). Historically, patterns like those in Figure A-1 were the result of disturbance regimes and succession that created spatial elements within and between vegetation types, including amount, proportion, size, interpatch distance, patch size variation, and landscape connectivity.

Landscape spatial patterns affect ecological processes and can be illustrated through differences in plant species composition and structure and through habitat utilization by wildlife. Despite recent interest and progress in spatial patch and pattern research, determining the conditions under which spatial heterogeneity is and is not important for various processes or organisms remains challenging (Spies and Turner 1999). Ecosystems often include recognizable patchiness, usually corresponding to physical changes in topography, hydrology, and substrate or due to large disturbances (Whittaker 1956; Bormann and Likens 1979; Taylor and Skinner 2003). Patchiness in the landscape can create changes in microclimate at patch edges, resulting in demographic fluxes of many individual plant species, varied plant species distribution, and edge-oriented patterns

(Matlack and Litvaitis 1999). These effects can subsequently alter ecological processes and habitat utilization.

Figure A-1. Patch Dynamics of Fire Regimes (Agee 1998)



Within a watershed, several forested vegetation types may be interspersed with several shrubland and/or grassland vegetation types. Additionally, several MPC designations may be superimposed upon these vegetation types. During project design it is important to consider the composition of the landscape that contains a project area. At the project level, opportunities exist to consider spatial patterns, how a project can affect spatial patterns, and what those effects (positive or negative) will be to plant and animal species. Spatial pattern considerations depend on current conditions and overriding management concerns for the area. Generally, these conditions and concerns are site-specific, depending on the project scale. Repeating patterns of change emerge at landscape scales, and some order can be found through descriptions of successional pathways, patch mosaics, and seral stages that facilitate understanding and managing vegetation at landscape scales. The challenge and art of management is to simplify without losing important attributes or losing sight of the underlying complexity (Spies and Turner 1999). A useful way of understanding vegetation dynamics is to characterize the landscape as a shifting mosaic of patches of different ages and developmental stages (Bormann and Likens 1979). The proportion of different age classes or seral stages across a landscape and over time is one of the fundamental characteristics of the vegetation mosaic.

In some cases, the prevailing landscape pattern has been altered so strongly that historical information may be necessary to determine appropriate landscape patterns. For example, fire was historically an important disturbance that maintained the dynamics between native grass and big sagebrush dominance. Frequent small fires opened the shrub canopy and aided the establishment of native perennial grasses at small scales, creating a mosaic of grassland and shrubland communities in different development stages at large scales (Knick 1999). The system dynamics changed when cheatgrass (*Bromus tectorum*) invaded the sagebrush ecosystem and provided continuous fuels, compared to more patchily distributed native bunchgrasses. This invasion facilitated fire spread and shrub loss, resulting in shrubland fragmentation into smaller, spread out patches. Ultimately, many patches did not persist (Knick and Rotenberry 1997). Patch and pattern have changed and may no longer provide for the processes and habitat associated with these systems (Rotenberry and Wiens 1980; Knick and Rotenberry 1995; Paige and Ritter 1999; Connelly et al. 2000; Knick and Rotenberry 2000). Spatial pattern considerations and subsequent management will be particularly difficult in these highly disrupted ecosystems and vegetation types.

DESIRED VEGETATION CONDITIONS

Forested Vegetation

The desired conditions for forested vegetation are described below. Forested vegetation refers to land that contains at least 10 percent canopy cover by forest trees of any size, or land that formerly had tree cover and is presently at an earlier seral stage. Forested vegetation is described by habitat types, which use potential climax vegetation as an indicator of environmental conditions. At the Forest Plan level, forested habitat types have been further grouped into Potential Vegetation Groups (PVGs) that share similar environmental characteristics, site productivity, and disturbance regimes. These groupings simplify the description of vegetative conditions for use at the broad scale. For additional details on the specific habitat types and groupings into PVGs, see Steele et al. (1981) and Mehl et al. (1998).

Table A-2 displays the forested PVGs grouped by fire regime. Additional information on PVGs is available in the Vegetation Classification and Mapping section at the end of this appendix.

Table A-2. Forested Potential Vegetation Groups (PVGs) by Fire Regimes

Fire Regimes	Potential Vegetation Group
Nonlethal	PVG 1—Dry Ponderosa Pine/Xeric Douglas-fir
	PVG 2—Warm Dry Douglas-fir/Moist Ponderosa Pine
Mixed1-Mixed2	PVG 3—Cool Moist Douglas-fir
	PVG 4—Cool Dry Douglas-fir
Mixed2	PVG 7—Warm Dry Subalpine Fir
	PVG 11—High Elevation Subalpine Fir
Mixed2-Lethal	PVG 10—Persistent Lodgepole Pine

Tree Size Class

Tree size class is based on the largest diameter at breast-height (d.b.h.) of trees according to the following definitions (Table A-3). If none of the definitions apply, the size class is considered grass/forb/shrub/seedling (GFSS). Though a smaller size class may represent a greater canopy cover area than a larger size class, the size class is determined by the largest trees that meet the class definition not the most abundant:

Table A-3. Tree Size Class Definitions

Diameter at Breast-Height (inches)	Total Nonoverlapping Canopy Cover Of Trees (Percent)	Tree Size Class
≥20.0	≥10	Large
≥12.0	≥10	Medium
≥5.0	≥10	Small
≥0.1	≥10	Sapling

A few individual trees (such as relic trees) representing a distinctly different tree size are not recognized as a size class if the total non-overlapping canopy cover is <10 percent. For example, two or three 18-inch d.b.h. trees in a plantation may be legacy trees; these legacies would not define the tree size class even though they are the largest trees in the stand since their canopy cover would not meet or exceed 10 percent. In this example, the size class is defined by the plantation trees and not the legacies.

Table A-4 displays the desired range of forested vegetation by PVG for all tree size classes other than large. The range for each size class reflects the dynamic development of trees, considering growth rates, type and extent of disturbances, and varying growth conditions. The individual components are described in more detail below.

Table A-4. Range of Desired Tree Size Classes for Stages Other than Large Tree, Arranged by Fire Regime

Tree Size	Nonlethal		Mixed1-Mixed2		Mixed2		Mixed2-Lethal
	PVG 1 (%)[a]	PVG 2 (%)	PVG 3 (%)	PVG 4 (%)	PVG 7 (%)	PVG 11 (%)	PVG 10[b] (%)
GFSS	1–12	4–5	9	14–15	7–16	9–15	16–23
Saplings	2–12	3–7	9	7–9	11–15	14–15	11–16
Small	2–18	5–21	18–27	19–22	21–22	19–22	46–48
Medium	3–29	7–35	23–36	24–36	32–36	22–38	11–20

[a] Percentage of forested vegetation within each PVG
[b] See the large tree size class discussion below for the desired conditions for medium size class in PVG 10

Canopy Cover

The tree size class is based on the largest d.b.h. trees that meet the definitions described in the Tree Size Class section. Canopy cover represents the total nonoverlapping cover of all trees in a stand, excluding the seedling size class. Trees in the seedling size class are used to estimate canopy cover only when they represent the only structural layer present.

Canopy cover classes are based on the following:

- Low = 10–39 percent canopy cover
- Moderate = 40–69 percent canopy cover
- High = 70 percent or more canopy cover

Canopy cover may be determined from visual estimates using aerial photos or from algorithms in programs such as Forest Vegetation Simulator. The canopy cover is used to calculate tree size class and canopy cover class. Tree size class is calculated using the largest trees that contain >10 percent canopy cover and only canopy cover of trees in that specific size class are used. Canopy cover as described in this section, uses trees of all sizes (except seedling) to calculate non-overlapping canopy cover used to assign canopy cover class.

