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Final Environmental Impact Statement for the Land Management Plan

Appendix B: Vegetation and Timber Analysis Process

Nez Perce-Clearwater National Forests

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Final Environmental Impact Statement for 2023 Land Management Plan for the Nez Perce-Clearwater National Forests

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Abstract: This Final Environmental Impact Statement documents the analysis of the Preferred Alternative and four additional action alternatives developed for programmatic management of the four million acres of National Forest system lands administered by the Nez Perce-Clearwater National Forests. The purpose is to provide land management direction for the Nez Perce-Clearwater National Forests, combining the 1987 Nez Perce National Forests Land Management Plan and the 1987 Clearwater National Forest Land Management Plan into one plan for the Nez Perce-Clearwater National Forests, now managed as one administrative unit.

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Introduction

The alternatives described in this environmental impact statement were simulated with vegetation models to provide information used to compare the effects to vegetation condition and changes to timber volume outputs through time. The analysis included an assessment on the natural range of variation to inform the development of desired conditions, identify lands suitable for timber production, and evaluate movement towards the vegetation desired conditions and associated management activities, as well as natural disturbances. This appendix describes the analytical methods and tools used to complete the analysis supporting the comparison of alternatives and summarizes the results.

Changes Between Draft and Final Environmental Impact Statement

Multiple changes were made for the Final Environmental Impact Statement; however, all changes are within the scope of the Draft Environmental Impact Statement analysis, and address issues that the public has had an opportunity to comment on. This section details the key changes between the draft and final PRISM and SIMPPLLE model analysis for terrestrial vegetation and wildlife habitat.

Analysis was added to incorporate the Preferred Alternative. With respect to vegetation and wildlife habitat, this alternative is like Action Alternatives W, X, Y, and Z, with respect to attainment of desired conditions.

- Incorporated updates to the VMap product. These updates were made to reflect existing vegetation conditions resulting from wildfires since 2015. The VMap product is used as a base layer in both the PRISM and SIMPPLLE models to provide spatial context to changes in vegetation conditions across the Nez Perce-Clearwater.
- Included a narrative which illustrates changes in species nomenclature used in the reference period documentation to the current species codes.
- Generated an updated natural range of variation (NRV) analysis to incorporate an updated climate model. This updated NRV analysis did not substantially change estimates of species presence or persistence over time. The overall trend is like the effects disclosed in the Draft Environmental Impact Statement. In addition, the updated NRV analysis included an estimate of vegetation conditions within riparian habitats. As a result, vegetation conditions for dominance type, size class and density are now distinguished as either upland or riparian.
- The NRV analysis was redone with the SIMPPLLE model to capture key improvements that were made based on internal and external comments. These improvements included:
    - Revised western spruce budworm logic based on regional entomologist input.
    - Updated fire spread logic and version that allows fire to move realistically across boundaries.
    - Updated geographic extent to reduce model run-time and summarize results on National Forest System lands.
    - Updated or corrected wildlife habitat queries.
- Vegetation desired conditions were adjusted based on new NRV results. Several desired conditions were also adjusted based on internal and public comments, utilizing best available science information (BASI). The methods and rationale for desired condition development are detailed.
- The SIMPPLLE modeling for all alternatives was redone, to capture the model improvements described for NRV, and to incorporate updated PRISM results (which used updated desired conditions, maps of lands suitable for timber production, and other changes as described in the timber

section). Another key improvement was incorporating a range of future wildfire scenarios to better capture a range of variation and the uncertainty associated with a warming climate, as described in this document. Based on the suite of updates made to the modeling process, the trend of some vegetation attributes changed. In all cases, the magnitude of change relative to the resource condition is within the scope of effects disclosed in the Draft Environmental Impact Statement.

- Updated estimates for average patch size, area weighted mean patch size and Jenks natural Breaks algorithm based on updated natural range of variation (NRV) analysis. In the Draft Environmental Impact Statement, it was estimated that the average patch size of early successional forests was increasing over time within the forestwide NRV and in all potential vegetation types (PVTs). In the Final Environmental Impact Statement, average patch size is also estimated to increase, but is estimated to be within the NRV.
- Updated suitability classifications based on updated VMap product and updated GIS analysis of land use allocation boundaries.
- Incorporated preferred alternative into timber suitability calculations, as well as the vegetation management strategies incorporated into the PRISM model.
- Updated landscape classification and PRISM model structure to reflect updated VMap product, suitability analysis and riparian habitat analysis.
- Updated resource constraints criteria to reflect revised plan components related to land use allocations by alternative, riparian management zones, conservation watersheds, lynx habitat and fisher habitat.
- Updated assumptions related to predicted wildfire frequency and severity for PRISM model projections.
- Updated desired condition ranges for dominance types and size class distributions by management area and broad potential vegetation types based on updated NRV analysis and incorporated these changes into the PRISM model formulation.
- Updated calibration of fire logic sub-model to incorporate revised estimates of fire effects by fire regime.
- Updated vegetation successional pathways to both distinguish between riparian and upland vegetation communities and reflect frequency and severity of disturbance.

Data and Information Sources for Vegetation Analyses

A variety of well-documented datasets and tools have been used to inform the models used for the terrestrial vegetation analysis. They collectively make up the current best available information for quantifying vegetation conditions. The primary databases and information sources used during the vegetation analysis process are briefly summarized below.

Forest Inventory and Analysis

Forest inventory and analysis data consists of a set of points established on a nationwide systematic grid across all ownerships regardless of management emphasis. The sample design and data collection methods are scientifically designed, publicly disclosed, and repeatable. For purposes of describing existing vegetation information for broad-scale analyses, it is infeasible to maintain a field inventory on every acre of a large analysis unit, such as the 3.9 million acres of the Nez Perce-Clearwater. The forest inventory and analysis plots provide a systematic, spatially balanced, statistically reliable inventory using national protocols appropriate for providing unbiased estimates of forest conditions for use at broad scales of analysis. There are 712 plots for the entire plan area. In 2015, in collaboration with the Remote Sensing Application Center and Interior West-Forest Inventory Analysis, the Forest Service Northern Region developed a set of protocols to re-measure forest inventory and analysis plots after they were burned by recent wildfires. The protocols were applied for the Nez Perce-Clearwater National Forests plots and used for this analysis. Plots are remeasured on a 10-year cycle, allowing evaluation of trends in forest conditions over time. Each plot represents about 6,000 acres. For more detailed information on the forest inventory and analysis process, refer to the work of Bush and Reyes (2014) and Czaplewski (2004), and the Interior West Forest Inventory and Analysis Program website.[1]

Region Vegetation Map (VMap)

The Forest Service Northern Region Vegetation Map (VMap) is a spatially explicit (mapped), polygon-based product derived from remotely sensed data that contains information about the extent, composition, and structure of vegetation across National Forest System lands in the Northern Region. The VMap database provides four primary map products: lifeform, tree canopy cover class, tree size class, and tree dominance type. Secondary map products used in this analysis include “image likeness scores” for each tree species in each polygon, as well as the estimated diameter of trees in each polygon. Satellite imagery and airborne-acquired imagery are used to develop the database and are refined through field sampling and verification. VMap was designed to allow consistent, continuous applications between regional inventory and map products and across all land ownerships with sufficient accuracy and precision. An independent accuracy assessment was conducted to provide a validation of the data, giving an indication of the reliability of the map products (Brown 2016). Refer to the Northern Region *Multi-level Vegetation Classification, Mapping, Inventory and Analysis System* (Barber et al. 2009) and other publications (Barber et al. 2011, Brown 2016) for an overview of the map unit design, the process used to develop the layers, and a detailed description of VMap vegetative data. Updates to the VMap product were undertaken in 2020 to reflect large scale disturbances, such as wildland fire, since 2015.

The nomenclature used to identify tree species has changed over time. Generic species codes used in historical context differ from those used today. The VMap product uses the modern four-character abbreviation of the scientific name, while generic nomenclature references the common name for a species. To provide consistency in data interpretation, Table 1 lists all conifer tree species found on the Nez Perce-Clearwater and relates both generic naming conventions with the four-character code used to identify species in the VMap layer.

Table 1. Tree species codes

Generic Tree Species Code	Tree Species	VMap Tree Species Code
PP	Ponderosa pine (Pinus Ponderosa)	PIPO
DF	Douglas-fir (Pseudotsuga menziesii)	PSME
GF	grand fir (Abies grandis)	ABGR
LP	lodgepole pine (Pinus contorta)	PICO
L, WL	western larch (Larix occidentalis)	LAOC
WP	western white pine (Pinus monticola)	PIMO
C, WRC	western redcedar (Thuja plicata)	THPL
Y	Pacific or western yew (Taxus brevifolia)	TABR
WH	western hemlock (Tsuga heterophylla)	TSHE
S, ES	Engelmann spruce (Picea engelmannii)	PIEN

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[1] Interior West Forest Inventory and Analysis Program: http://www.fs.fed.us/rm/ogden/index.shtml

Generic Tree Species Code	Tree Species	VMap Tree Species Code
MH	mountain hemlock (Tsuga mertensiana)	TSME
SAF, AF	subalpine fir (Abies lasiocarpa)	ABLA
WB, WBP	whitebark pine (Pinus albicaulis)	PIAL
SL, AL	subalpine larch (Larix lyallii)	LALY

Living Blended Drought Atlas

Projections of vegetation conditions and disturbance events modelled within the PRISM and SIMPPLLE models require calibration of climate data. Climate reconstruction of past climate conditions is derived from paleoclimatology proxies such as past temperature, precipitation, vegetation, streamflow, and sea surface temperatures to model climate dependent conditions. The Living Blended Drought Atlas (LBDA)[2] Version 2 was used to generate projections of climate conditions based on reconstruction of summer Palmer Modified Drought Index (PMDI) values over the last 1,000 years (Cook et al. 2009). The LBDA) database is hosted by the National Centers for Environmental Information, National Oceanic and Atmospheric Administration (NOAA) website. The LBDA climate calibration corroborates the PMDI with tree ring data for selected sites across North America. Tree ring data is collected and reconstructed for selected sites in association with established weather stations. Five weather stations located in and adjacent to the Nez Perce-Clearwater were used to derive climate reconstruction data for use with the PRISM and SIMPPLLE models.

The LBDA model was queried to generate estimates of annual PMDI values over the past 1,000 years. These values were grouped into decadal averages to produce a mean estimate of PMDI for each of 100 decades (Figure 1). Values for each decade are labeled by quartile and compared to the mean of all values. The bottom quartile (bottom 25 percent) represents the “dry” decades, and the upper quartile (upper 25 percent) represents the wet decades. Values falling between the lower and upper quartiles (middle 50 percent) represent “normal” climate conditions. The frequency of dry, normal, and wet decades is calculated and used within the PRISM and SIMPPLE model environments to estimate climate conditions for any given future decade projected by either model.

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[2] Living Blended Drought Atlas: https://www.ncei.noaa.gov/access/paleo-search/study/22454

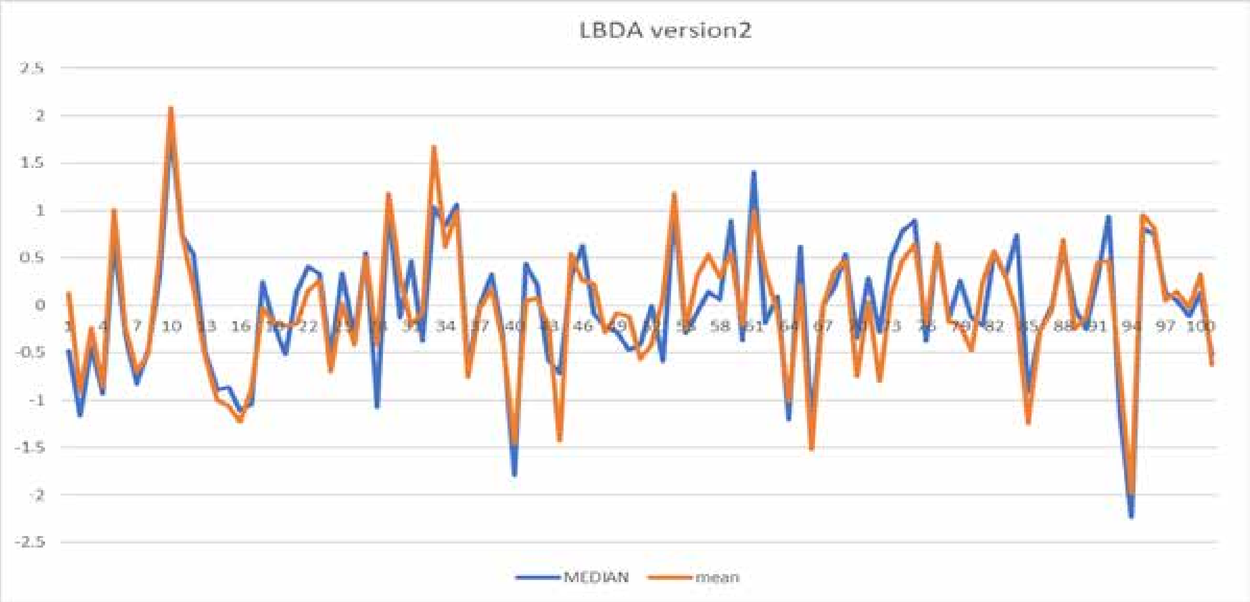

Figure 1. Median and mean Palmer Modified Drought Index values

Data Source: National Centers for Environmental Information, National Oceanic and Atmospheric Administration (Cook et al. 2009).

LANDFIRE

The LANDFIRE database was accessed to collect the fire regime group and mean fire return interval data for each of the five fire regime groups. Best available information was used to build the fire logic and assumptions within the SIMPPLLE and PRISM models, including corroboration with actual data and professional knowledge and experience. Refer to the Fire Management report, for a full discussion of historic fire regimes of the Nez Perce-Clearwater.

Monitoring Trends in Burn Severity

Monitoring Trends in Burn Severity (MTBS) is an interagency program whose goal is to consistently map the burn severity and extent of large fires across all lands of the United States from 1984 to present. This includes all fires 1000 acres or greater in the western United States and 500 acres or greater in the eastern Unites States. The extent of coverage includes the continental United States, Alaska, Hawaii, and Puerto Rico. MTBS data is freely available to the public and is generated by leveraging other national programs, including the Landsat satellite program, jointly developed, and managed by the United States Geological Survey and the National Aeronautics and Space Administration. Landsat data is analyzed through a standardized and consistent methodology, generating products at a 30-meter resolution dating back to 1984. One of the greatest strengths of the program is the consistency of the data products, which would be impossible without the historic Landsat archive, the largest in the world. Additional information and data can be found at https://www.mtbs.gov/ and Eidenshink et al (2007).

Nez Perce-Clearwater National Forests Geographic Information System

The Nez Perce-Clearwater has a library of geographic information system (GIS) data for the national forest. The library includes many mapped data layers with associated metadata. Primary layers referenced for the vegetation analysis include vegetation data layers (VMap); fire history; fire start history; timber harvest history; insect and disease aerial detection survey data; fisher habitat; lynx habitat layers; roads; topographical features, such as elevation and slope; and administrative-related boundary layers, such as ownership, inventoried roadless areas, wilderness areas, and wildland-urban interface. The link to Nez Perce-Clearwater geospatial data can be found at https://www.fs.usda.gov/main/nezperceclearwater/home.

Many summaries and assessments of the vegetation condition were developed using GIS, which is both an analysis tool and a display technology, meaning it can be used both to track information and to display it in a variety of graphic formats. As explained later, the GIS tool was used in determining timber suitability. It was also used to build the acre summaries needed for PRISM analysis areas and spatial data for the SIMPPLLE model.