Species Composition

Table A-5 displays the desired condition ranges for the large tree size class, including canopy cover and species composition. For species composition, finer scales are not expected to mirror these values because of the specific mix of habitat types present in individual analysis areas. For example, on the north end of the Forest for PVG 1, the desired range of 96–99 percent ponderosa pine (*Pinus ponderosa*) would be attained when evaluated north-end wide, while the remainder of PVG 1, up to 4 percent of the area, would be any other combination of tree cover. However, the

Table A-5. Range of desired conditions for the large tree size class for forested vegetation within each PVG, arranged by fire regime

Fire Regime	PVG	Large Tree Size Class (%)	Canopy Cover Class (%)	Species Composition[a] (%)
Nonlethal	1	47–91%	Low: 63–83% Moderate: 17–37% High: 0%	Aspen: Trace Ponderosa pine: 96–99% Douglas-fir: 0–2%
	2	59–80%	Low: 61–81% Moderate: 19–39% High: 0%	Aspen: Trace Lodgepole pine: Trace Ponderosa pine: 81–87% Douglas-fir: 10–16%
Mixed1-Mixed2b	3	23–41%	Low: 5–25% Moderate: 75–95% High: 0%	Aspen: 1–11% Lodgepole pine: Trace Ponderosa pine: 26–41% Douglas-fir: 47–69%
	4	20–34%	Low: 8–28% Moderate: 72–92% High: 0%	Aspen: 4–13% Limberpine: Trace Lodgepole pine:10–20% Ponderosa pine: Trace Douglas-fir: 66–81%
Mixed2	7	10–21%	Low: 0–14% Moderate: 86–100% High: 0%	Aspen: 6–11% Lodgepole: 28–42% Ponderosa pine: Trace Douglas-fir: 24–34% Engelmann spruce: 3–5% Subalpine fir: 12–21%
	11	14–27%	Low: 25–45% Moderate: 55–75% High: 0%	Aspen: Trace Limberpine: Trace Lodgepole pine: 18–25% Whitebark pine: 32–47% Engelmann spruce: 8–13% Subalpine fir: 18–29%
Mixed2-Lethal	10	Medium Tree Size Classb (See Table A-3)	Low: 0–21% Moderate: 71–91% High: 0–18%	Aspen: Trace Limberpine: Trace Lodgepole pine: 82–94% Whitebark pine: Trace Douglas-fir: Trace Engelmann spruce: Trace Subalpine fir: Trace

[a]Use this table as a reference. For project purposes describe the desired species composition based on species composition of the habitat types present within the analysis area. Refer to the appropriate habitat type guide for the analysis area when determining the correct species mix including those species that may occur as accidentals.
[b]Large tree size class was not modeled as part of the historical range of variability.

Douglas-fir / mountain snowberry (*Pseudotsuga menziesii* / *Symphoricarpos oreophilu*) habitat type, which occurs in PVG 1 only rarely, supports ponderosa pine. Therefore, managing for a species composition that reflects the desired condition would likely not be appropriate since managing for a predominance of Douglas-fir would be more ecologically suitable for this habitat type. Therefore, the proper species "mix" for a project area should be determined by habitat types and other concerns, such as wildlife or wildland-urban interface (WUI).

While Table A-5 displays the desired species composition for the large tree size class, this same species composition can be used to help guide projects conducted in intermediate size classes. Individual species described as "trace" were not explicitly modeled when developing the HRV because they occur in habitat types that represent a minor part of the PVGs within the southern part of the Idaho Batholith and/or because little is known about their historical occurrence within a PVG. Quaking aspen (*Populus tremuloides*), which occurs in minor amounts in many PVGs, is an example. Because quaking aspen is a minor component, it has not been extensively studied to fully understand its role. However, these "trace" species should be retained where they are found within the landscape, particularly species in decline, including quaking aspen and whitebark pine (*Pinus albicaulis*).

The appropriate species composition for a project area may vary from Table A-5 based on the mix of habitat types present, particularly for PVGs that include several habitat types representing a broad environmental range, such as PVG 7. Determining the mix of habitat types that comprise the PVGs within the project area is necessary for project application in most PVGs. Since most project areas will generally contain fewer habitat types than are represented by the PVGs, the desired species composition should reflect that more limited set. Therefore, the project area desired species composition may deviate from the desired composition but should, where appropriate, result in landscapes dominated by early-seral species. These species are better adapted to site conditions and usually more resilient to disturbances such as fire. For example, the desired species composition for sites dominated by warmer, drier habitat types in PVG 7, which supports Douglas-fir, would be different from sites dominated by cooler, more frost-prone habitat types that support lodgepole pine (*Pinus contorta*).

The ranges in Tables A-4 and A-5 were developed from the HRV estimates adopted from Morgan and Parsons (2001). The high end of the range for the large tree size class is equal to the mean HRV value; the low end of the range equals the low end of the HRV. Although current conditions may prevent us from obtaining desired conditions for quite some time, management actions over a longer period (perhaps more than 100 years) should result in forested vegetation approaching the desired conditions displayed in Tables A-4 and A-5. For the large tree size class, Table A-5 shows the set of components that together achieve the desired conditions.

Shrub and Herb Communities within the Forested Potential Vegetation Groups

Similar to the tree component, the shrub and herb communities historically occurred within some range of variability, depending on disturbance processes and succession (Steele and Geier-Hayes 1987). Shrub and herb communities that occur across the landscape reflect the environment as controlled by elevation; aspect; topography; soils; and other factors, including management activities that affect sites. The desired conditions for these communities are to have healthy, resilient, and resistant native shrub and herb species.

Snags and Coarse Woody Debris

Snags and coarse woody debris are created by disturbances and vary depending on vegetation type and stage of succession (Hutto 2006). In older forests, snags and coarse woody debris are generally products of disease, insects, lightning, low-intensity fire, and senescence (Spies et al. 1988). In postdisturbance forests, most snags and coarse woody debris are products of the disturbance that created the early-seral condition (Drapeau et al. 2002). Therefore, snags and coarse woody debris in older forests often exhibit more advanced stages of decay than postdisturbance forests, though some components of predisturbance snags and coarse woody debris may still be present (Nappi et al. 2003). In all forests, snags and course woody debris serve important ecological functions.

Much of the research regarding snags in older forests has focused on using them as nesting habitats, particularly for primary cavity nesters (Hutto 2006). Recent research has shown that while snags in postdisturbance forests provide nesting habitat, they are also an important resource for foraging (Nappi et al. 2003), particularly for species such as the black-backed woodpecker (*Picoides arcticue*) and the American three-toed woodpecker (*Picoides tridactylus*), which forage on insects that infest recently burned trees. Although these trees only provide suitable foraging habitat for a short time, they are an invaluable resource for these woodpecker species.

Tables A-6 and A-7 display the snag and coarse woody debris desired conditions for green stands by PVG. Snags and coarse woody debris are finer-scale elements than the coarse-scale vegetative components of species composition, tree size class, and canopy cover class. Snags and coarse woody debris occur as more discrete components within stands, whereas the species composition, tree size class, and canopy cover occur across stands. Therefore, snags and coarse woody debris are evaluated during project planning for an activity area, which better reflects the appropriate scale to consider these elements. The activity area for snags and coarse woody debris is the specific site affected, whether the effects are positive or negative. Actions where snags and coarse woody debris need to be assessed include timber harvest, reforestation, timber stand improvement, and prescribed fire activities.

Table A-6. Desired Range of Snags per Acre in Green Stands for Potential Vegetation Groups (PVGs)

Diameter Group	Nonlethal		Mixed1–Mixed2		Mixed2		Mixed2–Lethal
	PVG 1[a]	PVG 2[b]	PVG 3[b]	PVG 4[b]	PVG 7[b]	PVG 11[a]	PVG 10[a]
10–20 inches	0.4–0.5	1.8–2.7	1.8–4.1	1.8–2.7	1.8–5.5	1.4–2.2	1.8–7.7
>20 inches	0.4–2.3	0.4–3.0	0.2–2.8	0.2–2.1	0.2–3.5	0.0–4.4	NA
Total	0.8–2.8	2.2–5.7	2.0–6.9	2.0–4.8	2.0–9.0	1.4–6.6	1.8–7.7

Note: This table is not meant to provide an even distribution of snags across every acre of the forested landscape, but to provide numbers that serve as a guide to approximate an average condition for an activity area.
[a] Minimum height = 15 feet. Snags at or greater than the minimum height contribute to the desired conditions. However, snags less than the minimum height contribute to ecological functions and should be retained.
[b] Minimum height = 30 feet.

Table A-7. Desired Range of Coarse Woody Debris in Green Stands, in Tons per Acre Dry Weight, and Percent Desired Amounts in Large Classes for Potential Vegetation Groups (PVG)

Indicator	Nonlethal		Mixed1-Mixed2		Mixed2		Mixed2–Lethal
	PVG 1	PVG 2	PVG 3	PVG 4	PVG 7	PVG 11	PVG 10
Dry Weight (tons/acre) in Decay Classes I and II	3–10	4–14	4–14	4–14	5–19	4–14	5–19
Distribution >15 inches	>75%	>75%	>65%	>65%	>50%	>25%	>25%

Note: The recommended distribution is to try to provide coarse woody debris in the largest size classes, preferably over 15 inches (12 inches for PVG 10), that provide the most benefit for wildlife and soil productivity. This table is not meant to provide an even distribution of coarse woody debris across every acre of the forested landscape, but to provide numbers that serve as a guide to approximate an average condition for an activity area.

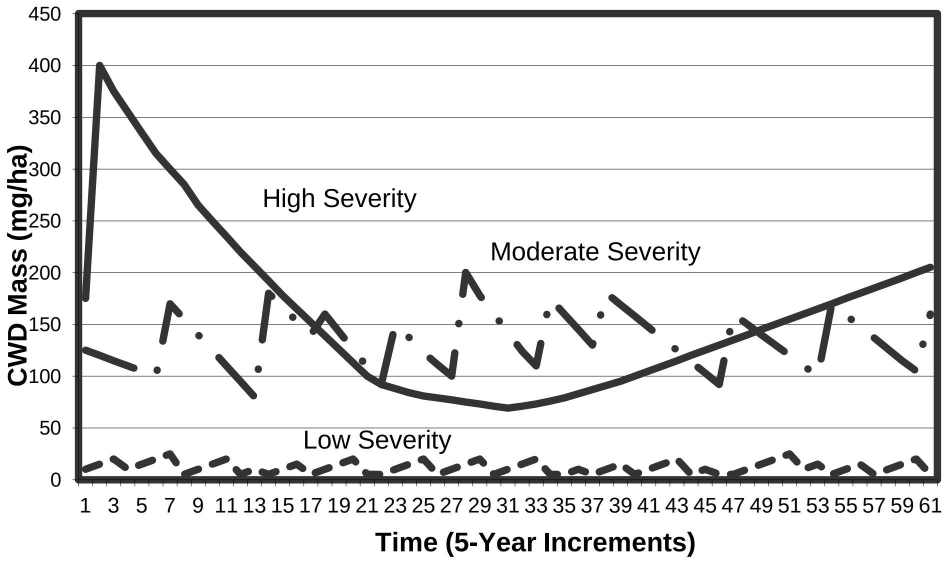
Because the desired conditions in Tables A-6 and A-7 are for green stands, in many cases they may not be appropriate for postdisturbance forests. While a portion of the snags and coarse woody debris in stands may be a legacy of postdisturbance communities, the kind of material created immediately postdisturbance and the role it plays is different than dead wood dynamics in green stands. Drapeau et al. (2002) found that snags in postdisturbance stands were generally less decayed than those in green stands. Postdisturbance communities provide important habitat for primary cavity nesters, while green stands support a greater proportion of secondary cavity nesters.

Using historical fire regimes, Agee (2002) presents several diagrams that depict the spatial and temporal variability found in snag and coarse woody debris numbers. According to Agee (2002), the landscape ecology of historical fire regimes is a function of place. Low-intensity fire regimes had small patches and little edge, while high-intensity regimes had the largest patch sizes and moderate amounts of edge (Figure A-1). Moderate- or mixed-intensity fire regimes had intermediate patch sizes and maximum amounts of edge.

Spatial distribution of snags and coarse woody debris is important. However, the desired conditions described in Tables A-6 and A-7 are not meant to provide an even distribution of snags or coarse woody debris across every acre of the forested landscape. The numbers serve as a guide to approximate an average condition for an activity area. Clumping all dead material in an activity area into one portion of the area would be undesirable and would leave little or no material in the remainder of the area. Though snags are generally found in clumps within patches, snag patches should be distributed across the activity area rather than clustered in a portion of the activity area; the activity area should have snag patches throughout, depending on what is appropriate for the PVG. Coarse woody debris is often more uniformly distributed across the landscape than snags because it is created from green trees as well as snags.

Agee (2002) also discusses how woody debris dynamics have historically varied by fire regime (Figure A-2). Frequent, low-intensity fires limit the amount of coarse woody debris. Figure A-2 displays fluctuations in course woody debris found in low-intensity fire regimes; the peaks may be as high as 13–16 tons/acre (30–35 megagrams per hectare [Mg/ha]), the lows could be <0.5 tons/acre (1 Mg/ha), and the average is around 5 tons/acre (11 Mg/ha) (Graham, personal communication 2001). Although fires were frequent, they rarely affected every acre. In moderate-intensity fire regimes, fires consumed and created coarse woody debris several times per century (Agee 2002). In high-intensity fire regimes, a "boom-and-bust" dynamic operated: substantial coarse woody debris was created postdisturbance, followed by a century or more without further substantial input. Therefore, it is important to understand the dynamics of the project area's particular PVG to best determine desired levels.

Figure A-2. Temporal Cycling of Coarse Woody Debris by Fire Regime (Agee 2002)



Large-diameter snags and coarse woody debris may not be available in seedling, sapling, and small tree size stands depending on the amount of material present from postdisturbance early-seral stands. In this case, some of the tonnage and snag numbers can be in smaller size classes. The total amounts, particularly for coarse woody debris, are not expected to be made up in smaller size classes, but opportunities to progress toward the desired ranges should exist. In particular, the amount of material retained with diameters <6 inches should be balanced against the fire hazard it—and the finer material that often comes with it—may create. Several factors determine the potential fire hazard created by surface fuels, including the kind, depth, continuity, and extent of surface fuels; connectivity to standing trees; and proximity to adjacent fuels. The risk of creating a potentially hazardous condition should also be considered relative to the area's management objectives.

Our primary objective is to provide the majority of course woody debris in larger size classes as this material is retained on-site longer. Although some small and intermediate stage stands may not have the larger material available, the expectation is not to compensate with an abundance of material in the small and medium size classes. If only smaller material is available, some should be left to assist with long-term soil productivity. Coarse woody debris with diameters ≥15 inches (≥12 inches for PVG 10) and lengths ≥6 feet are referred to as logs. These large pieces provide important material for meeting wildlife needs.

Single management treatments may not produce all the dead material in the amounts and/or decay classes desired. As much as possible, treatments should be designed to provide structural, compositional, and functional elements that contribute to long-term sustainability of snags and coarse woody debris. In many cases, actions will consume coarse wood (e.g., prescribed fire). However, if an action results in mortality that produces snags or coarse woody debris, it will contribute to desired levels of large snags and coarse woody debris over time. Furthermore, a range of dead wood sizes and age classes should be retained. Snag height minimums described in Table A-6 are just that—minimums—and do not preclude functions provided by smaller snags (Figure A-3). Large trees and snags provide nesting or denning sites longer than small snags do (Graham 1981; Morrison and Raphael 1993). However, smaller snags provide foraging sites, which are needed in greater abundance than nesting sites (Bunnell et al. 2002).

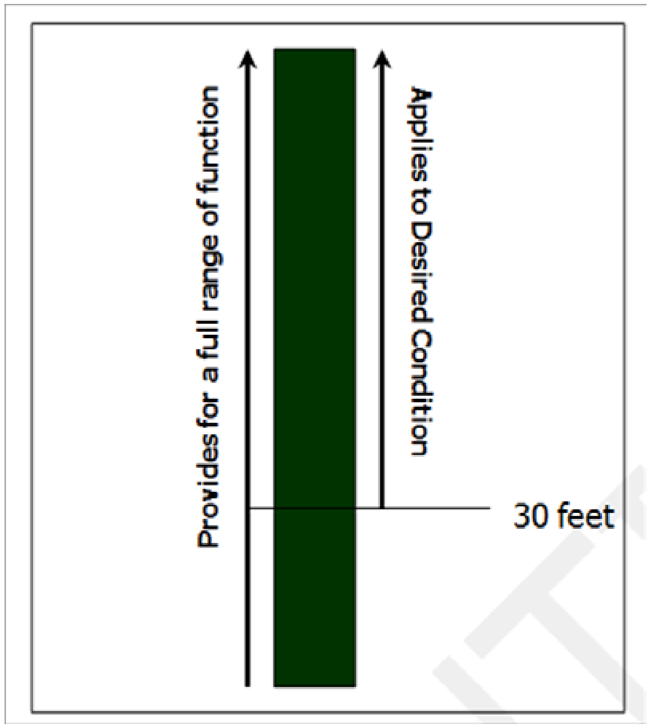


Figure A-3. Range of Snag Function Relative to Minimum Height Described in the Desired Condition (Example for PVGs with 30-foot Minimum Height)

Historical fire regimes, particularly the nonlethal and mixed1 regimes, continually recycle material. Larger material may take several fire cycles before it is fully consumed. This constant recycling also helps provide decay class variety, another important component of achieving desired conditions. Therefore, management actions should result in a variety of snag and coarse wood decay classes. Some wildlife species prefer hard snags, while others prefer those with more decay. For soil productivity, inputs from these different decay classes need to occur at various temporal increments to ensure productivity gaps do not result over time. To provide for continual recruitment into decay class III, only decay classes I and II count towards the desired amounts; the goal is to provide snags and coarse woody debris in decay class III. In addition to decay, characteristics that affect the type and extent of wildlife use of coarse woody debris include physical orientation (vertical or horizontal), size (diameter and length), wood species, and overall material abundance (Harmon et al. 1986; Bunnell et al. 2002).

The increasing number of studies on tree mortality and decomposition are providing a global view of how these processes vary by forest type and climate. These data also provide the basis for a dynamic rather than a static approach to the management of woody material (Harmon 2002). However, to be successful, this perspective must be coupled with a detailed understanding of how certain species and ecosystem processes vary with snag and coarse woody debris amount and quality. The application of a static-state approach, as illustrated by the desired conditions, is based on a set of general objectives designed to provide snags and coarse woody debris across the

Forest. However, applying a static-state approach does not account for the dynamic nature of ecosystem processes and the specific objective-oriented needs of species and their functions (Harmon 2002). Evidence suggests a variety of snags and coarse woody debris, with a variety of decay and size characteristics, provides for all functional wildlife groups and may be necessary for continuous soil productivity. Therefore, project analysis should consider that greater range of function and process that cannot be captured by the desired conditions.