Forest Activity Tracking System (FACTS)

FACTS is a web-based application that is used to manage activities at the forest level. The system supports such activities tracking as invasive species treatments, timber sale contracts, National Environmental Policy Act (NEPA) decisions, trust fund collection and expenditure and generates reports at multiple scales. The application standardizes the automation of activity information nationwide, providing tools to plan, track, and upward report activity data. The application currently consists of an integrated set of forms, reports, and map products that supports entry, edit, and retrieval of activity information. Information from FACTS was queried to generate estimates of existing conditions.

Forest Level Information Sources

The historical information presented below provides a comprehensive perspective of forest conditions during the early 1900s. Compilation of vegetation data uses a different system than that used today to describe species compositions, size class distributions, and forest densities. However, this information is still useful when considering the development of the natural range of variation. The historical information presented below, in combination with the fire history reconstruction analysis, is the basis for the reference conditions used to calibrate the natural range of variation model.

The 1900 Report on the Bitterroot Forest Reserve (Leiberg 1899) looked at 3.6 million acres of the current 3.9 million-acre Nez Perce-Clearwater. Leiberg sectioned the reserve into the five main drainages—the North Fork Clearwater, Lochsa and Middle Fork Clearwater, Selway, South Fork Clearwater, and the Salmon River. Leiberg's District I and District II (North Fork and Lochsa and Middle Fork) within the Bitterroot Reserve cover approximately the portion of Bailey's Section M333D (Bitterroot Mountains). This area approximates the Clearwater National Forest boundary. Districts III, IV, and V (Selway, South Fork, and Salmon) are approximately within Sections M332A (Idaho Batholith) and M332D (Blue Mountains). This area approximates the Nez Perce National Forest boundary. Ecological sections described by Bailey (2005) are based on the *National Hierarchical Framework of Ecological Units* and depicted on the ECOMAP of the United States (https://data.fs.usda.gov/geodata/edw/datasets.php?xmlKeyword=ecological). This hierarchical system stratifies landscapes into progressively smaller areas of increasingly uniform ecological potentials. Ecological types are classified, and ecological units are mapped based on associations of those biotic and environmental factors that directly affect or indirectly express energy, moisture, and nutrient gradients, which regulate the structure and function of ecosystems. These factors include climate, physiography, water, soils, air, hydrology, and potential natural vegetation communities.

Each ecosection contains broad vegetation and topographic conditions. Local land type classifications were used to divide each section into three settings, which are roughly equivalent to the subsections described in *Ecological Units of the Northern Region: Subsections* (Nesser et al. 1997). These settings are breaklands, uplands, and subalpine. Breaklands are mostly steep slopes at lower elevations with warmer temperature regimes. Uplands are generally above the breaklands in elevation and have more rolling topography. They tend to be cooler and more mesic than the breaklands. The subalpine setting is above the uplands in elevation, with mixed topography and generally colder temperatures. Disturbance regimes differ among the three settings, with frequent, low severity fire most common on the breaklands, infrequent mixed-severity or stand-replacing fires typical on the uplands, and mixed and stand-replacing fires on subalpine settings. Because such a small area of the Nez Perce National Forest is in the Blue Mountains Section, historic information for that area was combined with Idaho Batholith information to characterize the Nez Perce National Forest.

The analysis of terrestrial vegetation summarized in the Land Management Plan and supporting environmental impact statement does not use the same land type classification system as Bailey and Nesser. Instead, the broad potential vegetation type concept is used to group similar habitat types into groupings that are dependent on physiographic characteristics. The breaklands category contains similar forest cover types as described for the warm dry broad potential vegetation types, the uplands plant communities are divided between the warm moist and cool moist broad potential vegetation types, and the subalpine setting is assigned to the cold broad potential vegetation type.

For analysis and modeling purposes, the Bitterroot Mountains and Idaho Batholith ecosections are divided into geographic areas. This was necessary to accommodate the computation limits of both the PRISM and SIMPPLLE models. The Bitterroot Mountains ecosection is divided into the Palouse, North Fork, and Lochsa geographic areas, and the Idaho Batholith ecosection is divided into the Selway and South Fork geographic areas. Data outputs derived from each geographic area are further summarized for forestwide and management area metrics.

Lieberg (1899) described general conditions, as well as providing quantitative summaries of forest types and volumes; the amounts of old-growth greater than 175 years old, second growth between 75 to 175 years old, and new growth less than 75 years old; areas burned; and species abundance. Rockwell (1917) produced a map of white pine distribution, which apparently formed part of the most complete historical reconstruction of white pine distribution before its decline.

Losensky (1994) summarized 1930s inventory data and forest type maps, as well as earlier and later surveys, to arrive at estimates of circa 1900 species composition by cover type, age distribution by cover type, and structural-development stage distribution by cover type. He summarized the data by ecosections, of which 332A Idaho Batholith represents primarily the Nez Perce National Forest and 333D Bitterroot Mountains represents primarily the Clearwater National Forest. The old forest structural and development stage used the over-mature age class of 151 plus years old from the inventory data as a proxy.

The Idaho Batholith section description does not mention western red cedar presence, but it is common and widespread in the Selway and Middle Fork Clearwater basins on the Nez Perce National Forest. Therefore, western red cedar riparian habitat types and upland western red cedar habitat types were assigned to the Bitterroot Mountains’ breaklands and uplands, respectively.

The 1937 inventory data has also been summarized to ecosections. This is the earliest complete inventory data available for the Clearwater and Nez Perce National Forests. This inventory covered the entire state of Idaho. Because its extent is so expansive, it includes a broad picture of disturbance processes and could be thought to display the range of vegetation conditions expected on this landscape over time.

To attribute the forest cover types from the inventory to the three settings—breaklands, uplands, and subalpine—a map of potential vegetation types was used. This allowed for assigning grand fir and cedar types, for example, to the three settings in proportion to where they could support that cover type.

Leiberg's maps of different species locations were also useful in knowing where individual species occurred historically. Size classes were similarly apportioned.

Leiberg Report

Key points from the 1900 Bitterroot Forest Reserve report (U.S. Geological Survey 1900) are summarized below:

- The North Fork Clearwater drainage was 30 percent white pine by volume, followed by Engelmann spruce—western larch at 30 percent, and grand fir at 10 percent; the white pine type covered 75 percent of the area; mountain hemlock dominated the upper elevations; Ponderosa pine was minor; approximately 30 percent of the drainage was old-growth greater than 175 years old; white pine formed the majority of second-growth between 75 to 175 years old; white pine occurred up to 5800 feet elevation; 30 percent of the drainage experienced recent stand-replacing fire, most likely in 1889.
- The Lochsa and Middle Fork drainage was dominated by Engelmann spruce and Douglas-fir, at 24 percent and 22 percent by volume, respectively, followed by Ponderosa pine and western larch at 17 percent and 10 percent; white pine and grand fir were minor species. Vegetation was cleared around mining claims using fire which created large expanses of grass or sedge and beargrass. Approximately 50 percent of timber stands, experienced recent stand-replacing fires.
- The Selway drainage was dominated by the Ponderosa pine—Douglas-fir types and cedar, grand fir, and Engelmann spruce were minor species; in the Ponderosa pine—Douglas-fir type, Ponderosa pine was heavier on west and south slopes and dominated overall by volume; cedar groves were large old-growth; fires had burned out much Douglas-fir and cedar, which led to lodgepole pine regeneration in the subalpine, along with creating large, grassy openings.
- The South Fork was dominated by grand fir mixes, covering 65 percent of the drainage. Grand fir constituted about 50 percent of the volume, with Ponderosa pine and western larch comprising about 40 percent; it was noted that western larch was more common before fires, as determined from the common presence of large western larch stubs; lodgepole pine likely covered about 20 percent of the drainage in 90 to 120-year-old mature stands.
- The Salmon River drainage was covered by about 75 percent Ponderosa pine and 25 percent Douglas-fir by volume; low fire severity was noted here, and grassy slopes were common due to the soils and harsher environment.
- It was noted that fires had denuded 1.4 million acres, or about 40 percent, of the reserve since pre-European settlement, mostly due to miners, and that much old-growth in the Selway and South Fork had been destroyed by these fires; it was also noted that big stand-replacing fires had to have occurred from 1750 to 1800, resulting in the large expanses of 90- to 130-year-old second-growth.
- It is estimated that approximately 12 percent of the reserve was old-growth greater than 175 years old.
- The historic range of white pine occurred on the current North Fork and Palouse Ranger Districts (see Appendix 1, Figure 1of the land management plan); white pine was present but was a minor species south of these districts.

The fire history of the reserve after the Leiberg Report (U.S. Geological Survey 1900) includes the fires of 1910 in the North Fork and Selway-Bitterroot Wilderness, the 1919 wildfires in the South Fork, Selway, and North Fork, and the 1934 wildfires in the Selway and Lochsa and Middle Fork. In total, these fires burned approximately 1.8 million acres. These fires may explain the paucity of grand fir and cedar types in the 1937 Nez Perce inventory. Along with the settlement period fires after 1860, they are also most responsible for the expanse of mid-seral or mature forests found on the Nez Perce-Clearwater today.

Losensky Report

Key points from the 1994 Losensky Report (Losensky 1994) for the circa 1900 reference period are summarized below by ecosection.

Idaho Batholith

- Ponderosa pine, Douglas-fir, and lodgepole pine cover types comprised two-thirds of this ecosection; cedar, white pine, and grand fir types were minor, but some grand fir was "washed out" at the landscape-level mapping.
- The over-mature age class of greater than 150 years represented 20 percent of area, mostly in Ponderosa pine and Douglas-fir types; these were split about evenly between single- and multi-layer structure.
- Seedlings and saplings represented approximately 11 percent of area, mostly in the lodgepole pine and western larch—Douglas-fir cover types; 23 percent of area was in stand initiation stage (seedlings and saplings plus transitional forest).
- The age distribution was more reflective of mixed-severity and stand-replacing fire than other areas in the Columbia River Basin.

Table 2, Table 3, and Table 4 present Losensky's data for cover type, age classes, and structural classes in the Idaho Batholith ecosection (Losensky 1994).

Table 2. Percent cover by cover type circa 1900 in M332A Idaho Batholith

Cover Type	Percent Cover
Ponderosa pine Savanna	0.1%
Ponderosa pine	20.7%
Douglas-fir Savanna	0.2%
Douglas-fir	27.2%
Western larch-Douglas-fir	0.8%
Lodgepole pine	20.6%
Engelmann spruce-subalpine fir	6.6%
Subalpine	14.6%
Sage-Grass	0.5%
Bunchgrass	8.5%
Water	0.2%
Total	100.0%

Table 3. Age structure circa 1900 for major forest cover types in ecosection M332A Idaho Batholith, in percent of ecosystem by species and size or age class

Species	Non-stocked	0–6 inches 1–40 years	6–14 inches 41–100 years	Mature 101–150 years	Overmature >151 years
Ponderosa pine	6.1%	2.7%	9.6%	23.4%	58.2%
Douglas-fir	15.7%	9.8%	27.9%	28.4%	18.2%
Lodgepole pine-Douglas-fir	15.7%	19.7%	15.8%	28.0%	20.8%
Lodgepole pine	17.7%	34.9%	35.1%	9.2%	3.1%

Species	Non-stocked	0–6 inches 1–40 years	6–14 inches 41–100 years	Mature 101–150 years	Overmature >151 years
Engelmann spruce-subalpine fir	28.6%	3.6%	18.0%	27.2%	22.6%
Average of forested acres.	16.8%	14.1%	21.3%	23.2%	24.6%

Table 4. Percent cover by type and structural stage circa 1900 in ecosection M332A Idaho Batholith

Cover Type	SI	SEOC	SECC	UR	YFMS	OFMS	OFSS	Total
Ponderosa pine	7.4%	34.4%	0.0%	0.0%	0.0%	29.1%	29.1%	100%
Douglas-fir	20.6%	30.6%	33.6%	0.0%	0.0%	9.1%	9.1%	100%
Western larch-Douglas-fir	25.6%	0.0%	39.6%	14.0%	0.0%	15.6%	5.2%	100%
Lodgepole pine	35.2%	0.0%	52.6%	3.4%	2.3%	1.5%	0.0%	100%
Western white pine	30.4%	0.0%	19.8%	13.6%	13.6%	22.6%	0.0%	100%
Engelmann spruce-subalpine fir	40.0%	5.0%	5.0%	10.0%	15.0%	15.0%	10.0%	100%
Subalpine	7.4%	34.4%	0.0%	0.0%	0.0%	29.1%	29.1%	100%

Note: Structural stages include stand initiation (SI), stem exclusion open canopy (SEOC), stem exclusion closed canopy (SECC), understory re-initiation (UR), young forest multi-story (YFMS), old forest multi-story (OFMS), old forest single-story (OFSS).

Bitterroot Mountains

- White pine dominated the species composition at 34 percent, followed by Ponderosa pine at 21 percent and western larch—Douglas-fir at 20 percent; the western larch—Douglas-fir type was intermixed with the white pine type on slightly warmer sites, and the white pine type was a mix of species.
- The over-mature age class of greater than 150 years represented 27 percent of area, mostly in white pine, Ponderosa pine, and western larch—Douglas-fir; the Ponderosa pine was primarily single-layered, while the white pine and western larch—Douglas-fir types were multi-layered.
- Seedlings and saplings represented approximately 19 percent of area, mostly in the white pine, western larch—Douglas-fir, lodgepole pine, and Ponderosa pine cover types; 32 percent of the area was in stand initiation stage (seedlings and saplings plus transitional forest).
- Age distribution reflected fires of 1889, which created an abundance of young stands.

Table 5, Table 6, and Table 7 present Losensky's data for cover type, age classes, and structural classes in the Bitterroot Mountains. Ecosection on the Clearwater National Forest.

Table 5. Percent cover by cover type circa 1900 in ecosection M333D Bitterroot Mountains

Cover Type	Percent Cover
Ponderosa pine	20.8%
Douglas-fir	2.5%
Western larch and Douglas-fir	19.8%
Western white pine	33.8%
Lodgepole pine	9.2%
Engelmann spruce-subalpine fir	2.2%

Cover Type	Percent Cover
Subalpine	8.2%
Bluebunch wheatgrass-Idaho fescue	1.7%
Idaho fescue-snowberry	1.3%
Water	0.5%
Total	**100.0%**

Table 6. Age structure circa 1900 for major forest cover types in ecosection M333D Bitterroot Mountains, in percent of ecosystem by species and size and age class

Species	Non-stocked	0–6 inches 1–40 years	6–14 inches 41–100 years	Mature 101–150 years	Overmature >151 years	Total
Ponderosa pine	8.9%	11.1%	12.5%	9.3%	58.2%	100%
Douglas-fir	31.0%	21.7%	24.0%	16.9%	6.4%	100%
Western larch and Douglas-fir	27.7%	21.1%	15.3%	12.8%	23.1%	100%
Lodgepole pine	33.0%	38.8%	21.3%	5.9%	1.0%	100%
Western white pine	18.8%	23.2%	19.1%	12.1%	26.8%	100%
Engelmann spruce and subalpine fir	23.8%	4.4%	13.4%	24.7%	33.7%	100%

Table 7. Percent cover by type and structural stage circa 1900 in ecosection M333D Bitterroot Mountains

Cover Type	SI	SEOC	SECC	UR	YFMS	OFMS	OFSS	Total
Ponderosa pine	14.5%	27.4%	0.0%	0.0%	0.0%	14.6%	43.6%	100%
Douglas-fir	41.8%	25.9%	25.9%	0.0%	0.0%	3.2%	3.2%	100%
Western larch and Douglas-fir	38.2%	0.0%	32.2%	6.4%	0.0%	17.4%	5.8%	100%
Lodgepole pine	52.4%	0.0%	40.7%	4.9%	1.5%	0.5%	0.0%	100%
Western white pine	30.4%	0.0%	36.7%	6.1%	0.0%	26.8%	0.0%	100%
Engelmann spruce and subalpine fir	26.0%	0.0%	15.6%	12.3%	12.4%	33.7%	0.0%	100%
Subalpine fir	60.0%	0.0%	5.0%	5.0%	5.0%	5.0%	20.0%	100%

Note: Structural stages include stand initiation (SI), stem exclusion open canopy (SEOC), stem exclusion closed canopy (SECC), understory re-initiation (UR), young forest multi-story (YFMS), old forest multi-story (OFMS), old forest single-story (OFSS).