Legacy Trees

Perry and Amaranthus (1997) defined forest legacies as "anything handed down from a pre-disturbance ecosystem." These legacies can occur at different scales ranging from the landscape to the stand to individual components within a stand (Huckaby et al. 2003; Van Pelt 2008). For example, within a lethal fire area, unburned or underburned patches and individual trees are legacies. Legacies are not an artifact of current land-use activities—they also occurred in the historical landscape (Huckaby et al. 2003). Old live and dead ponderosa pine and Douglas-fir trees are an important legacy of the historical condition in many areas (see the Snags and Coarse Woody Debris section for a discussion on dead trees). Legacies are generally resistant to nonlethal/mixed1 fire, provide food and habitat for wildlife, and genetic material reflective of the local site conditions (Huckaby et al. 2003), particularly when present in plantations. However, legacies may now be less common in number and/or distribution due to changes in disturbance regimes (Van Pelt 2008). Since legacies, in particular old tree legacies, are deficient within many landscapes, retaining old trees, as well as trees that are transitioning into old, provides the greatest opportunity for creating and/or replacing these important components.

Vegetative Hazard and Wildfire within Forested Potential Vegetation Groups

Vegetative desired conditions are directly related to fire hazard: both define conditions that can occur on the landscape. Fire hazard describes potential fire behavior based on characteristics such as the horizontal and vertical arrangement of fuels, fuel continuity, and flammability. High fire hazard implies conditions where fires have a high likelihood of being lethal or difficult to suppress even without contributing factors such as drought or wind. In nonlethal and mixed1 fire regimes, near historical conditions are expected to reduce the risk of lethal wildfires due to the emphasis on larger trees, more fire resistant seral species, and discontinuous ladder and surface fuels. Ignitions within these conditions are more likely to stay on the ground, increasing the chances of keeping a wildfire small (Wagle and Eakle 1979; Omi and Martinson 2002). By definition, lethal fires are consistent with the way historically mixed2 and lethal fire regimes operated. Mixed2 and lethal fire regimes have a greater component of more flammable later-seral species and more continuous ladder and surface fuels.

Wildfires, whether historically characteristic or uncharacteristic, are undesirable in some cases, particularly in WUI areas. Although wildfire risks can partially be addressed by using defensible space, in many situations watersheds are a more appropriate scale to deal with concerns about firefighter and public safety and the multitude of infrastructures, resources, and values often associated with interface areas. Therefore, the juxtaposition and arrangement of vegetative conditions relative to WUIs need to be considered at a scale greater than the project area. Considering the vegetative conditions adjacent to the WUI is important because the desired vegetative conditions for some areas may contribute to a risk of stand-replacing wildland fire. In particular, the desired conditions for forested vegetation in mixed2 and lethal fire regimes are generally more hazardous than those found in nonlethal and mixed1 fire regimes. Since desired conditions are intended to create vegetative communities that reflect historical conditions, the resulting disturbances would also reflect historical disturbances. Therefore, by definition, desired conditions for PVGs in mixed2 and lethal fire regimes would produce more stand-replacing wildland fire.

Although desired conditions in certain PVGs increase the hazards associated with stand-replacing wildland fire, the risk of these events may be reduced using a variety of vegetation management techniques. These techniques can include strategically placing fuel breaks, surrounding vulnerable areas with vegetative conditions where fires can be more easily suppressed, or arranging treatments to break up continuous hazardous conditions (Deeming 1990; Graham et al. 1999; Finney 2001; Fulé et al. 2001; Omi and Martinson 2002). In some cases these strategic treatments can be effective without being extensive.

Although vegetative management techniques can reduce lethal wildland fire risk, they address only one of several factors (vegetative conditions). Vegetative manipulation alone cannot eliminate all the risks associated with wildland fire (Figure A-4). The efforts made by property owners on their own behalf are essential in protecting homes in the WUI.

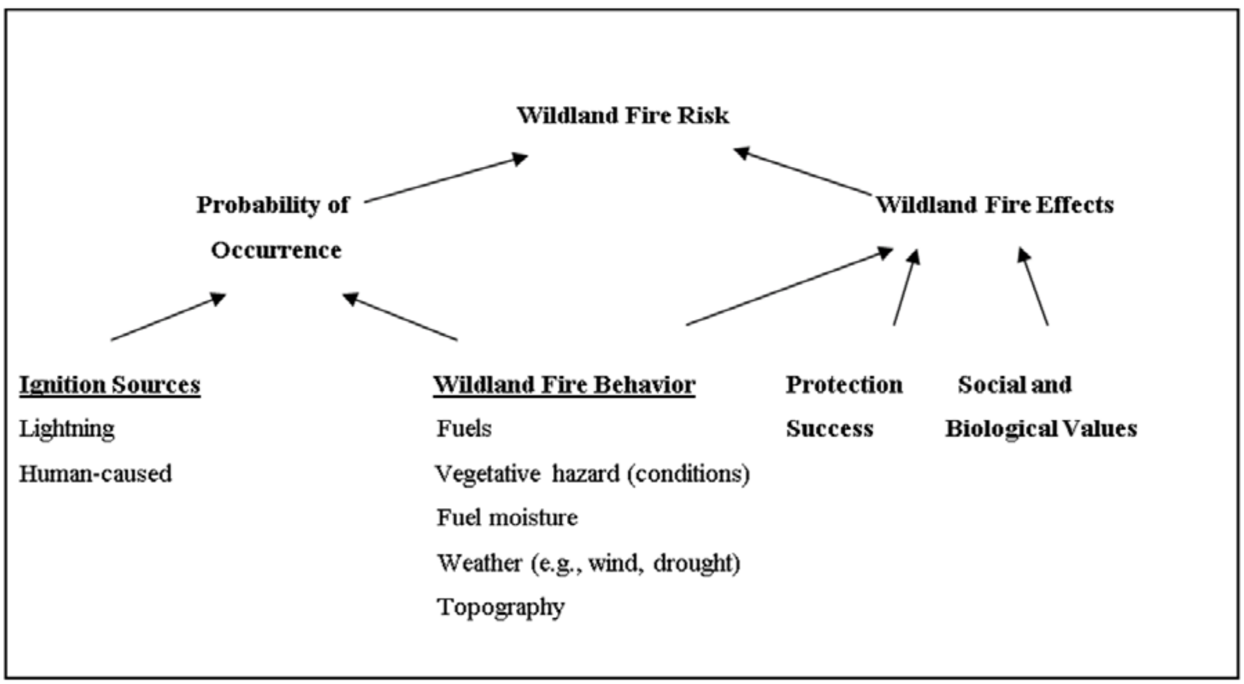


Figure A-4. Factors That Contribute To Wildland Fire Risk (Adopted from Bachman and Allgöwer 1999)

Wildlife and Vegetation Restoration Strategy

A *Wildlife and Vegetation Restoration Strategy* was developed for forested vegetation to identify Forest-wide priorities for restoring the large tree size class. Watersheds were assigned to active and passive restoration categories and prioritized as high, medium, or low. Active restoration watersheds are those with the most historically nonlethal and mixed1 fire regimes, and high priority watersheds are those with the greatest number of acres in medium and large tree size class within these fire regimes. These watersheds were selected as high priority because they likely contain larger patches of conditions that can be restored faster toward desired conditions than areas that have fewer medium and large tree size class acres and likely smaller patches. Active restoration is generally where management activities such as thinning, planting, control of nonnative plants, and prescribed fire may be needed to create conditions that are more resilient and resistant to disturbance. In many cases within historically nonlethal and mixed1 fire regime areas, conditions are such that current disturbances often create structures, functions, and processes that are out of sync with historical conditions and therefore can have undesirable ecosystem consequences.

Passive restoration watersheds are those where natural disturbances are likely to operate most similar to historical disturbances. In these areas, allowing disturbance processes to occur creates desirable ecosystem results. High-priority watersheds are those that have been undisturbed for a long time and would benefit from disturbances that begin to diversify spatial patch, pattern, and structure. Low-priority watersheds are those that have experienced recent large-scale disturbance, such as wildfire, and need time to allow early-seral conditions to progress into other size classes.

Other Forested/Woodland Vegetation Types

In addition to developing desired conditions for the 11 PVGs, 2 additional forest types, climax aspen and pinyon-juniper, are found on the southern portion of the Forest. As is the case for the 11 PVGs, forested vegetation for these two types refers to land that contains at least 10 percent canopy cover by trees of any size or land that formally had tree cover and is presently at an earlier seral stage. Climax aspen falls into the lethal fire regime and pinyon-juniper falls in the mixed2 fire regime category. Refer to the Vegetation Classification portion of this appendix for description of climax versus seral aspen, as the desired conditions do not apply to seral aspen.

Desired conditions for climax aspen and pinyon-juniper forest types are presented somewhat differently than ranges for other forest types. Rather than a range of desired conditions for specific components, the aspen and pinyon-juniper desired conditions are represented as ranges of acres found in the various size classes (TablesA-8 and A-9). Although current conditions may prevent us from obtaining desired condition for quite some time, over a longer period (perhaps more than 100 years), management actions should result in vegetation that is approaching Forest-wide desired conditions.

Table A-8. Desired Condition Ranges as Percent of Area by Size Class for Climax Aspen Forest Type

Aspen Size Classes	Percent of Area
Grass/Forb/Shrub/Seedling, <10% canopy cover or areas where tree height is <4.5 feet.	40–60% in this class
Saplings (0.1–4.9 inch d.b.h.), all canopy covers	20–35% in these two classes combined
Small (5.0–11.9 inch d.b.h.), all canopy covers	
Medium (≥12 inch d.b.h.), all canopy covers	20–25% in this class

Table A-9 displays the desired ranges for pinyon-juniper forest type, which refers to stands whose potential vegetation is pinyon-juniper (refer to the classification portion of this appendix for the description). This determination generally needs to be site-specific. In those areas with pinyon-juniper potential, the desired ranges are similar to climax aspen in that they represent ranges for the amounts of acres found in the various combinations of size and canopy cover for pinyon-juniper.

Table A-9. Desired Condition Ranges as Percent of Area by Size Class for Pinyon-Juniper Forest Type

Pinyon-Juniper Size Classes	Percent of Area
Grass/Forb/Shrub/Seedling <10% canopy cover or areas where tree height is less than 4.5 feet	15–20%
Saplings (0.1–4.9 inches d.b.h.), all canopy covers	15–20%
Small (5.0–11.9 inches d.b.h.), all canopy covers	15–25%
Medium (>12 inches d.b.h.), 10–39% canopy cover	15–25%
Medium (>12 inches d.b.h.), >40% canopy cover	30–35%

As was recognized for the other forested vegetation types, in some cases, developing conditions that meet the desired conditions for these woodland forests may take several years. If the larger size classes are lacking, several-to-many decades may be required to achieve desired conditions. Management actions that advance the rate of growth into larger trees would be an example of "trending toward" desired conditions. If an intermediate size class is lacking, actions that assist the growth of the smaller classes into intermediate classes or treatment of larger-to-smaller classes would be considered as trending toward desired conditions.

Shrublands

Shrublands occur on areas not classified as forestland and where shrub cover has the potential to be greater than 10 percent of canopy cover. Desired conditions have been developed for some of the shrubland communities that occur on the Forest. The shrubland groups reflect the LANDFIRE Environmental Site Potentials (ESPs) (refer to Vegetation Classification portion of this appendix for descriptions of shrubland types). Like the forested vegetation, these groupings reflect similar environmental characteristics, site productivity, and disturbance regimes. Table A-10 displays the fire regimes for the shrubland communities.

Table A-10. Shrubland Environmental Site Potential (ESP) Groups by Fire Regime

Fire Regime	Shrubland ESP Group
Mixed1	Low Sagebrush
Mixed1[a]–Mixed2	Mountain, Basin, and Wyoming[b] Big Sagebrush
	Montane Shrub

[a] The mixed1 portion of the fire regime range applies to areas within the Mountain and Wyoming Big Sagebrush ESP Group dominated by Wyoming Big Sagebrush. Mountain Big Sagebrush and Montane Shrub are mixed2.
[b] Though Wyoming Big Sagebrush ESPs were grouped with Mountain Big Sagebrush, there are separate desired conditions for Wyoming Big Sagebrush described below.

Similar to the forested vegetation, desired conditions for shrublands are expressed as ranges for the amounts of acres found in the various conditions. To reach the desired ranges, conditions would have to be within these Forest-wide ranges. Although current conditions may prevent us from obtaining desired condition for quite some time, management actions over a longer period (perhaps more than 50 years) should result in shrubland vegetation that is approaching the Forest-wide desired conditions.

Canopy Cover

Shrubland desired conditions are represented by canopy cover of shrubs based on the following groupings:

- Grass/Forb = <10% canopy cover

- Low = 10–25% canopy cover
- Moderate = 26–35% canopy cover
- High = ≥36% canopy cover

Canopy cover may be determined through ocular estimates from aerial photo interpretation or while conducting on-site assessments. As expressed here, canopy cover represents the total non-overlapping shrub cover.

Table A-11 presents the desired condition values for the Low Sagebrush ESP Groups and Table A-12 presents the desired condition ranges for the Mountain Big Sagebrush ESP Groups. Though LANDFIRE ESPs were grouped together for mountain (*Artemisia tridentata* Nutt. ssp. *vaseyana*) and Wyoming big sagebrush (*Artemisia tridentata* Nutt. ssp. *wyomingensis*) for coarse-scale analysis, the desired conditions for projects in areas with Wyoming big sagebrush are displayed in Table A-13. Table A-14 contains the desired conditions for the Montane Shrub ESP Groups.

Table A-11. Desired Condition Ranges for Low Sagebrush Environmental Site Potential Groups

Canopy Cover	Percent of Area
Grass/Forb	0–20
Low	80–100
Moderate	0
High	0

Table A-12. Desired Condition Ranges for Mountain Big Sagebrush and/or Basin Big Sagebrush ESP Groups

Canopy Cover	Percent of Area
Grass/Forb	13–33
Low	27–47
Moderate	12–32
High	8–28

Table A-13. Desired Condition Ranges for Wyoming Big Sagebrush

Canopy Cover	Percent of Area
Grass/Forb	25–30
Low	20–35
Moderate	13–33
High	12–32

Table A-14. Desired Condition Ranges for Montane Shrub Environmental Site Potential Groups

Canopy Cover	Percent of Area
Grass/Forb	0
Low	5–25
Moderate	5–25
High	60–80

Unlike the other vegetation groups, desired conditions for Wyoming big sagebrush are not within the HRV. Because these sites are extremely vulnerable to invasion by non-native species following disturbance, the intent is to limit disturbance in areas currently occupied by Wyoming big sagebrush. Lack of disturbance will increase the amount of area in higher canopy cover classes compared to what would have occurred historically but will reduce the risk of more area becoming occupied by non-native species.

Similar to the forested vegetation types, in some cases it may take many years to reach desired conditions. If an area has recently experienced a large wildfire, the necessary structural complexity can take many years to develop at a landscape level. Conversely, an area with little disturbance over many years may have dense canopy cover. Management actions that reduce canopy cover would be an example of "trending toward" desired conditions, even if only applied on a small scale. When at desired conditions, maintenance activities would keep the balance of canopy cover classes within the range of desired conditions; as some acres become denser through succession, other acres may be treated to limit overall canopy cover density. For example, if the Mountain Big Sagebrush ESP Groups are currently at desired conditions but with acres of high canopy cover approaching the high end of the range, it may be necessary to move some of these acres into another canopy cover class to prevent conditions from exceeding desired ranges and creating insufficient amounts of other canopy cover classes. Natural disturbances will also play a role in moving acres in and out of canopy cover classes.

Herb Communities within the Shrubland Environmental Site Potential Groups

Like with the tree and shrub component, some of the grass and forb communities that developed within shrubland ecosystems occurred within the HRV, depending on disturbance processes and succession. These herb communities also reflect environmental conditions such as elevation; aspect; topography; soils; and other factors, including management activities that affect sites. Due to the high variability of these communities across the Forest, desired conditions should be determined at the site-specific scale. The desired conditions should focus on producing healthy, resilient, and resistant grass and forb communities dominated by native species.

Riparian Vegetation

Refer to Tables A-4 and A-5 for the desired conditions for riparian vegetation comprised of coniferous PVGs. The desired conditions in Tables A-4 and A-5 include the upland portions of coniferous vegetation found in the RCAs. Additional information for RCAs is found in Appendix B, Table B-1.

Riparian vegetation is dominated by a variety of species, age classes, and structures—including deciduous trees, willows (*Salix* spp.), alders (*Alnus* spp.), sedges (*Cyperaceae* spp.), and hydric grasses—depending on stream substrate, gradient, elevation, soil hydrology, and disturbance processes. Riparian areas have their own disturbance processes that influence vegetative dynamics, causing an almost continual readjustment in successional stages in many areas. Riparian vegetation is also influenced by upland and upstream processes. Site conditions are highly variable due to these factors, which influence riparian vegetation desired conditions at site-specific locations. Therefore, site-specific desired condition determinations are needed.

Grasslands

Grasslands occur in areas where forest or shrubland canopy cover does not have the potential to exceed 10 percent. Grassland communities on the Forest are comprised of perennial grass species.

The grassland groups reflect the LANDFIRE ESPs (refer to Vegetation Classification section at the end of this appendix for descriptions of grassland types). Like the forested and shrubland vegetation, these groupings reflect similar environmental characteristics, site productivity, and disturbance regimes. Two grassland communities are described for the Forest: Perennial Grass Slopes and Perennial Grass Montane. The fire regimes for these communities are mixed1 to mixed2 for the Perennial Grass Slopes and nonlethal to mixed1 for the Perennial Grass Montane. Desired conditions in these grasslands support native species and aim to reduce threats from nonnative species, particularly invasive annual grasses.