Interior Columbia Basin Ecosystem Management Project (ICBEMP) Historic Change Information

The Pend Oreille River Basin in northeast Washington and northwest Idaho was chosen to analyze vegetation changes in the Columbia Basin northern Rockies ecoregion. Change was detected by aerial photo interpretation of 1930s and 1980s photos. Observed changes parallel the conditions noted above when comparing existing species composition and size class distribution to historic information. Major trends can be summarized as follows:

- There was a clear shift in overstory composition away from early-seral forest that included Ponderosa pine, western larch, white pine, and whitebark pine and a corresponding increase in a forest that included Douglas-fir, grand fir, western hemlock, subalpine fir, and Engelmann spruce.

- There was a clear increase in tolerant species in the understory.
- There was an increase in mid-seral structural types, such as a mid-seral bulge in age class distribution.

Broad Potential Vegetation Types

Broad potential vegetation types are mapping units delineating areas that have similar biophysical environments, such as climate and soil characteristics, that produce plant communities of similar composition, structure, and function. Potential vegetation types provide a basis for identifying and mapping unique biophysical conditions (Pfister et al. 1977), which can form the basis of understanding for ecological dynamics including successional development (Arno et al. 1985), fire regimes (Barrett 1988, Morgan et al. 2001), and site productivity (Milner 1992). The Forest Service Northern Region has identified potential vegetation groups for broad- and mid-level groupings of habitat types that are recommended for use at the broad levels to provide consistent analysis and monitoring, as described by Milburn and others (2015). Four coniferous forest broad potential vegetation types are found on the Nez Perce-Clearwater: warm-dry, warm-moist, cool-moist, and cold.

The relative percentage of each broad potential vegetation type varies by management area as illustrated in Table 8. Management Area 3 is dominated by the warm moist potential vegetation type (PVT) group with the warm dry PVT group comprising the second largest percentage at 32 percent. Management Area 2 has the second largest percentage of warm moist PVT group but also contains a large percentage (30 percent) of the cool moist PVT group. Management Area 1 contains the largest percentages of cold and cool moist PVT groups reflecting the higher elevations zones of this management area.

Table 8. Percentage of broad potential vegetation type (PVT) by management area (MA)

Broad Potential Vegetation Type	Percent of MA 1	Percent of MA 2	Percent of MA 3
Cold PVT	26%	10%	4%
Cool Moist PVT	34%	30%	13%
Warm Dry PVT	31%	26%	32%
Warm Moist PVT	8%	34%	49%
Non-Forested	2%	1%	2%

Data Source: R1 FIA Hybrid 2015 dataset.

For modeling and analysis, it was necessary to map the distribution of potential vegetation types across the Nez Perce-Clearwater. The potential vegetation type map used for the Final Environmental Impact Statement was developed by the Northern Region in the early 2000s (Jones and Post 2004). Sources of data included field plots and remote sensing. Lands with no field data were populated by extrapolation of plot data and the use of models that integrated site factors influencing vegetation, such as precipitation, slope, and elevation. This layer, referred to as *R1 Potential Vegetation Types* or *R1-PVT* (Figure 2), is the best available potential vegetation type layer. It is the only map of potential vegetation that covers the Nez Perce-Clearwater and is a mid-level depiction of ecological conditions, which informs the coarse filter approach.

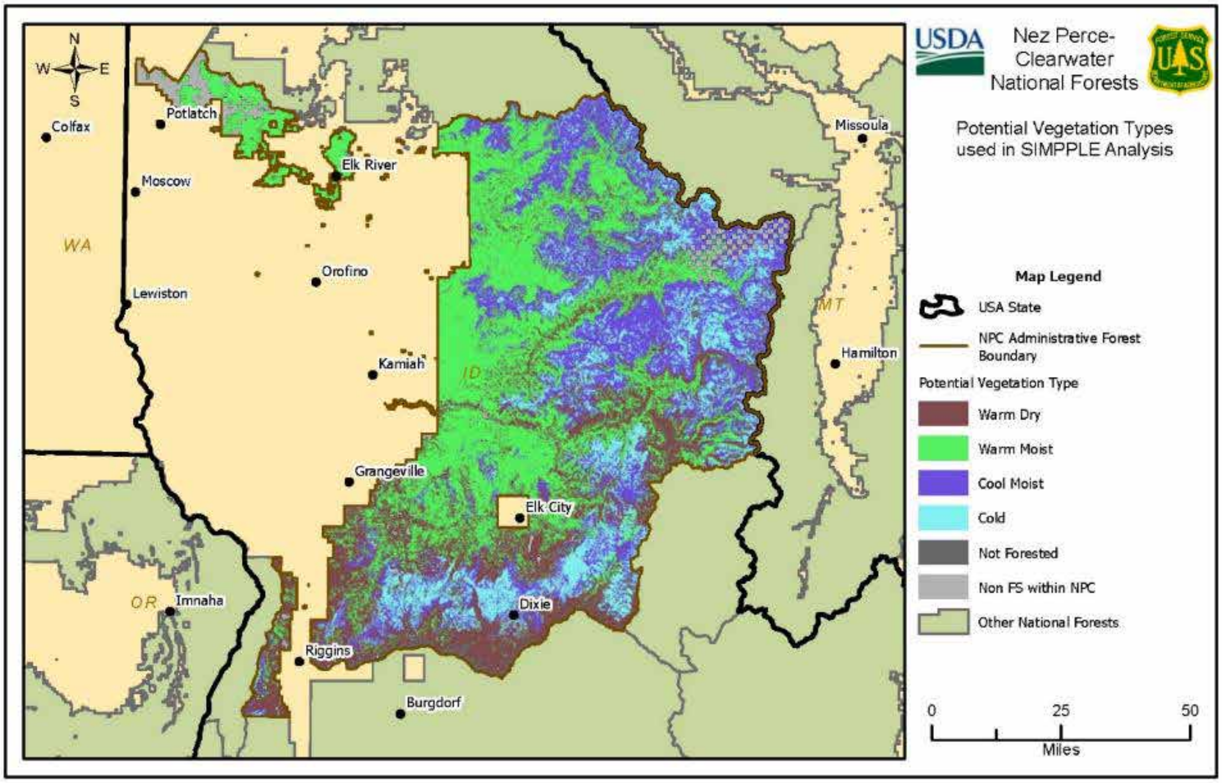

Figure 2. Distribution of broad potential vegetation types within the modeled lands in and adjacent to the Nez Perce National Forest

Dominance Types

Dominance types for the desired conditions are defined using the same definitions as the DOM_MID40 attribute in the Existing Vegetation Classification (Barber et al. 2011). This method uses a 40 percent plurality determined by trees per acre for seedling and sapling size and by basal area for all other sizes to determine the dominance type of a pixel. This means that a pixel receives the classification of the tree species that is most prevalent, and species must comprise at least 40 percent of the pixel.

Dominance type was chosen as an indicator because dominance type is one of the primary ways in which the landscape is departed from the natural range of variation (See SIMPPLLE Natural Range of Variation results). To analyze dominance types, the Hybrid 2015 dataset from the Forest Inventory and Analysis (FIA) database was used to generate estimates of dominance types using the Northern Region Summary Database Estimator. The Dominance Group Mid-40 was combined with the Dominance Group 6040 attribute to track minor species components. This attribute is based on a 60 percent threshold and a 40 percent threshold where a stand is classified as a given species if it comprises 60 percent of the stand, then if no species comprises 60 percent of a stand, it is classified by the species that comprises 40 percent of the stand (Barber et al. 2011). Estimates were generated as “final” in the estimator, which is recommended for planning (Bush et al. 2016). Because the exact effects of timber harvest and wildfire are unknown, plots that had been affected by fire and timber harvest since the time of sampling were removed. This means that all plots that had been burned or harvested after they were sampled were not included in the estimates of preliminary current conditions. Subsequently, plots affected by wildfires between 2015 and 2017 were re-measured and this updated data was included in the final estimates of current conditions. Disturbances affect dominance type and are critically important for the development of successional pathways and vegetation patterns. Land use allocations and management area direction also influence dominance types.

The effect each alternative would have on dominance types was originally analyzed using the Spectrum model and the modeling was performed by Kendrick Greer of Mason, Bruce, and Girard. A design document was written recording the various parameters used to predict dominance types under each alternative. This document is included in the project record. Transition pathways were created for Spectrum that identify the requirements for dominance types to change and are also part of the project record. As modeling development progressed, it was recognized that the Spectrum model was not robust enough to handle all the modeling elements and parameters needed to generate this comparative analysis. The original Spectrum design document and data input records were imported into the PRISM model to assure that the model could generate a solution for each parameter across all alternatives. All PRISM documentation is included in the project record.

The relationship between broad potential vegetation type groups and the existing condition for dominance types is illustrated in Table 9. Generally, dominance types are highly correlated with broad potential vegetation types. Several species such as Douglas-fir, lodgepole pine, and Engelmann spruce occur within all broad potential vegetation types but are most prominent within one group.

Table 9. Percent broad potential vegetation type by cover dominance types

Dominance Type	Cold	Cool Moist	Warm Dry	Warm Moist
Ponderosa pine	0%	0%	16.4%	1.2%
Douglas-fir	2.8%	19.0%	31.5%	24.1%
Grand fir	0%	2.5%	34.4%	46.2%
Western larch	0.4%	2.0%	1.2%	2.5%
Western red cedar	0%	0%	0.3%	14.7%
Western hemlock	0%	0%	0%	1.3%
Mountain hemlock	9.0%	5.7%	0%	0.5%
Western white pine	0.4%	0%	0%	1.2%
Lodgepole pine	41.2%	14.6%	12.7%	3.7%
Engelmann spruce	6.8%	22.0%	2.0%	3.1%
Subalpine fir	39.0%	27.2%	0.7%	1.0%
Whitebark pine	0.4%	0.5%	0%	0%
Pacific yew	0%	0%	0%	0.3%

Data Source: R1 Hybrid 2015 Data Set.

Size Class

Size class was identified as a forestwide indicator. The rationale for this is that size class distribution on the Nez Perce-Clearwater is departed from the natural range of variation (see SIMPPLLE Natural Range of Variation results). Size class distribution refers to the amount of the Nez Perce-Clearwater within different size classes rather than the geographic location of the size classes. Size classes are defined by basal area weighted average diameter, which is in accordance with and described in greater detail in the Northern Region Existing Vegetation Classification document (Barber et al. 2011). The analysis was performed using the Size Class National Technical Guide, which indicates that the size classes coincide with the size classes used in the guide and represent five-inch diameter classes.

Many factors influence the size class distribution of forests on the Nez Perce-Clearwater. Natural disturbance regimes and fire suppression history have contributed to stand development, maintenance, and stand initiation. Low severity fires and most prescribed burns promote larger diameter classes. Mixed severity fires have a greater influence on species composition than size class but like low severity fires tend to favor larger diameter classes, particularly within the overstory. High severity (stand replacing) fires promote the establishment of smaller diameter classes.

Broad potential vegetation types are associated with specific fire regimes and varying ratios of different fire regimes as illustrated in Table 10 (refer to the Fire Management Report for further details). The warm moist broad potential vegetation type group is strongly associated with fire regime group III. Fire regime group III is characterized as mixed and low severity. This relationship is illustrated in Table 11, which displays the existing condition for size class distributing by broad potential vegetation type groups. The warm moist broad potential vegetation type is skewed toward the larger diameter classes which reflects both the high level of site productivity and the influence of fire regime on these areas.

Table 10. Fire regime group (FRG) and FRG severity by broad potential vegetation type

Regime	FRG severity	Cold	Cool Moist	Warm Dry	Warm Moist
FRG I	Low to mixed	2.7%	5.1%	59.3%	33.0%
FRG II	high	0.7%	1.7%	85.6%	12.0%
FRG III	Mixed to low	5.2%	12.1%	23.6%	59.1%
FRG IV	High	28.1%	50.2%	11.8%	9.9%
FRG V	High to mixed to low	4.7%	5.0%	28.1%	62.2%

Note: Percentages are summed by Fire Regime Group.
Data Source: LANDFIRE.

Table 11. Existing size class distribution by broad potential vegetation type

Size class	Cold	Cool Moist	Warm Dry	Warm Moist
Grass or shrub	20%	19%	21%	10%
Seedling	5%	5%	3%	2%
0–4.9” DBH*	8%	4%	3%	3%
5–9.9” DBH	33%	20%	20%	17%
10–14.9” DBH	27%	30%	22%	26%
15–19.9” DBH	7%	13%	17%	24%
20” + DBH	2%	8%	15%	18%

Data Source: R1 FIA Hybrid 2015 dataset
*DBH = diameter at breast height

Land use allocations such as designated wilderness, roadless areas, and areas focused on vegetation management also affect size class distribution. The desired conditions, based on natural range of variation estimates, are partitioned by management area for the same reasons as above for dominance types. Because Management Area 3 has objectives for growing timber as a commodity, the size class distribution is adjusted to accommodate the need to maintain a balance of all size classes. Since much of Management Area 3 is suitable for timber production, it should be maintained with a size class distribution that supports a commercial harvest entry schedule. A small percentage of early seral grass or shrub size class is maintained to provide for wildlife habitat desired conditions and to reflect natural vegetation patterns at the landscape scale. Table 12 illustrates the existing conditions for size class distribution by management area.

Table 12. Existing size class distribution by management area

Size class	Management Area 1	Management Area 2	Management Area 3
Grass or shrub	24%	16%	12%
Seedling	5%	4%	3%
0–4.9” DBH*	4%	3%	4%
5–9.9” DBH	19%	19%	24%
10–14.9” DBH	22%	30%	24%
15–19.9” DBH	15%	17%	17%
20” + DBH	11%	11%	14%

Data Source: R1 FIA Hybrid 2015 dataset.
*DBH = diameter at breast height

Species Presence

Species presence is a metric which simply describes the presence of a species within a given area of interest. The metric is expressed as a percentage of the area in which the species is present. This species presence analysis includes all diameter classes for any species, from seedling size to the very large diameter class. No minimum thresholds for species density are expressed. Species presence is described and illustrated here to provide context for the existing frequency and distribution of tree species on the Nez Perce-Clearwater. Desired conditions for species composition are used to describe the desired range of species in the context of the natural range of variation. It is more relevant to potential management actions given that a single species does not typically occupy a significant percentage of any area and most forested stands on the Nez Perce-Clearwater exist as multi-species stands.

At the forestwide scale, grand fir is the most common tree species with a species presence of over 43 percent. Douglas-fir is the second most prevalent tree species at 38 percent. Figure 3 illustrates the species presence for 21 tree species found on the Nez Perce-Clearwater ranked in order of percentage. Species presence associated with each broad potential vegetation type is illustrated in figure 4. The graphic clearly illustrates the strong relationship between species presence and broad potential vegetation type for several species. Grand fir, Douglas-fir, and western red cedar are common within the warm moist potential vegetation type (PVT) group while subalpine fir and lodgepole are more common within the cold PVT group. As illustrated in Figure 4, several species occur within multiple broad potential vegetation types. This relationship occurs for numerous reasons including disturbance history, management actions, a given species genetic plasticity allowing for tolerance of extremes in growing conditions, and inclusions of different site conditions. Species such as subalpine fir and Engelmann spruce are associated with the warm dry PVT group because of inclusions of riparian areas while lodgepole pine is associated with all PVT groups in response to wildfire disturbance. Portions of the Nez Perce-Clearwater have experienced fire suppression over the last century resulting in stand densities that exceed the natural range of variation estimates. These dense stands promote the establishment and growth of shade tolerant species such as grand fir at levels that exceed the natural range of variation estimates for species composition.