Other Vegetation

Other vegetation types, such as wetlands, marshes, and alpine habits, not described above exist on the Forest. Desired conditions for these vegetation types need to be determined on a project basis, using available local information. Other Forest-wide and Management Area Direction may apply to these types, such as limiting potential establishment and spread of noxious weeds. Some of these communities may also be important habitats for rare plants.

VEGETATION MAPPING

Forested Vegetation Mapping

Forested vegetation is evaluated using habitat types, which use potential climax vegetation as an indicator of environmental conditions. Habitat type describes the mix of vegetative communities that may occur within landscapes based on site potential. For example, subalpine fir habitat types, which generally occur on cooler sites, would support a different mix of vegetative communities than ponderosa pine habitat types, which are found on warmer sites. Existing vegetation is described using cover types, which represent the vegetation on the landscape. Cover types are often an earlier seral stage relative to the climax plant community. Cover types, and associated attributes of size class and canopy cover, were mapped using a LANDSAT remote sensing classification developed at the University of Montana by Redmond et al. (1998). This information was updated in 2008 to reflect changes from wildland fires and other disturbances.

Forested PVGs were mapped using a modeling process. The Forest was divided into 5th field HU groupings that shared similar larger-scale environmental characteristics, such as climate and geology. Each of these groupings was modeled separately. Models were based primarily on slope, aspect, elevation, and land type associations but could also include forest inventory information, forest timber strata information, cover type information, existing habitat type mapping, and cold air drainage models. Where necessary, some field verification did occur. Modeling rules were developed and processed in ArcGrid. Draft maps were sent to ranger district personnel knowledgeable of the area for review, and refinements were made as necessary.

Non-Forested Vegetation Mapping

Shrubland and grassland areas were identified using LANDFIRE ESPs, which are based on NatureServe's Ecological Systems Classification (Comer et al. 2003). ESPs represent the natural plant communities that would become established at late or climax stages of successional development in the absence of disturbance. They reflect the current climate and physical environment, as well as the competitive potential of native plant species. The LANDFIRE ESP concept is similar to that used in classifications of potential vegetation, including habitat types (Daubenmire 1968, Pfister et al. 1977). Therefore, the ESP Groups described for the shrubland

and grassland communities are conceptually similar to the PVGs used to describe the forested vegetation. The LANDFIRE ESP layer was generated using a predictive modeling approach that relates spatially explicit layers representing biophysical gradients and topography to field training sites assigned to ESP map units. Existing vegetation was described in LANDFIRE using Existing Vegetation Types (EVTs).

VEGETATION CLASSIFICATION

Forest Vegetation - Potential Vegetation Groups

PVG 1—Dry Ponderosa Pine/Xeric Douglas-fir

This group represents the warm, dry extreme of the forested zone. Typically, this group occurs at lower timberline elevations from 3,000 feet to 6,500 feet on steep, dry, south-facing slopes. Ponderosa pine is a dominant cover type that historically persisted due to frequent nonlethal fire. Under such conditions, open park-like stands of large, old ponderosa pine dominated the area. Douglas-fir may occur occasionally in PVG 1, particularly at higher elevations. Understories are sparse and consist of low-to-moderately dense perennial grasses such as bluebunch wheatgrass (*Pseudoroegneria spicata*) and Idaho fescue (*Festuca idahoensis*). In some areas, shrubs such as mountain snowberry and bitterbrush dominate (*Purshia* spp.). This group is found only on the west side of the Forest. On the east side of the Forest, the Douglas-fir/mountain snowberry is found, which although part of PVG 1, does not contain ponderosa pine.

PVG 2—Warm, Dry Douglas-fir/Moist Ponderosa Pine

This group represents warm, mild environments at low-to-mid elevations, but may extend upward to 6,500 feet on dry, southerly slopes. Ponderosa pine, particularly at lower elevations, or large ponderosa pine mixed with smaller size classes of Douglas-fir, are the dominant cover types in this group. Historically, frequent nonlethal fire maintained stands of large, park-like ponderosa pine. Douglas-fir would occur on moister aspects, particularly at higher elevations. Understories are mostly graminoids such as pinegrass (*Calamagrostis rubescens*) and elk sedge (*Carex garberi*), with a cover of shrubs such as common snowberry (*Symphoricarpos albus*), white spirea (*Spiraea betulifolia*), and mallow ninebark (*Physocarpus malvaceus*). This group is found only on the west side of the Forest (Fairfield District), primarily in the lower elevation river canyons.

PVG 3—Cool, Moist Douglas-fir

This group represents the cooler extremes in the Douglas-fir zone. This group can extend from 4,800 feet up to 6,800 feet elevation, following cold air. Adjacent sites are often subalpine fir (*Abies lasiocarpa*). This group has a relatively minor representation on the Forest. Some areas support grand fir (*Abies grandis*). Ponderosa pine occurs as a major seral species only in the warmest extremes of the group. Lodgepole pine may dominate in cold air areas, particularly where cold air accumulates to form frost pockets. In some areas, Douglas-fir is the only species capable of occupying a site. The conifer cover types that historically dominated are a combination of several factors, including fire frequency and intensity, elevation, and topography. Understories in this group are primarily shrub species including mountain maple (*Acer glabrum*), mountain ash (*Sorbus* spp.), and blue huckleberry (*Gaylussacia frondosa*). Several other species—including Scouler's willow (*Salix scouleriana*), thimbleberry (*Rubus parviflorus*), and chokecherry (*Prunus virginiana*)—may occur from disturbance, depending on its intensity. Historical fire regimes were mixed (generally mixed1 where ponderosa pine occurs and mixed2 where other species dominate), creating a diversity of vegetative combinations. Two habitat type phases occur within this PVG: (1) Douglas-fir/Rocky Mountain Maple occurs on the west side of the Forest and (2) Douglas-fir/Rocky Mountain Maple-Mountain Snowberry occurs on the east side of the Forest.

PVG 4—Cool, Dry Douglas-fir

Douglas-fir is the only species that occurs throughout the entire range of the group. Lodgepole pine may be found in areas with cold air. Quaking aspen is also a common early seral species. Understories are sparse due to the cool, dry environment, and often support pinegrass and elk sedge. Understories of low shrubs—such as white spirea, common snowberry, Oregon grape (*Mahonia aquifolium*), and mallow ninebark—occur in some areas that represent slightly different environments across the group. The historical fire regime ranged from mixed1 to mixed2, depending on the fuels present at the time of ignition. Organic matter accumulates slowly in this group, so fire effects depend on the interval between fires, stand density and mortality, and other factors. Fire regimes tend to be mixed1 in the drier habitat types with discontinuous fuels and mixed2 in the habitat types that support lodgepole pine as a major seral species. This group is most common on eastern portions of the Forest although it may be found in minor amounts at higher elevations in the Douglas-fir zone in other parts of the Forest. In these cases, it is usually found above 6,000 feet on sites that are too cool to support ponderosa pine. Where it is common, it occurs at lower elevations in areas that are beyond the extent of ponderosa pine.

PVG 7—Warm, Dry Subalpine Fir

This group is common. It represents warmer, drier environments in the subalpine fir zone. Elevations range from 4,800 to 7,500 feet. It is found on rolling topography. Adjacent sites at lower elevations are Douglas-fir, and these commonly intermix where topography controls cold air flow. Douglas-fir is the most common cover type throughout this group. Ponderosa pine may be found at the warmest extremes, particularly where this group grades into the Douglas-fir zone. Lodgepole pine can dominate as a persistent seral species, and graminoids comprise the majority of the understory. Historical fire regimes were generally mixed2, though mixed1 fires may have occurred where ponderosa pine was maintained.

PVG 10—Persistent Lodgepole Pine

This group is common throughout the subalpine fir zone. It represents cold, dry subalpine fir sites in frost-pockets that range in elevation from 5,200 to over 9,200 feet. Lodgepole pine is the dominant cover type although small amounts of other species may occasionally occur. Vegetation under the tree cover can be sparse. Generally, grasses and scattered forbs are the most common components. Shrubs are sparse and consist mainly of low-growing huckleberries, including dwarf huckleberry (*Gaylussacia dumosa*) and grouse whortleberry (*Vaccinium scoparium*). Historically, this group experienced lethal fire although nonlethal fires may have occurred during stand development. Lodgepole pine is more often non-serotinous in western portions of Idaho and appears to become more serotinous moving eastward across the state. Within the Forest, lodgepole pine may reproduce in areas that experience nonlethal fires. The result is more vertical stand diversity in some areas than is often found where lodgepole pine is mostly serotinous. Over time, the combinations of these low-intensity events, subsequent reproduction, and mountain pine beetle (*Dendroctonus ponderosae*) mortality would have created fuel conditions that allowed lethal fires to occur under the right weather conditions.

PVG 11 - High Elevation Subalpine Fir (with Whitebark Pine)

This group occurs at the highest elevations of the subalpine fir zone and generally represents the upper timberline conditions. It often grades into krummholz or alpine communities. Whitebark pine is a major seral species in this group. Engelmann spruce (*Picea engelmannii*) and subalpine fir are the climax co-dominates. In some areas, whitebark pine serves as a cover for Engelmann spruce–subalpine fir establishment. Understories are primarily forbs and grasses tolerant of freezing temperatures that can occur any time during the growing season. Shrubs are sparse due to the cold, harsh conditions. Historically, the fire regime in this group is characterized as mixed2 although the effects of fires were highly variable. Ignitions are common due to the high elevation; however, fuel conditions were historically sparse due to the cold growing conditions and shallow soils. Therefore, fire effects were patchy. Fire regimes are mixed2 with whitebark pine being a major early seral component.

Stand Structure

Stands can be classified as single- or multistoried. While historically, this structure reflected succession and disturbance, current stand structure can also be attributed to management activities. Stands generally become multistoried in the absence of disturbance, with seral, shade intolerant species forming upper layers with later seral/climax, shade-tolerant species underneath. Single-storied stands historically resulted from disturbance processes such as nonlethal fire that killed regeneration. In some cases, single-storied stands can be even-aged, such as a lodgepole pine stand that results from a lethal fire and is unaffected by disturbance until the next lethal fire. In other cases, single-storied stands can be multi-aged, such as a ponderosa pine stand where small groups or individuals regenerated following disturbances that occurred at different times and survived, eventually becoming large enough to be defined as the largest tree size class.

Other Forested/Woodland Vegetation Types

Aspen

Aspen forest type covers a broad environmental range across the Intermountain Region (Mueggler and Campbell 1982). It grows at elevations as low as 5,000 feet and as high as 11,000 feet. Quaking aspen occurs both as a seral and climax tree species within its range (Mueggler 1985) and both types of communities are found on the Forest. Throughout areas where quaking aspen is seral, individual stands are relatively small, early-seral stage stands that seldom exceed 5 acres (Mueggler 1985) and are maintained on the landscape by disturbance. Historically, fire was considered a primary disturbance agent (Jones and DeByle 1985). Fires result in single-aged stands that develop from root suckering, and fire frequencies and severities vary greatly from low to high. Although it does not burn readily, all but the lowest intensity fires kill aspen because of its thin, uninsulated bark. Declines in quaking aspen, particularly in the seral stage, have been attributed to a lack of disturbances that allowed this shade-intolerant species to persist across the landscape where conifers could eventually shade it out (Jones and DeByle 1985).

Pinyon-Juniper

Within the interior west, different species of pinyon and juniper occur with diverse shrubs and herbs forming distinct associations. The mapping of these associations is difficult because various associations exist with different assemblages of species, highly variable tree densities, and variable age classes (Monsen and Stevens 1999). The development of mature pinyon and especially juniper woodlands has often resulted in a decrease in the herbaceous and shrub understory components.

Junipers are much more widespread than pinyons. The term "pinyon-juniper" refers to the PVG. There are many different habitat types and cover types within this group. On the Forest, the majority of cover types in the pinyon-juniper are pure juniper stands.

Pinyon-juniper woodland vegetation occurs at the northern extent of its range in Idaho (Cronquist et al. 1972). The furthest north that self-sown pinyon occurs is in the extreme south of Idaho (West 1999). Pinyons are less tolerant of drought and cold than junipers, so many dominate at middle elevations, while junipers tend to dominate both the higher and lower elevations of the woodland belt of Intermountain ranges (West 1999). Fires are frequent on deep soils that produce an abundance of fine fuels and infrequent on shallow soils and rocky sites where fuels are sparse (Gruell 1999).

Rust (1990) describes 23 pinyon-juniper plant associations or habitat types that are endemic to Idaho. Overstory contains singleleaf pinyon (*Pinus monophylla*), Utah juniper (*Juniperus osteosperma*), Rocky Mountain juniper (*Juniperus scopulorum*), or curl-leaf mountain-mahogany (*Cercocarpus ledifolius*), which vary in dominance on an apparent environmental gradient of moisture availability and temperature. Our desired future condition table (Table A-9) refers only to those pinyon-juniper sites determined to be potential pinyon-juniper, those sites that would be dominated by pinyon-juniper in the overstory at climax. This is a site-specific determination to distinguish potential pinyon-juniper from shrub-steppe or grasslands newly invaded by pinyon-juniper. Rust's (1990) description provides a baseline to assist with the identification and description of reference stand conditions in pinyon-juniper woodland vegetation. Determining the relationships of plant associations identified by Rust (1990) to similar vegetation within the region can be difficult due to the lack of availability and presentation of existing information.

New woodlands are those that have largely developed this century, without any indication they were previously present. The expansion and development of new woodlands is usually attributed to altered fire regimes, domestic livestock use, and optimal climate for establishment (Miller et al. 1999). Pinyon-juniper communities often occur as a mosaic with shrub-steppe and grassland communities. The desired future condition tables are not meant to apply to new woodlands; however, when a vegetation type is potential woodland or new woodland is not always clear because these types can respond to ecological thresholds. Once a threshold is crossed, the new community may have very different functional capabilities than the previous community. Management actions need to occur well before a threshold is crossed to be effective, and those actions need to reflect the scales of time and space in which the affected ecosystems and their threshold function (Tausch 1999). Recognizing both spatial and temporal heterogeneity is important when evaluating habitat suitability, predicting potential resource problems related to stand development, developing management plans, and setting priorities (Miller et al. 1999).

Shrubland and Grassland Vegetation

Shrubland Environmental Site Potential Groups

Low Sagebrush—The following LANDFIRE ESPs were assigned to this group:

- Columbia Plateau Low Sagebrush Steppe
- Great Basin Xeric Mixed Sagebrush Shrubland

This ESP group is dispersed in patches overlapping Wyoming and Mountain Big Sagebrush sites. Patchiness is related to sites of strongly developed soils (clay hardpan), and to soils generally derived from basalt or rhyolitic parent material. Typically, this group occurs in the 8–16 inch precipitation zone and on slopes <40 percent. Canopies are open with few areas of closed or dense canopies. Fire intervals are seldom (40–60 years), with a mixed1 fire regime. Historical vegetation disturbances were related to frost heaving of fine soils, ungulate grazing of highly palatable sagebrush, and fast spring snowmelt conditions. Common understory species are bluebunch wheatgrass (*Pseudoroegneria spicata*), Sandberg bluegrass (*Poa secunda*), wild onion (*Allium ascalonicum*), milk vetches (*Astragalus* spp.), eriogonums, and fleabanes (*Erigeron* spp.). Green rabbitbrush (*Ericameria teretifolia*) may occur. Low sagebrush species on the Forest is primarily low sagebrush (*Artemesia arbuscula)*, however black sagebrush (*Artemesia nova)* and little sagebrush *Artemesia longiloba* also occur and were included in the low sagebrush cover type.

Mountain and Wyoming Big Sagebrush**—**The following LANDFIRE ESPs were assigned to this group:

- *Artemisia tridentata* ssp. vaseyana Shrubland Alliance
- Inter-mountain Basins Montane Sagebrush Steppe
- Inter-mountain Basins Big Sagebrush Steppe
- Inter-mountain Basins Big Sagebrush Shrubland
- Inter-mountain Basins Mixed Salt Desert Scrub

This ESP group connects with the greatest number of other forest, non-forest, and riparian cover types. This type consists of large blocks with a wide range of distribution. This group occurs in the 14–18 inches or greater precipitation zone on well-drained sites and on soils with a high content of rock or gravel. Structural stage ranges are typically balanced with high ground cover and few cryptogams. Fire intervals can be frequent, ranging from 20–60 years, with a mixed1 to mixed2 fire regime. Historical vegetation disturbances were related to ungulate grazing of southern exposures due to less snow and early green-up. Understory forb and grass species can be variable and diverse. Bitterbrush (*Purshia* spp.), grey horsebrush, and green rabbitbrush are frequently present. Snowberry is present on moister sites.

Mountain Mahogany—The following LANDFIRE ESP was assigned to this group:

- Inter-mountain Basins Curl-leaf Mountain Mahogany Woodland and Shrubland

This ESP group typically occurs from 1,970 to over 8,690 feet in elevation on rocky outcrops or escarpments and forms small-to-large-patch stands in forested areas. Most stands occur as shrublands on ridges and steep rim-rock slopes, but they may be composed of small trees in steppe areas. Scattered junipers or pines may also occur. This system includes both woodlands and shrublands dominated by mountain mahogany, mountain big sagebrush, and bitterbrush. Species of currant or snowberry are often present. Undergrowth is often very sparse and dominated by bunch grasses, usually bluebunch wheatgrass and Idaho fescue (*Festuca idahoensis*). Mountain mahogany (*Cercocarpus* sp.) is a slow-growing, drought-tolerant species that generally does not resprout after burning and needs protection from fire that rocky sites provide. Fire intervals are long and fire regimes are lethal.