Species presence and the distribution of species is also influenced by land use allocation decisions and the resulting limitations on management actions. Designated wilderness areas and Idaho roadless rule areas have not experienced fire suppression to the same degree as the managed front country of the Nez Perce-Clearwater.

The relative percentage of each broad potential vegetation type varies by management area as illustrated in Table 8. Management Area 3 is dominated by the warm moist PVT group with the warm dry PVT group comprising the second largest percentage at 32 percent. Management Area 2 has the second largest percentage of warm moist PVT group but also contains a large percentage (30 percent) of the cool moist PVT group. Management Area 1 contains the largest percentages of cold and cool moist PVT groups reflecting the higher elevations zones of this management area.

Given that each management area contains different percentages of broad potential vegetation types; species presence can be expected to vary by management area. Figure 5 illustrates species presence associated with each management area. Only species having a species presence percentage of over 1 percent are illustrated in Figure 5. The seral species of Ponderosa pine, western white pine, and western larch exhibit significant differences in species presence between management areas within the respective broad potential vegetation types.

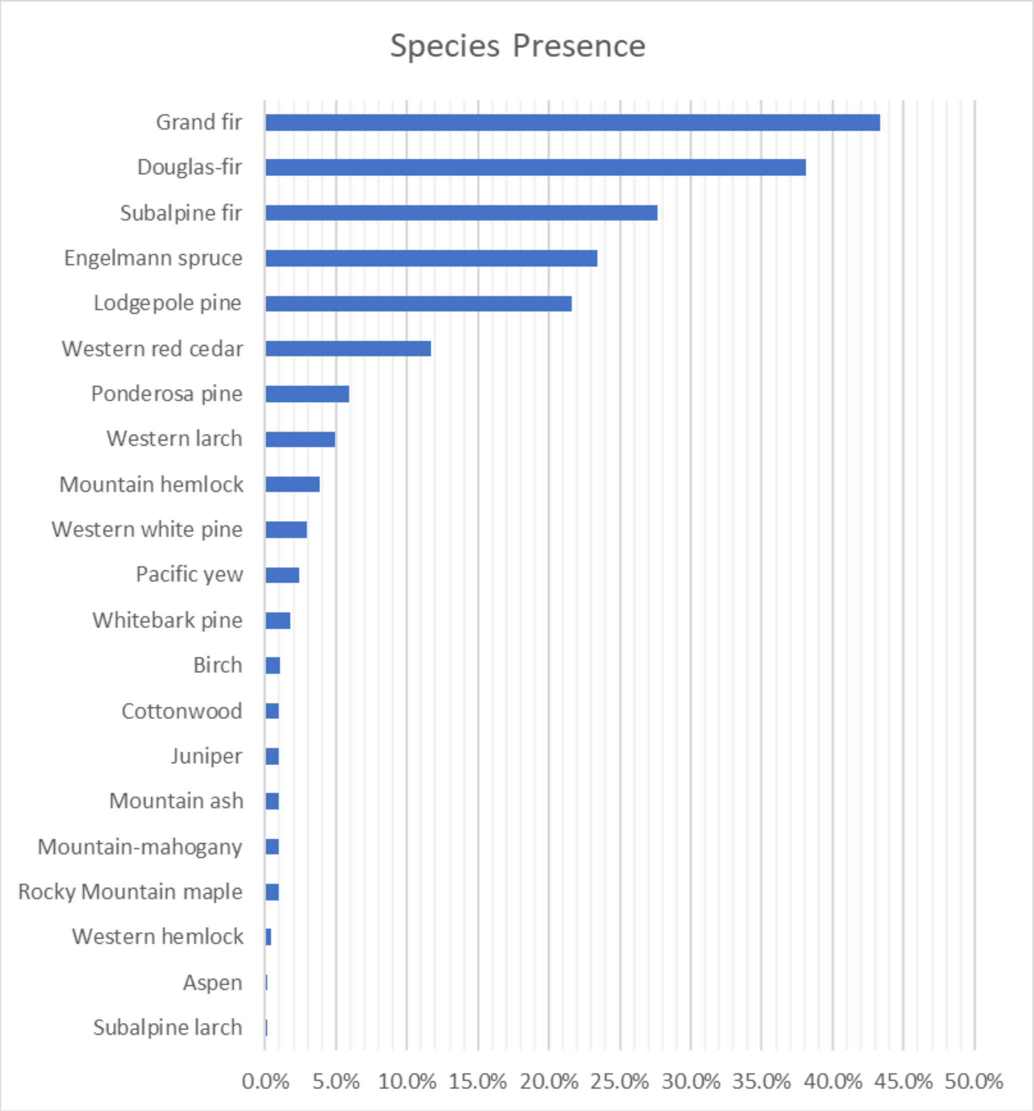

Figure 3. Forestwide percent species presence

Data Source: R1 FIA Hybrid 2015 dataset, Sp_Presence21.xlsx

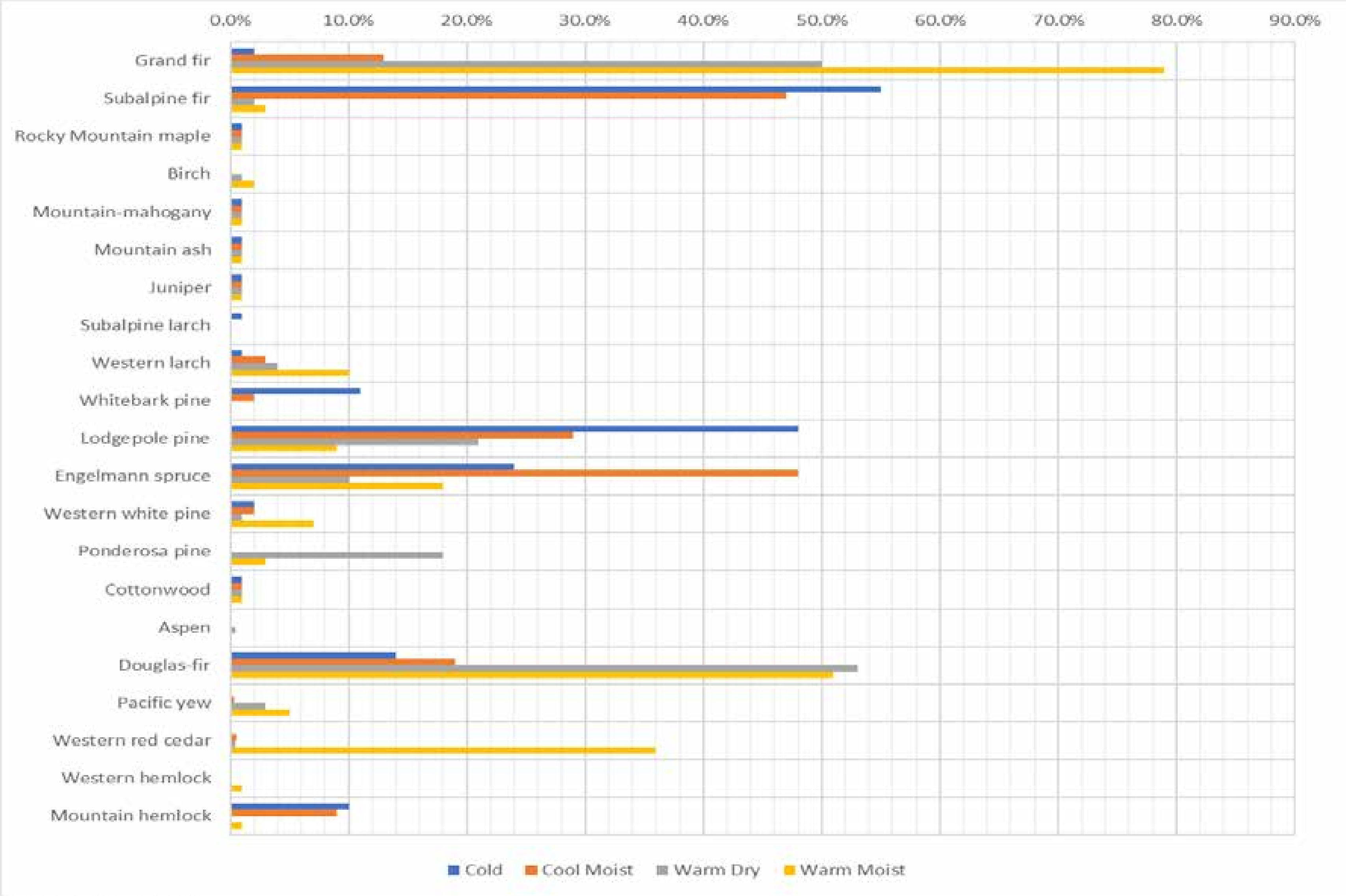

Figure 4. Percent species presence by broad potential vegetation type

Data Source: R1 FIA Hybrid 2015 dataset, Sp_Presence21.xlsx.

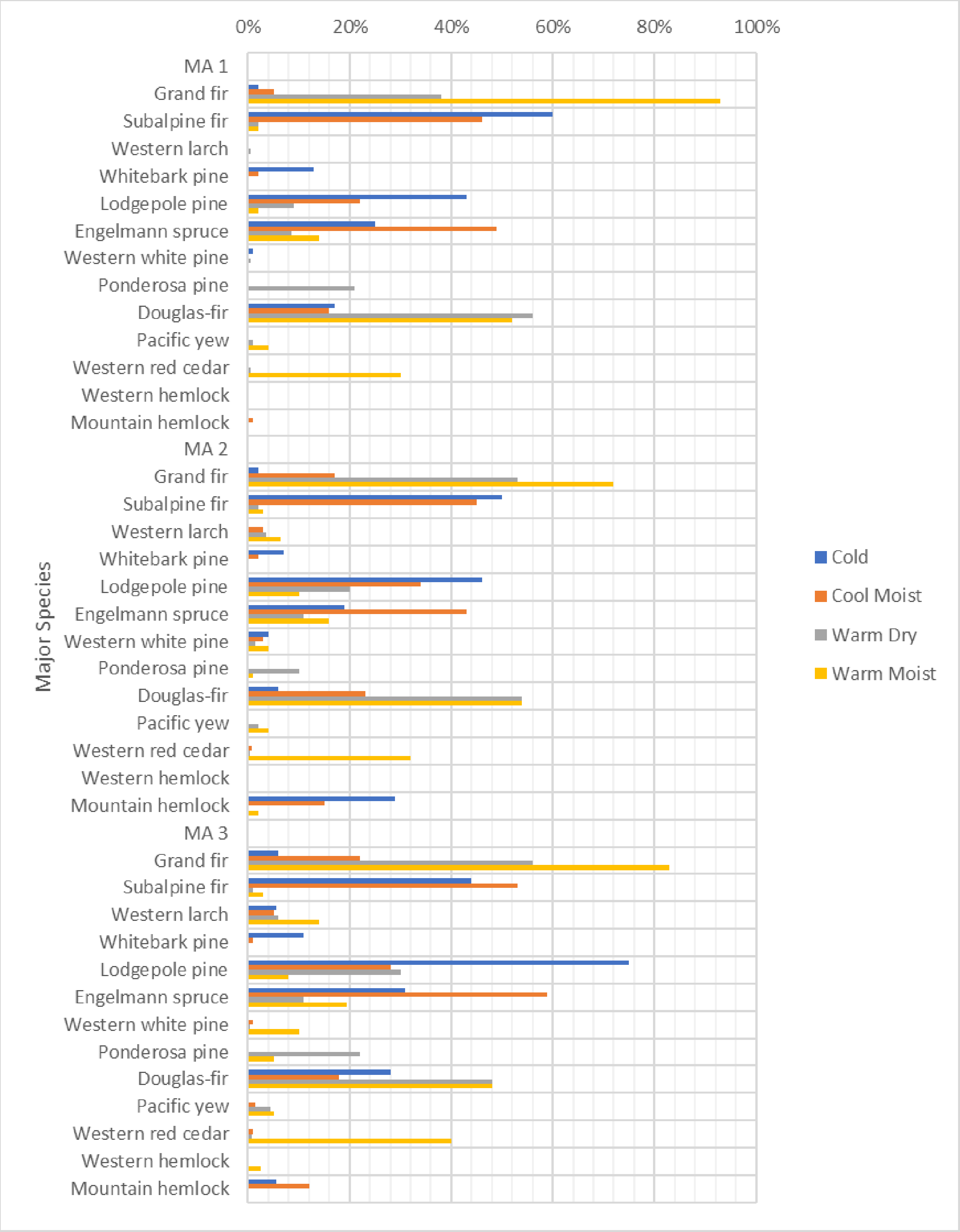

Figure 5. Percent species presence by management area

Data Source: R1 FIA Hybrid 2015 dataset, Sp_Presence21.xlsx.

Large-tree Structure

Resource specialists and members of the public are interested in the amount and distribution of large and very large trees occurring across the landscape. This understanding is important in the context of defining the natural range of variation, desired conditions, and resilience of forested ecosystems. The Northern Region Existing Vegetation Classification System (Barber et al. 2011) includes a size class metric, which classifies plots or stands based on the basal area weighted average diameter; a single label is assigned to a plot or stand. Scattered individuals, groups, and clumps of large and very large trees may occur in forests classified into a smaller size class. The Northern Region Large-Tree Structure attribute was developed to characterize stands or plots where large and very large trees occur at certain minimum densities. Large-tree Structure, coupled with Size Class, provides information on the density of large trees as well as the average size of the trees on a plot or within a stand.

Large-tree structure identifies where large and very large trees are present in sufficient numbers to contribute to key ecosystem processes. This structure may occur within any forest size class. Based on Forest Inventory and Analysis (FIA) data, a large-tree structure is found in 0 percent of the seedling and sapling class; 10 percent of the small tree class; 36 percent of the medium tree class; 26 percent of the large tree class; and 12 percent of the very large tree class. Given the high level of productivity associated with most of the forested areas of the Nez Perce-Clearwater, areas of the forest meeting large tree structure criteria are common. Areas of the forest meeting the “Both” structural criteria are more meaningful in terms of legacy trees, genetic refugia, and wildlife habitat components. Based on forestwide FIA data, the Both (large-tree and very large tree) structure is found in 0 percent of the seedling and sapling class; 1 percent of the small tree class; 15 percent of the medium tree class; 49 percent of the large tree class; and 61 percent of the very large tree class. Desired conditions are not expressly derived for the large tree structure attribute within the Land Management Plan. Plan components FW-DC-FOR-05, 08, and 11 express the desired condition of having legacy tree components to be distributed among all size classes present on the national forest. As Figure 6 illustrates, there is an opportunity to incorporate large tree structure within the seedling and sapling size classes. SIMPPLLE does not track these classes explicitly. However, as discussed in the size class section, this attribute can be directly compared to the SIMPPLE natural range of variation outputs for large and very large tree size classes.

Site productivity and species composition vary between broad potential vegetation type groups (PVT). The cold PVT group is typified by short growing seasons and sites with limited productivity. Lodgepole pine, subalpine fir, mountain hemlock, and Engelmann spruce dominate the species composition of cold sites. These species typically have potential to grow into the large size class but have limited potential to grow into the very-large size class. By contrast, the warm moist PVT group includes the most productive growing sites and includes species which can grow into the very-large size class. Relative percentage of large-tree structures associated with each broad potential vegetation type group is illustrated in Figure 7. Approximately 38 percent of sites within the warm moist broad potential vegetation type exhibit large-tree structure characterized as both, indicating that both large-tree and very-large tree size classes are aggregated.

Percent of each management area exhibiting large-tree structure is illustrated in Figure 8. The relative percentage of each management area meeting large-tree structure criteria is similar for each management area. Ecosystem functions, vegetation patterns, species composition and size class distributions are exclusively influenced by natural disturbance agents within Management Area 1. Management Area 2 is primarily influenced by natural disturbance agents along with prescribed fire, wildfires managed to achieve land management plan objectives, and minor amounts of mechanical vegetation treatments.

Large-tree structure within Management Area 3 is more closely aligned with Management Area 1 than that of Management Area 2.

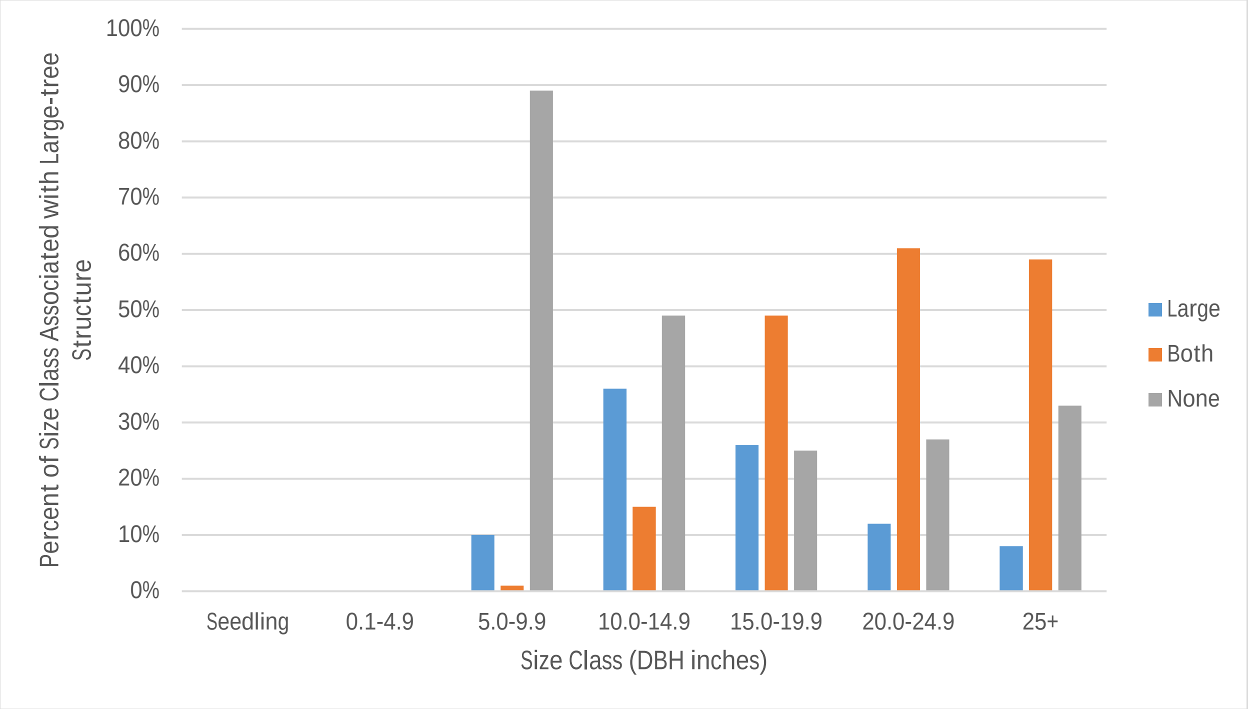

Figure 6. Percent large-tree structure by forestwide size class

Data Source: R1 FIA Hybrid 2015 dataset, LargeTreeStructure_OG_Analysis.xlsx

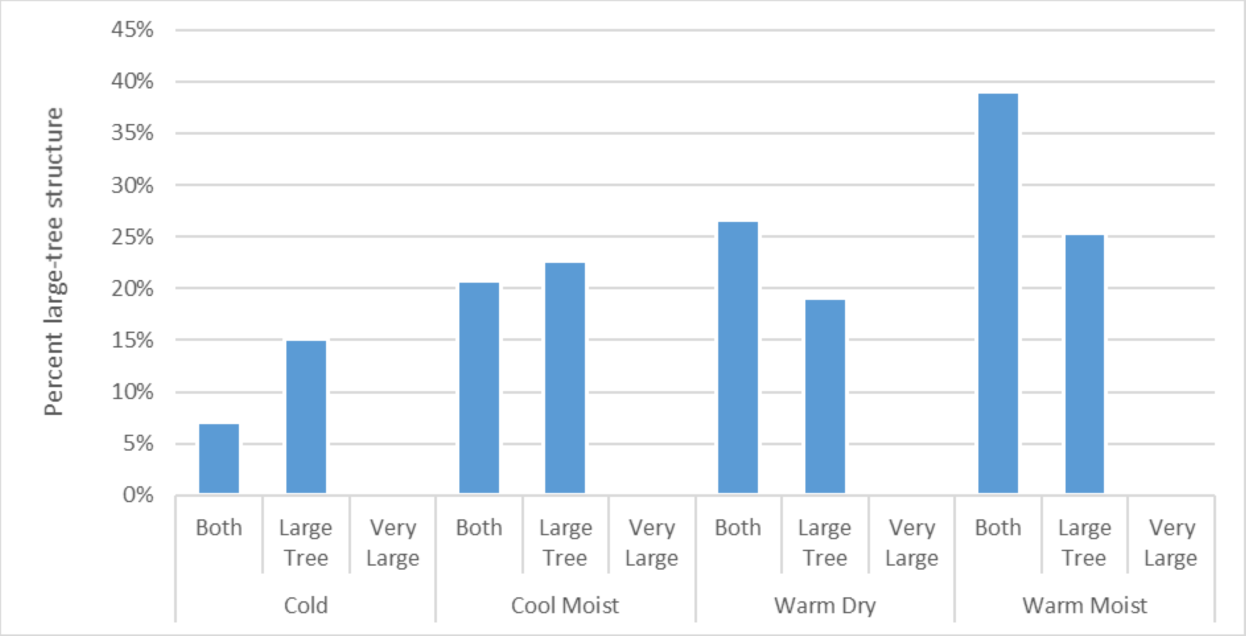

Figure 7. Percent large tree structure by broad potential vegetation type

Data Source: R1 FIA Hybrid 2015 dataset, LargeTreeStructure_OG_Analysis.xlsx

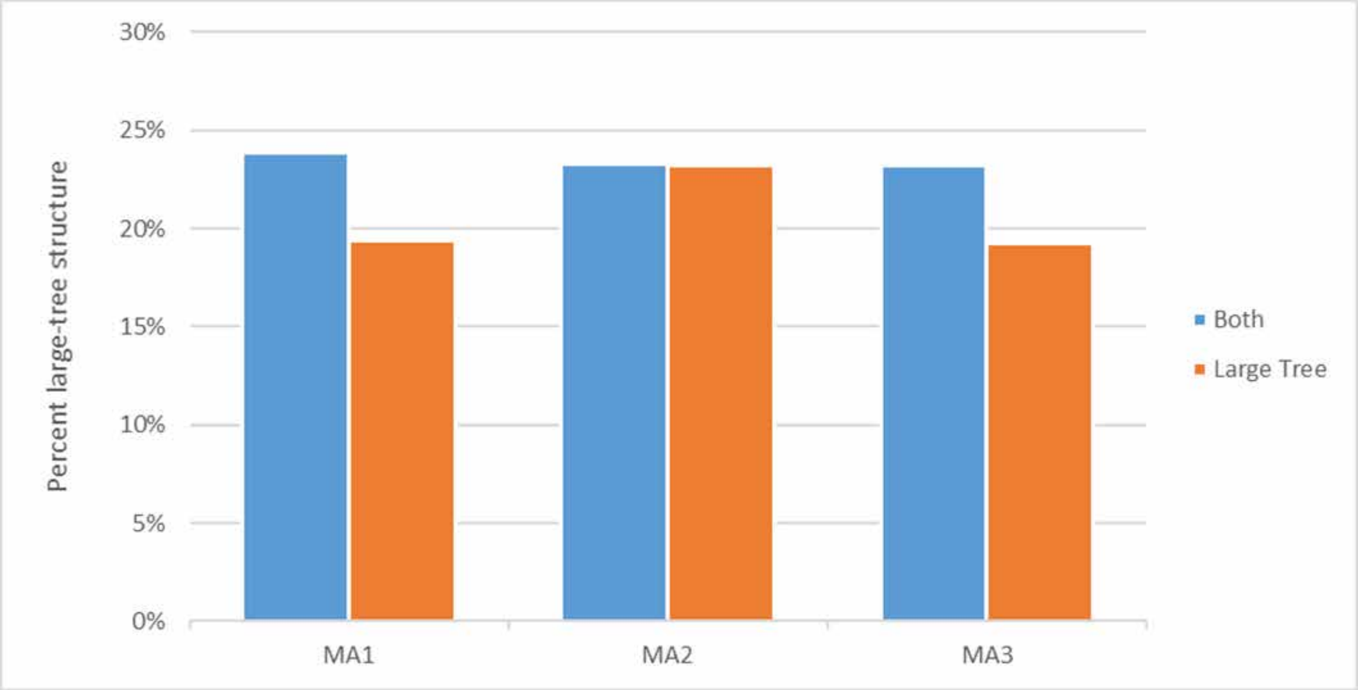

Figure 8. Percent large tree structure by management area

Data Source: R1 FIA Hybrid 2015 dataset, LargeTreeStructure_OG_Analysis.xlsx.

Opening Patch Size

The distribution and range of sizes of early successional forest patches (transitional and seedling or sapling size classes) have been identified as the key ecosystem characteristics to represent landscape pattern because this condition is quantifiable, represents likely patterns of older forests, and is meaningful for many species. Openings in the forest are created after a stand-replacing disturbance and are the most distinct and easily detectable structural conditions in a forested landscape because they are dominated by grass, forbs, shrubs, and seedling or sapling sized trees. They are meaningful to many wildlife species because of their distinctive composition and openness, which affects the growth and survival of plants that wildlife depends on, and strong contrast to adjacent mid or late successional forest (“edge”). They also represent the initiation point in forest development, the foundation upon which rests the pattern of the future forest.

Results of the natural range of variation analysis were used to inform the desired conditions for early successional forest patches, or “openings.” An opening was included in the calculation if it was classified as either transitional or seedling or sapling size class and generated within 10 years of a wildland fire. The indicators used are:

- *Average opening size*, which is a simple arithmetic mean of cumulative area of openings divided by the number of openings; and
- *Area weighted mean opening size*, in which the mean is weighted based on the proportion of the area of openings relative to the total. This metric indicates whether there are large openings in the landscape, or if most openings are close to the average. For example, in a forest with a 99-acre patch and a 1-acre patch, the average size is 50 acres, and the area-weighted mean is (99*.99 + 1*.01) 98.02 acres.

- *Jenks Natural Breaks Distribution:* This algorithm arranges opening size values into logical size classes that minimize the within-class variance while maximizing the between-class variance.

Patch size distribution for openings is not normal and skews toward the small size. There are relatively few large patches and many smaller patches. Furthermore, the smallest recognized patch, or grain size, is highly influential to the average patch size calculation (Teng, 2016)[3]. As the grain size decreases and smaller patches are included in the calculation, the average size will similarly approach zero. To keep the analysis of opening size within the realm of feasible management practices, an eighteen-acre filter was used to remove openings less than 18 acres in size. Since each pixel in the analysis frame represents 5.6 acres; a minimum of four adjacent pixels are required to define a patch in this analysis. Figure 9 illustrates the relationship between the estimates of average patch size per decade with the mean of all patches projected for 100 decades. Given the bi-model distribution of the data; the mean is a poor estimate of the central tendency of this data set.

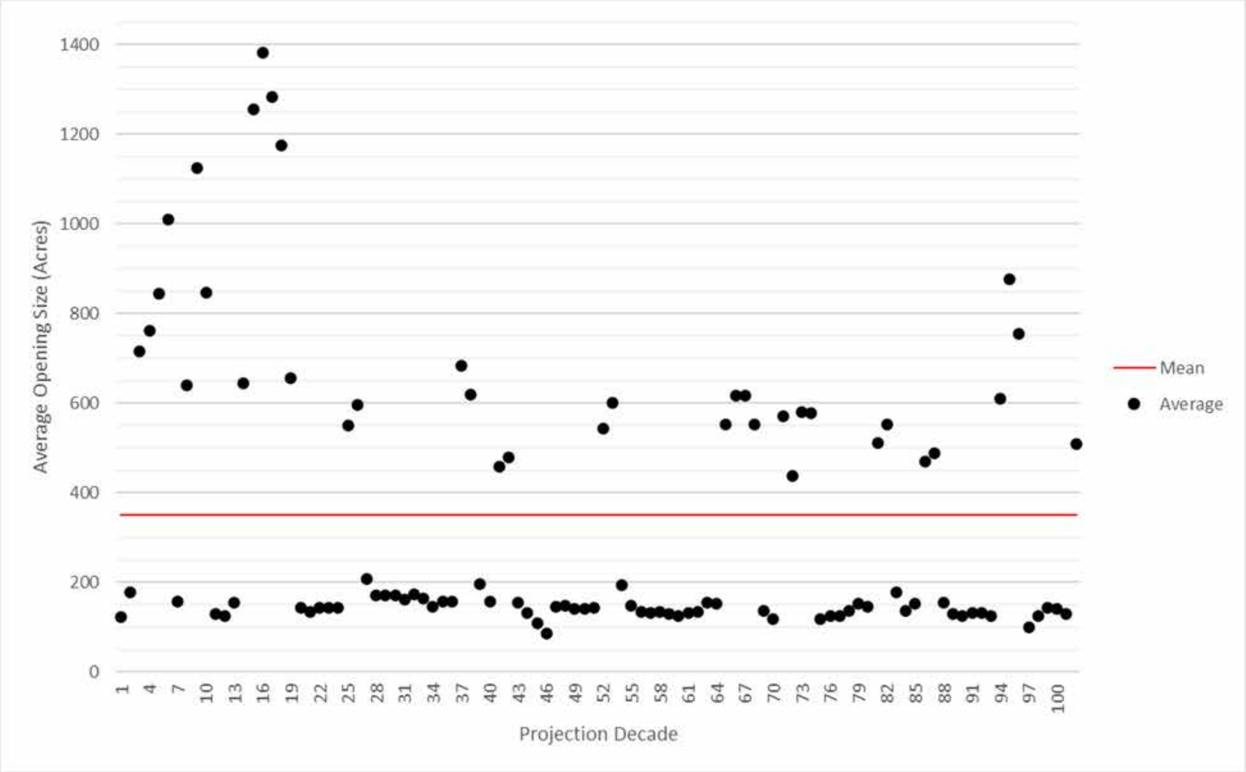

Figure 9. Natural range of variation estimate of average opening size by projected decade

Data source: SIMPPLLE

The Jenks Natural Breaks distribution analysis provides a different context for classifying and analyzing opening patch sizes. This is a mathematical classification where the variance is minimized within a size class (the area between two breaks), but the variance between size classes tends to be large.

To test the sensitivity of the algorithm’s parameters, openings were classified into both 7 breaks and 10 breaks. Seven corresponds with the number of fire size categories that are recognized by the Forest

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[3] Teng, M., Zeng, L., Zhou, Z. et al. Responses of landscape metrics to altering grain size in the Three Gorges Reservoir landscape in China. Environ Earth Sci 75, 1055 (2016). https://doi.org/10.1007/s12665-016-5605-6 https://link.springer.com/article/10.1007/s12665-016-5605-6

Service, and wildfires are the primary cause of young forest in this analysis. The ten-break analysis was used as an additional category to assess sensitivity. Breaks were then evaluated to determine which most appropriately represented the class in which the Forest Service can feasibly conduct management activities. Finally, the 90th percentile of the break was calculated to potentially represent a logical maximum opening size standard.