Montane Shrub—The following LANDFIRE ESPs were assigned to this group:

- Northern Rocky Mountain Montane-Foothill Deciduous Shrubland
- Rocky Mountain Lower Montane-Foothill Shrubland
- Rocky Mountain Bigtooth Maple Ravine Woodland

This ESP group is usually interspersed as stringers and patches within the mountain and Wyoming big sagebrush, quaking aspen, and conifer cover types. The patchiness found in this cover type is strongly related to mesic soils with high water-holding capacity and/or northerly exposures. Typically, this group has multiple vegetation layers that are dominated by sprouting species. Species include chokecherry, snowberry, serviceberry (*Amelanchier* sp.), and wild rose. Several other browse species may occur. This group usually has a rich and diverse herbaceous component. These conditions provide extremely diverse wildlife habitats. Fire intervals are typically 20–40 years, with a mixed2 fire regime. Ungulate and grazing disturbance are not uncommon components. Insect and disease may be common with occasional outbreaks.

Grassland Environmental Site Potential Groups

Perennial Grass Slopes—The following LANDFIRE ESPs were assigned to this group:

- Inter-mountain Basins Semi-desert Shrub Steppe

This ESP group connects with the dry forested cover types and mountain and Wyoming big sagebrush communities and is more prevalent in the north and northwestern foothills and canyonlands of the Forest. It usually occurs between the 10–18 inch precipitation zone, on southern and western aspects. Perennial grasses are dominant on the sites, composing 80–90 percent of production. The group is predominantly bluebunch wheatgrass. Sandberg bluegrass is a lesser but constant associate. The forb component contains a large number of species, few of which are common throughout. The most common forbs are Indian wheat (*Plantago ovate*), shiny chickweed (*Stellaria nitens*), salsify (*Tragopogon porrifolius*), yarrow (*Achillea* spp.), lupine (*Lupinus* spp.), balsamroot (*Balsamorhiza* spp.), biscuit root (*Lomatium* spp.), hawksbeard (*Crepis* spp.), fleabane, milkvetch, and phlox (*Phlox* spp.). This vegetation group can be susceptible to damage under very hot and dry conditions and stand recovery is very difficult and slow in the Idaho Batholith. Historical fire intervals are frequent (20 years), with typically a mixed1 to mixed2 fire regime, depending upon the amount of Idaho fescue present. This group is highly susceptible to several invaders including annual bromes (*Bromus* spp.), rush skeletonweed (*Chondrilla juncea*), yellow star thistle (*Centaurea solstitialis*), several knapweeds (*Centaurea* spp.), Dyer’s woad (*Isatis tinctoria*), and Dalmatian toadflax (*Linaria dalmatica*).

Perennial Grass Montane—The following LANDFIRE ESPs were assigned to this group:

- Columbia Plateau Steppe and Grassland
- Northern Rocky Mountain Lower Montane Foothill–Valley Grassland
- Rocky Mountain Alpine / Montane Sparsely Vegetated Systems

This ESP group connects with numerous forested, mountain and Wyoming big sagebrush, and bluebunch communities. Its ecotone diversity is very highly rated. It usually occurs between the 18–30 inch precipitation zone on southern aspects, and 14–30 inches on northern aspects and represents slightly moister and cooler conditions than the Perennial Grass Slopes. Idaho fescue is the predominant grass in this group. Other grass species that occur are slender wheatgrass (*Elymus trachycaulus*), sedges, intermediate oatgrass (*Danthonia intermedia)*, western needlegrass (*Achnatherum occidentale*), and Richardson’s needlegrass (*Achnatherum richardsonii*). Forbs comprise 40–65 percent of overall production. Common forbs are yarrow, bessaya, geum, Indian paintbrush (*Castilleja* spp.), lupines, phlox, and balsamroot. Historical fire intervals are frequent (20 years) in typically nonlethal to mixed1 regimes. Certain species within the community are susceptible to fire damage under very hot and dry conditions, but recovery occurs in a few years. Trampling damage is minimal-to-nonexistent and primarily occurs at the higher elevations.

Bluegrass (*Poa* spp.) is a common invader. This group is highly susceptible to several invaders, including annual bromes, rush skeletonweed, yellow star thistle, several knapweeds, dyer's woad, and Dalmatian toadflax.

Riparian Cover Types

No comprehensive riparian classifications or vegetative community descriptions exist for the Forest. However, a riparian classification is being developed and is forthcoming. Riparian community type classifications have been developed by Youngblood et al. (1985) for eastern Idaho and western Wyoming; by Padgett et al. (1989) for Utah and southeastern Idaho; and by Hall and Hansen (1997) for Bureau of Land Management districts in southern and eastern Idaho, which includes portions of the South Hills on the Forest. Due to the lack of comprehensive classification information for this area, the Forest Plan Revision Team chose to use the Utah LANDSAT cover types to display these communities.

Riverine Riparian

This cover type consists of vegetative communities dominated by conifer species and shrubs. The primary conifers are subalpine fir, Engelmann spruce, limber pine (*Pinus flexilis*), and Douglas-fir, with some quaking aspen. Other trees and shrubs include Rocky Mountain maple (*Acer glabrum*), serviceberry, chokecherry, thinleaf alder (*Alnus incana*), currants (*Ribes* spp.), and willows. These communities generally occur on steep slopes and occupy edges of riparian zones with A and B stream channel types. Padgett et al. (1989) and Youngblood et al. (1985) stated that these community types in their areas likely represent successional stages within described forested communities. For this reason, Padgett et al. (1989) recommended consulting available forest habitat type classifications for additional information.

Deciduous Tree

This cover type consists of a dominant overstory of black cottonwood (*Populus balsamifera*) or narrowleaf cottonwood (*Populus angustifolia*). Associated tree species include thinleaf alder, Rocky Mountain maple, water birch (*Betula occidentalis*), and aspen. Primary shrub species include chokecherry and willows. This cover type is generally located below 5,500 feet along stream channels in lower canyons. This cover type usually requires a moist and coarse substrate.

Shrub Riparian

This cover type is dominated by willow species. Primary associated tree and shrub species include cottonwoods (*Populus* spp.), swamp birch (*Betula pumila*), thinleaf alder, Rocky Mountain maple, shrubby cinquefoil (*Dasiphora fruticosa*), and chokecherry. Grasses and forbs include sedges, tufted hairgrass (*Deschampsia cespitosa*), geranium (*Geranium* spp.), louseworts (*Pedicularis* spp.), and American bistort (*Polygonum bistortoides*). This cover type is found in mid-toupper elevations in broad, wet meadows and alluvial terraces on relatively low gradients (1–3 percent).

Herbaceous Riparian

This cover type is typically found in mountain meadows where soil moisture is abundant throughout the growing season. Principle species include sedges, woodrush (*Luzula* spp.), reedgrass (*Calamagrostis* spp.), pinegrass, timothy (*Phleum* L.), bluegrass, tufted hairgrass, saxifrage (*Saxifraga* spp.), and fireweed (*Chamerion angustifolium*). The herbaceous riparian cover type occurs widely and is typically found in broad, flat meadows.

Other Vegetation

Wetlands

Wetlands are those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, wet meadows, seeps, and similar areas. These lands are transitional areas between terrestrial and aquatic systems. Vegetative species found in wetlands are heavily influenced by local site conditions.

Marshes—This cover type is permanently or semi-permanently flooded and dominated by hydric species located adjacent to small streams, beaver ponds, lakes, and meadows. Sedges are the most common species. This cover type usually occurs around the 7,000-foot elevation level. Sites are dominated or co-dominated by bulrushes, cattails (*Typha* spp.), woodrushes, or sedges.

Bogs, Fens, and Peatlands—These cover types are wetlands that typically have sub-irrigated cold waters sources. Peatlands are generally defined as wetlands with waterlogged substrates and at least 30 centimeters of peat accumulation (Moseley et al. 1994). The vegetation is often dense and dominated with low-growing perennial herbs (Skinner and Pavlick 1994).

Wet Meadows and Seeps—These cover types are wet openings that contain grasses, sedges, rushes and herbaceous forbs that thrive under saturated moist conditions. These habitats can occur on a variety of substrates and may be surrounded by grasslands, forests, woodlands, or shrublands (Skinner and Pavlick 1994).

Alpine

Alpine habitats are defined as the area above the treeline in high mountains. Rocky or gravelly terrain is generally prevalent. Grasses and sedges often form thick, sod-like mats in meadows. Most alpine plant species have unique adaptations to survive the harsh conditions of this habitat (Billings 1974). Many plants grow in mats or cushions. Perennials predominate in the alpine floras, as the growing season is often too short for annuals to complete their life cycles (Strickler 1990).

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