Opening size metrics were derived from 30 model runs of 100 decades each, or 3,000 data points and summarized in the NRV Results section.

Vegetation Models

The vegetation management strategy for the Nez Perce-Clearwater is to maintain or trend towards the desired conditions for vegetation. Modeling changes in vegetation over time, choosing appropriate management practices, and evaluation of movement towards desired conditions was accomplished using the following set of analytical tools and models:

- Forest Vegetation Simulator—This forest growth simulation model was used to estimate timber growth and yield, as well as vegetation response to alternative management timings and methods (Dixon 2008).
- PRISM (**P**lan-level fo**R**est act**I**vity **S**cheduling **M**odel)—This model was used to derive a schedule of potential vegetation treatments to achieve vegetative desired conditions, (Nguyen 2018, Henderson 2017, Nguyen et al. 2022). Treatments were chosen from the suite of possible management options modeled with the Forest Vegetation Simulator. Treatments were also chosen to respond to resource constraints, such as watershed integrity, sustainable timber products, and budget limitation.
- SIMPPLLE (**SIM**ulating **P**atterns and **P**rocesses at **L**andscape sca**LE**s)—This model was used to project the treatments scheduled by the PRISM model in the context of an uncertain future (Chew et al. 2012). Natural processes, such as wildfire, succession, insects, and disease, were simulated in a stochastic fashion in and around the PRISM-scheduled treatments to provide a range of possible vegetation conditions for each alternative.

These models are tools that provide information useful for understanding vegetation change over time and the relative differences between alternatives. The PRISM and SIMPPLLE models are best used to provide information of comparative value; these models are not intended to be predictive or to produce precise values for vegetation conditions. Out of necessity, the models simplify very complex and dynamic relationships between ecosystem processes and disturbances, such as climate, wildfire, and succession, and vegetation over time and space. Though best available information, including corroboration with independent data sources, professional experience, and knowledge, is used to build these models, there is a high degree of variability and an element of uncertainty associated with the results because of the ecological complexity and the inability to accurately predict the timing or location of future events. The following sections provide more detailed descriptions of each of the above-mentioned models.

Forest Vegetation Simulator

Growth and yield tables for the PRISM model were developed using the Forest Vegetation Simulator (Dixon 2008). The Forest Vegetation Simulator is a family of forest growth simulation models. The basic Forest Vegetation Simulator model structure has been calibrated to unique geographic areas to produce individual Forest Vegetation Simulator variants. Since its initial development in 1973, it has become a system of highly integrated analytical tools. These tools are based upon a body of scientific knowledge developed from decades of natural resources research. Data from the Forest Inventory and Analysis (FIA) database was used in describing starting vegetation conditions for developing the growth and yield tables. For each vegetation classification, consisting of potential vegetation type, species, size, and density, a series of possible management approaches was modeled with the Forest Vegetation Simulator. These approaches included prescribed fire, thinning, uneven-aged management, even-aged management, effects of insects, disease, and nonlethal fire, and, finally, a succession-only simulation. Active management types were modeled with different timing options, such as thin at age 40 versus thin at age 50. This model reported various metrics at each point in time into the future, including timber volume, standing volume, vegetation condition, fire hazard, lynx habitat suitability, and management action type. The use of the Forest Vegetation Simulator and of the timber prescriptions are documented in the project record. The resulting yield tables were used as a basis for the PRISM model to select the appropriate management action and timing choice for each vegetation type.

PRISM Model

The PRISM (**P**lan-level fo**R**est act**I**vity **S**cheduling **M**odel) model is a software package that was developed in conjunction with the Nez Perce-Clearwater Land Management Plan and is intended for broader application in plan revisions elsewhere in the country (Nguyen 2018). Its application is nearly identical to non-commercial (Spectrum and FORPLAN) and commercial (Woodstock) forest management models used in other forestry applications. PRISM is a software modeling system designed to assist decision makers in exploring and evaluating multiple resource management choices and objectives. Models constructed with PRISM schedule management actions on landscapes through a time horizon and display resulting outcomes. Management actions are scheduled to achieve while complying with all identified management objectives and limitations (constraints). PRISM makes it possible to display management actions at multiple spatial and temporal scales. This model is very effective in modeling alternative resource management scenarios in support of strategic and tactical planning. Examples of this include scheduling vegetation treatments to achieve desired conditions; modeling resource effects and interactions within management scenarios; exploring "tradeoffs" between alternative management scenarios; and analyzing minimum habitat requirements to ensure species viability and diversity. PRISM was used to model potential vegetation treatments across the Nez Perce-Clearwater over time under the different alternatives developed for the Land Management Plan. The action alternatives were modeled with an objective based on the achievement of desired conditions, as described in the plan, for forest composition and size classes.

In addition to the objectives, the model applies constraints to potential actions based on other resource factors that would limit treatments, such as lynx habitat; known operational or logistical limitations, such as with prescribed burning; and management area direction, such as suitability for timber production or prohibitions on certain treatments. Limits associated with budget levels are also evaluated. In the end, the PRISM model formulation and outcomes provide a schedule of activities for the Nez Perce-Clearwater National Forests' harvest and prescribed fire that help provide answers to the following questions:

- What vegetative treatments should be selected and scheduled to move towards the desired conditions for vegetation, with and without budget limitations?
- What is the projected timber sale quantity, with and without budget limitations?
- What amount of timber can be removed annually in perpetuity on a sustained-yield basis (that is, the sustained yield limit)?

Technical Notes on Model Formulation

The PRISM model structure is slightly different from other forest management scheduling applications in the Northern Region. The model schedules one of two broad categories of silviculture treatment methods and then within each category chooses a specific management schedule (timing of that treatment).

The Model 1 category includes non-stand replacing methods, including Natural Growth (NG), Mixed-severity fire (MS), Prescribed Burn (PB), Group Selection (GS), and insect disturbance (BS). An acre scheduled with a Model 1 method follows that yield trajectory for the entire planning horizon. The model chooses the specific timing of the method and activities from a list of available timing choices. For instance, mixed-severity fire might have several choices: burn in Period 1 and then Periods 6, 11, 16, 21, 26 or burn in Period 2 and then 7, 12, 17, 22, 27, and so forth. The timing the model chooses, as well as the total number of acres assigned to the method, are dependent on the disturbance assumptions and constraints described below.

Model 2 is the other management category used in the PRISM model and represents two stand-replacing methods: even-aged management and stand-replacing fire. When Model 2 methods are scheduled, the regenerated stands are pooled with other types within the same map area that are regenerated in the same period and then given a full set of choices from that point forward. For instance, if 100 acres of Vegetation Type C size P are scheduled for even-aged management and regenerated as Type C and 50 acres of Vegetation Type C Size J burned with stand-replacing fire and regenerated as Type C in Period 2, the model will consider management for 150 acres of the regenerated type in Period 3 and choose a suite of methods (either Model 1 or Model 2) and timings to apply. A portion of these 150 acres will also be burned with stand-replacing fire (SR) according to the vegetation type or size class rules described below. This Model 2 structure allows for flexible scheduling of acres between different management activity types, as well as allowing for species dominance type conversion to occur in newly regenerated stands.

SIMPPLLE Model

SIMPPLLE (**SIM**ulating **P**atterns and **P**rocesses at **L**andscape sca**LE**s) is a model that simulates changes in vegetation on landscapes in response to both natural disturbances and management activities as they interact with climatic conditions (Chew et al. 2012). This model was used in the Land Management Plan for two purposes: to calculate the natural range of variation for vegetation conditions and to project the vegetation conditions of the alternatives across the Nez Perce-Clearwater into the future for analysis in the environmental impact statement. The Northern Region VMap GIS layer is the primary data source used for describing the existing vegetation conditions spatially for the Nez Perce-Clearwater. Potential vegetation types, geographic areas, and ownership are also integrated into the existing data layer. The SIMPPLLE model has been used to inform land management decisions on large landscapes for over twenty years. It has been used on many landscapes across the United States, and most extensively on areas in the Forest Service Northern Regio. Most recently, it supported forest plan revisions on the Flathead, Helena-Lewis and Clark and Custer Gallatin National Forests.

SIMPPLLE takes a landscape condition at the beginning of a simulation, including past disturbances and treatments, and uses logic to grow the landscape through time while simulating processes, such as growth, wildfire, and insects that might occur on that landscape during the projection, accounting for the effects of those processes. It is a state and transition model, incorporating multiple pathways of change in vegetation in response to climate, disturbances, growth, and other processes. Simulation timesteps are 10 years, and simulations are made for multiple timesteps. The logic assumptions in the model come from a variety of sources, including expert opinion; empirical data; modeled data from other forestry computer applications, such as the Forest Vegetation Simulator; and initial model logic files that reflect a long history of trial and error and research that has been maintained and documented in files that are passed from Forest to Forest.

SIMPPLLE takes a landscape condition at the beginning of a simulation and uses state and transition logic flows to model landscape change through time. States in the model are discrete combinations of vegetation type, size, and density. Transitions are the pathways that describe how vegetation moves between states through time. Forest succession is modeled as a deterministic process and disturbances are modeled as a stochastic process. First, processes such as wildfire and insects that might occur on that landscape are simulated for a point in time (timestep). Next, the effects of these processes on the underlying vegetation are determined through the transition logic which may result in a different state. The model incorporates multiple pathways of change in vegetation in response to climate, disturbances, growth, and other processes. It is important to note that the model is spatially-interactive; that is, what happens to a particular piece of land at a point in time is dependent on what is going on in the landscape nearby such as a fire spreading across a landscape. Another novel feature of the model is that information at different scales can interact to affect the likelihood of processes occurring. For instance, a dry climate might stress mature trees of a certain species and make them susceptible to insect infestation. Another example is a wet climate cycle may result in fewer wildfires and enhanced regeneration, which might load a site for more intensive fire effects in a future dry climate cycle. Simulation timesteps are 10 years, and simulations are made for multiple timesteps. The logic assumptions in the model come from a variety of sources, including scientific studies, expert knowledge, empirical data such as forest-maintained datasets, and modeled data from other forestry applications such as the Forest Vegetation Simulator.

The other main utility of the SIMPPLLE model is its spatially interactive nature. A process occurring on one site is dependent, to an extent, on the processes that are occurring on adjacent sites. Consider a wildfire event. SIMPPLLE simulates fire by assigning fire starts with a probability consistent with what historic records indicate for the area and climate. Each start is then given the opportunity to grow. The size the fire grows to is dependent on the surrounding vegetation, as well as the historic probability that it will end with a weather event, or, if simulating fire suppression, whether or not there are enough resources to put the fire out. The type of fire that spreads (lethal, semi-lethal, or non-lethal) is dependent on the vegetation conditions of the site, including past disturbance or treatment; the climate assumption for the timestep; its elevational position relative to the burning fire (uphill, downhill, etc.); and whether it is downwind or not. The speed at which a fire grows in a certain direction is dependent on the slope of the landscape and the wind speed and direction. Again, the fire process will stop according to the probability of a weather-ending event, successful fire suppression, or perhaps running up against a natural barrier, such as the treeline or a lake. SIMPPLLE will then determine the effect of the fire by considering whether there are trees present capable of reseeding or resprouting the site (in the case of a lethal fire), whether the stand’s fuel conditions have been reduced (for semi- or non-lethal fires), and whether there has been a change in size or species on the site.

The SIMPPLLE analysis for the Nez Perce-Clearwater uses the Northern Region VMap as the existing vegetation conditions layer. SIMPPLLE data was calibrated with Forest Inventory and Analysis data for vegetation species and size classes. Updates to the logic files and assumptions were implemented to reflect the ecosystems and processes more closely on the Nez Perce-Clearwater. These include modification of certain successional pathways, regeneration logic, insect or disease probabilities, and fire logic (for example, fire severity, fire size or spread, fire event probabilities, and weather-ending events). Updates to the model between the publishing of the proposed action and the Draft Environmental Impact Statement also occurred to reflect successional growth rates and the age of the stands by diameter class, as well as corroboration of the species presence between the Northern Region VMap data layer and the Forest Inventory and Analysis data set. Details on the development of the SIMPPLLE model and the model updates that were completed throughout the forest plan revision analysis process can be found in the project record. As discussed earlier, even though best available information was used to develop and update the model, there remains relatively high uncertainty in the results (in absolute terms) due to the ecological complexities and lack of ability to predict the future. Actual amounts of wildland fire or bark beetle activity on the landscape in the future, for example, and the impact to vegetation could be quite different from that modeled. Up to 50 model simulations were run to better capture the variability and uncertainties associated with disturbance events and resulting vegetation change. Nevertheless, the model is extremely valuable as a comparative tool to understand relative differences among alternatives.

Model Interaction

The PRISM and SIMPPLLE models are used interactively to analyze vegetation conditions. Wildfire disturbances are first modeled in SIMPPLLE. Resultant disturbance levels are then input into the PRISM model as acres of projected wildfire and insect disturbance. The PRISM model is then run to schedule treatments to move toward desired conditions in the context of average expected disturbance levels. The outputs from PRISM are then input into the SIMPPLLE model to evaluate treatments in the context of a range of stochastic ecological processes and disturbances (fire, insect, disease, and succession) and spatial analysis of the change in vegetation conditions over time. Figure 10 displays the interaction and relationship between the PRISM and SIMPPLLE models.

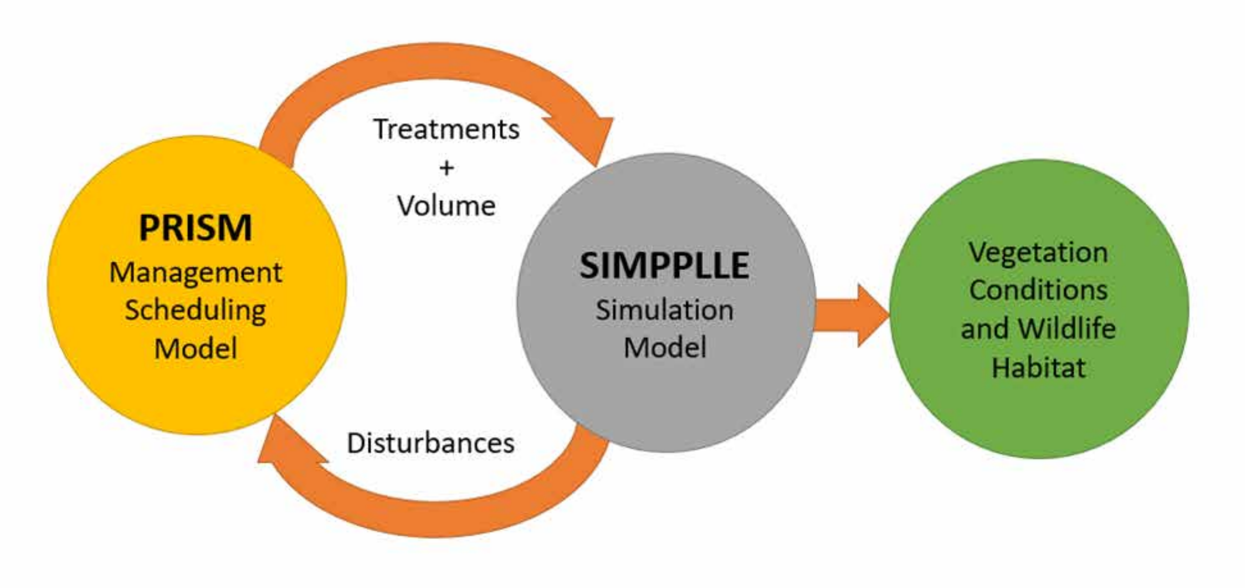

Figure 10. Use of PRISM and SIMPPLLE models in determining effects on vegetation conditions and habitat

Vegetation Analyses Process and Assumptions

Natural Range of Variation

A critical step in assessing ecological integrity and desired conditions was to determine the natural range of variation for selected key ecosystem characteristics and then assess the status of the ecosystem based on projected trends of key ecosystem characteristics. The natural range of variation refers to the variation of ecological characteristics and processes over scales of time and space that are appropriate for a given management application (FSH 1909.12); it represents the distribution of conditions under which ecosystems developed and gives context for evaluating the integrity of current conditions and identifying important compositional, structural, and functional elements that may warrant restoration. In contrast to the generality of historical ecology, the natural range of variation concept focuses on a distilled subset of past ecological knowledge developed for use by resource managers; it represents an explicit effort to incorporate a past perspective into management and conservation decisions (Romme et al. 2016).

One method for determining the natural range of variation (NRV) is to model it with a known set of assumptions to learn about historic conditions. A common tool in NRV modeling is a state and transition simulation model (STSM) (Blankenship, 2015)[4]. These models partition ecosystems into discrete components, or "states", that share common characteristics such as vegetation type and maturity. They then define the different pathways between the states, or "transitions", and the associated causes and probabilities of those transitions. Modeled NRV may be used in instances where historical information does not exist. It may also be used to infer additional attributes about a model area with incomplete information. For example, known information can be used in the SIMPPLLE STSM to derive spatial metrics about opening sizes. Refer to the document entitled "Using Natural Range of Variation Modeling to Estimate Opening Size on the Nez Perce-Clearwater National Forests" located in the project record, for a further discussion of the SIMMPPLE model calibration and validation process.

The future will not be the same as the past. Further, the analysis includes inherent uncertainty, and it is appropriate to utilize additional resources, including literature and expert opinion, to ensure the "envelope" of vegetation conditions described by desired conditions will meet future ecological and social needs. Therefore, the desired conditions are not always equal to the natural range of variation. Additional factors were considered in the development of desired conditions. There may be other factors (social, economic, or ecological) that lead the responsible official to determine that the natural range of variation may not be an appropriate desired condition for certain characteristics. These considerations include maintaining conditions that contribute to long-term resilience given uncertainties in future climate and disturbances; sustaining stand structures or species compositions that provide habitat for at-risk wildlife or plant species; and conserving rare structures or components, anticipated or existing human use patterns, the effects changing climate may have, and ecosystem services expected from National Forest System lands, such as the reduction of fire hazards and production of forest products.

There is also a potential for ecological transformations to occur in temperate ecosystems based on the potential for interrelated drivers, such as chronic and acute drought, wildfire, and insect outbreaks, to push ecosystems beyond their thresholds for resilience (Millar and Stephenson 2015, Golladay et al. 2016). In some cases, management intervention might be able to ease the transition to new forest states and minimize losses of ecosystem services (Millar and Stephenson 2015). The capability to predict such possible shifts at the local scale currently does not exist. By basing the desired conditions around the full range of natural variation, with a focus on maintaining the full suite of ecosystem diversity and components that enhance resilience to disturbance, the Land Management Plan would guide management toward maintaining functioning ecosystems in the face of uncertainty.

Process and Methods

The modeling extent for the original natural range of variation analysis (Milburn et al. 2015) covers the entire Nez Perce-Clearwater plan area, including lands of other ownerships. This includes private lands around the Palouse Ranger District, as well as wide buffers around smaller pieces of ownership, such the State of Idaho and the Army Corps of Engineers in the Dworshak area. This area was included to allow natural processes to move across the large landscape. In addition, the "Island" west of the Salmon River

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[4] https://www.aimspress.com/aimspress-data/aimses/2015/2/PDF/20150209.pdf

was included for similar reasons, even though this area is administered by the Wallowa-Whitman National Forest. Outputs were summarized for National Forest System lands on the Nez Perce-Clearwater.

When considering the time over which to evaluate the natural range of variation, "the pre-European influenced reference period considered should be sufficiently long, often several centuries… and should… include short-term variation and cycles in climate" (FSH 1909.12.05). In 2019, an updated climate model was developed which incorporated the Palmer Modified Drought Index. The Living Blended Drought Atlas (LBDA) (Cook et al. 2009) was used to reconstruct climate history for the Nez Perce-Clearwater. This updated climate model correlated well with recorded data from 1870 to present. The reconstruction of climate history is an important step toward developing the natural range of variation for plant communities and to gain insight into natural disturbance patterns. To meet this intent, vegetation conditions 1,000 years into the past were modeled. This reference period allowed the Nez Perce-Clearwater to simulate the conditions associated with much of the period known as the Medieval Climate Anomaly (about 1,000 to 700 BP), as well as the other end of the climate spectrum known as the Little Ice Age (early 650 BP to about 80 BP). The inclusion of the Medieval Climate Anomaly is valuable in that it might indicate conditions and processes that could occur in the modern climate regime. SIMPPLLE was run under a scenario that included natural ecological processes and disturbances, and their interaction with climate, using the Palmer Modified Drought Severity Index as the indicator of past climate. Data for this index is reconstructed for localized points, and the data points nearest the Nez Perce-Clearwater were used to evaluate the climate. The data was categorized into three climate scenarios—wetter, drier, and normal—and the appropriate scenario was applied to each modeling period (decade). Key model processes, such as tree growth, wildfire, insects, and disease populations, function differently depending on the climate scenario.

Disturbance Regime Calibration

Wildfire processes, including the probability of ignition, fire sizes, fire regimes (frequencies and severities), weather ending events, and the effects to successional pathways are key drivers in the projection models. Wildfire processes were calibrated using local fire history data, applicable fire history studies and publications, previous modeling efforts, and expert judgment. Most notably, a detailed analysis was done to estimate historic fire regimes using LANDFIRE reference data (Rollins and Frame 2006). The LANDFIRE database was queried to generate estimated ranges of average acres burned per decade within each of the five fire regimes represented on the Nez Perce-Clearwater. Mean values for each fire regime range were correlated with broad potential vegetation type and used to calibrate the SIMPPLLE model. These mean values are incorporated into the model as desired conditions for wildland fire disturbance by broad potential vegetation type. Each fire regime is expressed as having both fire return intervals and fire severities. Both fire return interval and fire severity type have great influence on ecosystem functions and processes including average patch size and species successional pathways.

The probability and effects of key insect and disease processes (bark beetles, defoliators, and root diseases) were also calibrated using the latest science regarding insect hazard and mortality trends, local data, and expert judgment.

For the natural range of variation, the model was run for 50 iterations. Multiple iterations were used to capture the stochastic nature of disturbances and their influence on vegetation dynamics on the landscape. Since data on the exact vegetation and disturbance histories does not exist, simulating multiple scenarios within the range of known and understood uncertainty results in a range of outcomes that collectively represent the natural condition of the past. It was important to create a range of random starting points so that the analysis reflected conditions unaffected by modern influences. To accomplish this, each geographic area—Palouse, North Fork, Lochsa, Selway, and South Fork—was run for 100 periods (1,000 years) to achieve an equilibrium in the historic disturbance or vegetation dynamic. This data set represents the “Full Natural Range of Variation” run. A subset of the SIMPPLLE 100-decade simulation (Dry Natural Range of Variation) with warmer and drier climatic conditions was chosen to represent the potential climate change predictions for the northern Rockies. The natural range of variation analysis was run using 5-acre polygons. Differences from the Full Natural Range of Variation simulation are similar for all geographic areas and are summarized as follows:

- There is a substantial increase in the grass or shrub type, with slight increases in Ponderosa pine, western larch—Douglas-fir, whitebark pine, lodgepole pine, and white pine.
- There are substantial decreases in grand fir and subalpine fir—Engelmann spruce.
- There is a substantial increase in the seedling or sapling and very large size class, with decreases in all large size classes.
- Disturbance processes (primarily wildland fire) increase, thereby keeping the landscape in a more open condition with large percentages of grass or shrub and young trees, with higher percentages of early-seral, fire tolerant and disease resistant species, and more 20 inch plus size class.

Natural Range of Variation Analysis for Old Growth Forests

Old growth cannot be modeled because the definition requires information, which is only available in plot or stand-level field inventory; such data is not mapped across the Forests, nor can it be derived from models such as SIMPPLLE. Therefore, there is no means to determine a quantifiable estimate of the natural range of variation (NRV) for old growth amount, patch size, or distribution. The historic condition must be inferred from other attributes. Tree size class can be reliably estimated using FIA and R1-VMap. Because old growth definitions are based in part on the presence of large trees, a correlation can be drawn with the presence of large-tree structure. The definition of large-tree structure was developed using the minimum large tree criteria found in old growth definitions as a reference point (Green et al. 2008, Milburn et al. 2019). Areas exhibiting large-tree structure are the most likely to contain sufficient large trees that are old growth.

To develop an estimate of NRV for old growth forests, the analysis area must be larger than the area for which the estimate is applied to avoid bias associated with the ratios of broad potential vegetation types per unit area. Areas which have experienced vegetation treatments are illuminated from consideration to avoid bias in species compositions. The resulting analysis area is referred to as the North Idaho Analysis Area (NIAA) and consists of all lands in northern Idaho classified as wilderness, roadless, national historical landmark areas, natural research area and other special areas where timber harvest has been excluded. Habitat types and associated old growth forest types are consistent within the North Idaho analysis area.

Estimates of the NRV derived from the NIAA, suggest a mean of about 22 percent (range 19 to 24 percent) of the landscape had large-tree structure. On the Nez Perce-Clearwater, large tree (15-to-19.9-inch DBH) structure is not as ecologically meaningful as very large (20+ inch DBH) tree structure for most cover types. Exceptions occur within the cold potential vegetation type group including lodgepole pine, Engelman spruce or subalpine fir or mountain hemlock and subalpine fir old growth cover types. These types rarely achieve diameters over 15-inch DBH. Much of the land area of the Nez Perce-Clearwater is highly productive and capable of growing trees 15-to-19.9-inch DBH within 80 years. These trees are much younger than the minimum screening criteria age for most old growth forest types.

The NRV analysis area (Nez Perce-Clearwater) revealed very few areas meeting the selection criteria of very large trees only. This indicates that very large trees are highly correlated with the presence of large trees. The preponderance of the area meeting large-tree structure is classified as “both,” indicating that the area meets both large-tree and vary large-tree criteria. The mean of this “both” NRV analysis estimate is 24 percent (range 21 to 27 percent). The estimated mean for large-tree structure meeting the large-tree only classification is 22 percent (range 19 to 24 percent). Not all areas would have been old growth because factors, such as tree age and density, are not reflected. It is important to recognize that not all old growth forest types can grow into the large-tree structure classification of “Both” due to site limitations and species characteristics. To estimate a possible proportion, the current relationship between large-tree structure and old growth is explored.

An estimated 20 percent (range 15 to 25 percent) of Nez Perce-Clearwater FIA plots classified as having large-tree structure are also classified as old growth. Approximately 55 percent (range 49 to 61 percent) of FIA plots are currently classified as having both large-tree and very large-tree structure (large-very large tree structure) and classified as old growth.

If this proportion were applied to the natural range of variation (NRV) estimates of large-tree and large-very large tree structures separately, then it can be postulated that a natural range of old growth may be estimated. These calculations are illustrated in Table 13 and Table 14. A forestwide estimate of between 3.8 and 4.8 percent is calculated for old growth types meeting the large-tree only (15 to 19.9 inch DBH) criteria. These old growth types are generally associated with the cold and cool moist broad potential vegetation types and include lodgepole pine, mountain hemlock or subalpine fir and Engelmann spruce or subalpine fir old growth types. The NRV estimate for old growth types meeting the large-very large-tree structure classification has a mean between 11.6 and 14.8 percent.

Table 13. Mean percent and confidence interval of the natural range of variation estimate for old growth by size class, for the North Idaho Analysis Area and the Nez Perce-Clearwater

Area	Mean	Confidence Interval
North Idaho Analysis Area Large-tree only	22%	19-24%
North Idaho Analysis Area Large-tree and Very-large tree	24%	21-27%
Nez Perce-Clearwater Large-tree only	20%	15-25%
Nez Perce-Clearwater Large-tree and Very-large tree	55%	49-61%

Data Source: R1 FIA Hybrid 2015 dataset, LargeTreeStructure_OG_Analysis.xlsx.

Table 14. Summary of the North Idaho Analysis Area (NIAA) and natural range of variation (NRV), percent old growth structure, and estimate for old growth by size class

North Idaho Analysis Area	NIAA est. range	Percent structure	NRV est. range
Large-tree only	19-24%	20%	3.8-4.8%
Large-tree and very-large tree	21-27%	55%	11.6-14.8%

Data Source: R1 FIA Hybrid 2015 dataset, LargeTreeStructure_OG_Analysis.xlsx

Natural Range of Variation Analysis Results

Natural Range of Variation for Dominance Type

Estimates derived from the natural range of variation (NRV) analysis presented in this section are used to inform the desired conditions for dominance and size classes presented in the Land Management Plan. In some cases, the desired conditions presented in the plan do not fall exactly within the ranges estimated by the NRV analysis. For example, the estimated range for Ponderosa pine dominance type within the warm moist broad PVT group is between 0 and 1 percent. The desired condition statement for Ponderosa pine dominance type in the warm moist broad PVT group is between 10 and 20 percent. This increase in composition above the NRV estimate is desirable due to the need to both increase the amount of wildland fire used to achieve landscape level vegetation objectives but also to generate a sustainable yield of saw timber to promote economic and social sustainability. Development of desired conditions is informed by both the full and dry ranges. In general, the minimum and maximum dry ranges are lower than the full ranges.

Table 15 shows the results of the NRV analysis for species composition. The Full and Dry NRV range reflects the mean value of all simulated decades.

Table 15: Natural range of variation by dominance type Warm Group

	Warm Dry PVT Group				**Warm Moist PVT Group**			
	Full Range		**Dry Range**		**Full Range**		**Dry Range**	
Dominance Type	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**
Ponderosa pine	37%	44%	36%	43%	0%	1%	0%	1%
Douglas-fir	17%	25%	17%	25%	4%	8%	5%	9%
Lodgepole pine	5%	13%	5%	13%	1%	2%	1%	2%
Western larch and Douglas-fir	0%	1%	0%	1%	4%	7%	4%	7%
Grand fir and western redcedar and western hemlock	0%	0%	0%	0%	10%	20%	8%	18%
White pine	0%	0%	0%	0%	14%	27%	13%	25%
Subalpine fir and spruce mix	0%	0%	0%	0%	0%	1%	0%	1%
Western larch	0%	0%	0%	0%	4%	7%	4%	7%
Grand fir	20%	28	20	28	28%	38%	26%	36%
Seral grass or shrub	1%	10%	3%	12%	4%	25%	8%	30%
Non-forest	0%	0%	0%	0%	0%	0%	0%	0%
	Cool Moist PVT Group				**Cold PVT Group**			
	Full Range		**Dry Range**		**Full Range**		**Dry Range**	
Dominance Type	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**
Ponderosa pine mix	0%	0%	0%	0%	0%	0%	0%	0%
Douglas-fir	2%	4%	3%	4%	0%	0%	0%	0%
Lodgepole pine	25%	38%	26%	38%	32%	38%	32%	38%
Western larch and Douglas-fir	1%	2%	1%	2%	0%	0%	0%	0%
Grand fir and mountain hemlock	0%	0%	0%	0%	0%	0%	0%	0%
White pine	0%	0%	0%	0%	0%	0%	0%	0%
Subalpine fir and spruce mix	35%	60%	31%	53%	2%	7%	2%	7%
Western larch	0%	0%	0%	0%	0%	0%	0%	0%
Subalpine fir and whitebark pine	0%	0%	0%	0%	38%	61%	38%	59%
Mountain hemlock	0%	0%	0%	0%	0%	0%	0%	0%
Seral grass or shrub	4%	27%	10%	31%	1%	19%	2%	21%
Non-forest	0%	0%	0%	1%	0%	0%	0%	0%

Data Source: SIMPPLLE.

Natural Range of Variation for Size Class

Table 16 illustrates the natural range of variation (NRV) ranges for size class distribution for each Northern Region broad potential vegetation type. The Full and Dry NRV reflects the mean value of all simulated decades.

Table 16: Natural range of variation by size class

	Warm Dry PVT* Group				**Warm Moist PVT Group**			
	Full Range		**Dry Range**		**Full Range**		**Dry Range**	
Size Class	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**
Non-forest	0%	0%	0%	0%	0%	0%	0%	0%
Seral grass or shrub	1%	10%	3%	12%	4%	25%	8%	30%
Seedling or Sapling 0–4.9” DBH	4%	21%	8%	23%	4%	21%	9%	22%
Pole 5–9.9” DBH	6%	18%	7%	18%	7%	20%	8%	21%
Medium 10–14.9” DBH	14%	22%	13%	20%	11%	20%	10%	17%
Large 15–19.9” DBH	26%	37%	25%	35%	20%	36%	18%	35%
Very Large 20+” DBH	13%	31%	12%	28%	10%	28%	8%	22%
	Cool Moist PVT Group				**Cold PVT Group**			
	Full Range		**Dry Range**		**Full Range**		**Dry Range**	
Size Class	Min	Max	Min	Max	Min	Max	Min	Max
Non-forest	0%	0%	0%	0%	0%	0%	0%	0%
Seral grass or shrub	4%	27%	10%	31%	1%	19%	2%	21%
Seedling or Sapling 0–4.9” DBH	9%	28%	14%	30%	12%	36%	18%	38%
Pole 5–9.9” DBH	13%	31%	12%	28%	6%	23%	7%	23%
Medium 10–14.9” DBH	8%	25%	7%	19%	7%	20%	7%	19%
Large 15–19.9” DBH	11%	31%	13%	31%	24%	58%	21%	50%
Very Large 20+” DBH	2%	25%	2%	7%	0%	4%	0%	1%

*potential vegetation type
Data Source: SIMPPLLE.

Structural stage is highly correlated with size class but is also a function of stand density, species composition, and disturbance history. For example, a stand in the warm dry broad potential vegetation type group may exist as in the open stem exclusion stage due to frequent disturbances, such as low severity fire and low site productivity. Mature multi-storied stands may result from stands composed of several species often exhibiting a mixture of both tolerant and intolerant species or may result from mixed severity fire events, which allow for multiple age classes to develop in the stand. Table 17 illustrates the relationship between canopy cover percentage and canopy structure. Canopy structure is built into the successional pathways defined for each dominance type and tracked within the SIMPPLLE model.

Table 17. Density class based on canopy cover percentage and relationship to canopy structure

Density Class	Canopy coverage percent	Canopy Structure
1	0-14%	Open
2	15-39%	Open
3	40-69%	Closed

Density Class	Canopy coverage percent	Canopy Structure
4	70-100%	Closed

A size class and canopy structure code are assigned to each analysis unit within both the PRISM and SIMPPLLE models. These size class and canopy structure codes change as disturbances and successional pathways develop for each stand. Table 18 illustrates the size class—canopy structure codes used within each model to both define size class and stand structure as well as to track changes over time.

Table 18. Size class and canopy structure

Size Class—Canopy Structure	Description
Seedling and sapling	Seedling and sapling, less than 5 inches DBH
Pole	5 to 8.9 inches DBH
PTS	Pole two storied
PMU	Pole multiple stories
Medium	9 to 14.9 inches DBH
MTS	Medium two stories
MMU	Medium multiple stories
Large	15 to 20.9 inches DBH
LTS	Large two stories
LMU	Large multiple stories
Very-Large	21 + inches DBH
VLTS	Very large two stories
VLMU	Very large multiple stories

Data Source: SIMPPLLE (Chew, Moeller, and Stalling, 2012).

Forest structural stage is also tracked within the SIMPPLLE model over time. Structural stage is affected by size class, canopy structure and canopy density (Table 19). Canopy density is the primary factor that determines if a stand is classified as either open or closed.

Table 19: Relationship between size class and forest structural stage

Structural Stage	Size Class
Non-forest	None
Seral grass or shrub stage	0–4.9” DBH*
Seedling or Sapling	0–4.9” DBH
Open Stem Exclusion	5–14.9” DBH
Closed Stem Exclusion	5–14.9” DBH
Understory Re-initiation	15–19.9” DBH
Mature Single Story	20+” DBH
Mature Multi-Story	20+” DBH

*DBH = diameter at breast height

Natural Range of Variation for Canopy Density

A natural range of variation estimate was developed for canopy closure based on canopy density (Table 20). Canopy closure is estimated and tracked through time for each analysis unit. Both natural disturbance events and management actions affect canopy closure percentage as well as site potential.

Table 20. Natural range of variation estimate for canopy density

Canopy Closure	Percent Canopy Closure	Percent of Landscape
Early seral	< 10%	16%
Open	10–40%	49%
Closed	40–70%	35%

A separate vegetation cover analysis was generated to estimate dominance types and size class distribution for riparian habitats. Riparian habitats were derived through a GIS synthesis of the National Hydrologic Data set and the National Wetland Index. An estimated 295,000 acres of riparian habitat was estimated for the Nez Perce-Clearwater (Ahl 2020b, a). These habitats were tracked separately through the same climate model using the SIMPPLLE model to generate estimates of dominance type and size class changes over time. Habitat types on the extreme ends of the riparian habitat systems did not differ in response to climate change compared to upland habitat types. Habitat types in the driest end of the warm dry broad potential vegetation types and habitat types on the coldest and wettest end of the cool moist and cold broad potential vegetation types were also consistent with upland plant communities. For those mid-elevational riparian habitat types that differed from upland habitats, an estimated 24 percent of these habitat types occurred in the early seral shrub stage. This shrub stage is expressed by dominance of tall woody shrubs and hardwood tree species. These woody shrubs and hardwood tree plant communities are created and maintained on the landscape through disturbance processes, which remove conifer species. Wildland fire is the dominant disturbance process, which creates woody shrub and hardwood tree dominated sites. In the absence of disturbance, these sites become dominated by conifer species through forest succession processes. Results of the riparian analysis are presented in the SIMPPLLE results section.

NRV for Old Growth

Roughly one-half of all old growth forest types occur within the warm dry and warm moist broad potential vegetation type groups. These old growth types are typically capable of growing into the very large diameter class and are associated with the large-tree structure classification of both large and very large tree structures. These old growth types are represented by the 11.6 to 14.8 percent natural range of variation (NRV) range. By contrast, the other one-half of all old growth forest types are associated with the cool moist and cold broad potential vegetation type groups. Old growth forest types occurring within these types (3.8 to 4.8 percent NRV range) generally do not grow into the very large diameter class and are typically associated with the large-tree structure class of large-tree only. A simple proportion of each relative range suggests a NRV average of 9 percent as a forestwide old growth estimate.

Based on this NRV analysis, it is reasonable to conclude that the current level of old growth on the Nez Perce-Clearwater (11 percent) is likely within historical levels of old growth. This conclusion is supported by the finding that the existing abundance of large-tree structures and size classes are appropriate to maintain old growth structure on the Nez Perce-Clearwater.

Natural Range of Variation for Opening Patch Size

The natural range of variation (NRV) for opening sizes is summarized in Table 21. Openings are defined as any opening in a forest cover type, which results in either a seedling or transitional forest size class. Patch openings are counted, and area estimated for as long as the patch remains in the seedling and sapling stage. Forest openings are typically the result of a disturbance event, such as a wildland fire. Forest openings are estimated for all modeled disturbances greater than 18 acres and expressed as: the average, area weighted mean and Jenks Natural Breaks classification.

Openings were identified for each of the 30 NRV runs across 100 timesteps (3,000 sample points). Openings were identified by Broad potential vegetation type (PVT) as well as for the entire forest and concatenated into a single dataset representing these 3,000 points. There were approximately 3.5 million Cold PVT openings, 5.6 million Cool Moist PVT openings, 8.3 million Warm Dry PVT openings, and 11 million Warm Moist openings. Across the Nez Perce-Clearwater, when PVT was ignored, there were 14 million patches.

Opening size results for both *average* and *area weighted mean* sizes are shown in Table 21. This data illustrates both existing conditions and NRV for both Broad PVT Group and forestwide conditions. In all situations, the forestwide existing mean and weighted-area mean opening patch sizes are below the historic average. With the exception of the Cold AWM and the Warm Moist Average, all size metrics are below the historic range for PVTs. Note that the opening patch sizes at the sub-forest level are smaller than when aggregated to the forest level. This is a result of the spatial arrangement of the Broad Potential Vegetation Groups. An opening resulting from a wildfire that spans the border between two PVTs, for instance, will have an overall larger size than the openings in each of the PVTs.

Table 21. Comparison of existing condition and natural range of variation (NRV) for both mean patch size and area weighted mean patch size. NRV metrics include the average across all runs and time periods as well as a minimum and maximum average across all runs in any specific time period

Broad Potential Vegetation Group	Existing-Mean Opening Size (acres)	NRV-Mean Opening Size (min - max)	Existing-Area Weighted Mean of Opening Sizes (acres)	NRV-Area Weighted Mean Opening Size (min - max)
Forestwide	79	350 (85–1382)	736	28,207 (1150–136,759)
Cold	31	95 (48–190)	124	1,094 (105–3,315)
Cool Moist	59	188 (85–381)	390	6,579 (812–25,244)
Warm Dry	35	77 (52–106)	95	1,442 (110–4,158)
Warm Moist	54	160 (45–467)	331	9,536 (101–51,146)

Data Source: SIMPPLLE.

Openings were also stratified into classes using the "Jenks Natural Breaks" algorithm, which minimizes the sum of squared deviation from the mean of each class. Openings were classified into both seven breaks and 10 breaks at both the Broad PVT level and the forestwide level. Results of this analysis are shown in Table 22. The distribution of area within both Broad PVT and forestwide openings according to the 10 Jenks Natural Breaks classification is depicted in Figure 11. Note that the area includes the full model area, not only National Forest[5]. The first break in all classifications was the grain size, or 5.6 acres. The second break was more variable, but in all instances included the 40-acre default NFMA opening size value. In all cases, the second break class contains the largest number of acres, and the amount in each class generally tapers off through the larger patch sizes. Note that the break class values vary for each graph. The second break class also captures the scale at which the Forest Service can feasibly conduct

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[5] Clipping the analysis to only National Forest lands would artificially reduce the patch size in the landscape. We determined presenting the patch analysis at the full scale of the landscape was a better depiction of historical conditions (NRV).

management activities. While some small (less than 5.6 acre) treatments may be prescribed, it may not be cost effective to do so regularly. For larger activities, the cost of roads, forest plan direction constraints, and ecological effects (for example) may be prohibitive. It is better to allow natural processes to shape large openings in the future. Thus, the analysis focused on the second class, larger than 5.6 acres and smaller than maximum opening patch size of the class, that is, the second break.

Figure 11. Histogram of opening acres in each of the Jenks Natural Breaks classified with 10 breaks. The "Acres in Break Class" represents the per-decade average acres of openings within each size (break) class within the context of the full model extent (National Forest and non-National Forest).

While the magnitude of the second break is relatively large, the patch sizes within the break tend to skew toward the small end. Therefore, the mean size within the break's ranges from 21 to 73 acres (Table 22). The 90th percentile value of this break is presented for comparison. This value is highlighted in Table 22 and may be a better indicator of the maximum opening size standard considered for the forest plan. The forest could still exceed this size with regional forester approval, and there would be openings smaller than this size created as well.

Table 22. Jenks Natural Breaks solution to the 7 and 10 break analysis of opening size patches. The table includes information on the Second break from 5.6 acres to the 2nd Break maximum. Mean opening patch size within the break is included as well as the size of the patch at the 90th percentile of patches in the break. Values are in acres.

Broad Potential Vegetation Type (PVT)	Number of Breaks	2nd Break Maximum	2nd Break Mean Value	2nd Break 90th Percentile Value
COLD	10	111	25	56
COLD	7	261	32	72

Broad Potential Vegetation Type (PVT)	Number of Breaks	2nd Break Maximum	2nd Break Mean Value	2nd Break 90th Percentile Value
COOL MOIST	10	751	50	111
COOL MOIST	7	1,718	61	122
WARM DRY	10	72	21	39
WARM DRY	7	556	30	61
WARM MOIST	10	506	36	78
WARM MOIST	7	1,440	45	83
FULL FOREST	10	1,785	56	106
FULL FOREST	7	4,854	73	111

Timber Suitability Analysis

For each alternative, a determination of “Lands Suited for Timber Production” was made according to FSH 1909.12.61. In general, the process first identifies those lands that are not suited for timber production and any remaining lands are available for timber production and management objectives. The suitability analysis follows the two-stage process described in detail below. The first stage is to identify lands not suited for timber production based on legal, technical, and ecological context. Specifically, lands that are legally withdrawn (such as wilderness), cannot be harvested without causing irreversible damage to the land or those that are not forested or not capable of re-growing trees are withdrawn at the first stage. This stage is constant and used as a basis for all alternatives and is termed “lands that may be suited for timber production.”

The second stage of suitability withdraws land from “lands that may be suited for timber production” based on desired conditions of land management designations, which can vary by alternative. Alternatives can vary land management designations, such as recommended wilderness, special areas, research natural areas, and so forth. Some of these land designations may have desired conditions incompatible with managing the land for timber production, in which case they are withdrawn from suitability for that alternative.

As described below, identifying suitable timber land depends, in part, on assessing the biophysical properties of the land (for example, site productivity, soils, potential vegetation, etc.). The available spatial data depicting this information is often derived from coarse-scale assessments, satellite imagery, and statistical models. Consequently, while broad-scale estimates of timber suitability are reliable, there is far less certainty about the spatial precision and classification accuracy of any given acre or pixel. Indeed, some areas will certainly be misclassified on the “maps” due to inherent error in the input data. As such, the purpose of this exercise is to model and estimate the acres of suitable timber land for broad-scale planning purposes, not to create precise maps of suitable timber lands for use in project planning or implementation. The final determination of timber suitability must consider plan direction but should be made on-the-ground at the project-level using site-specific information and analysis.

Step 1: Identification of Lands that May be Suited for Timber Production

The first step of the timber suitability analysis consists of identifying lands that are not suited based on the legal and technical factors described in 36 CFR 219.11 (a) (i), (ii), (iv), (v,) and (vi) and sections 61.11 to 61.14 of FSH 1909.12. If any of these factors apply to the land, the land is not suited for timber production. These lands do not vary by alternative in the environmental impact statement. After subtracting the lands that are not suited from the total of National Forest System lands, the remaining lands are lands that may be suited for timber production and are considered in Step 2.

First, the areas identified in Table 23 were subtracted from the total National Forest System land ownership area (about 3,939,167 acres) to address 36 CFR 219.11(a)(i) and (ii) – lands that have been withdrawn or prohibited from timber production. The area eliminated from timber production was approximately 2,792,343 acres, roughly 71 percent, of the National Forest System lands. Total withdrawn lands are consistent across all alternatives. Within Management Area 2, withdrawn areas may be suitable for timber harvest to meet other resource objectives, depending on the Idaho Roadless Rule theme category.

Table 23. Designated areas that have been withdrawn from timber production

Designated Area	Acres	Rationale for Not being Suitable for Timber Production
Designated Wilderness	1,139,059	The Nez Perce-Clearwater manages portions of the Frank Church-River of No Return Wilderness, the Selway-Bitterroot Wilderness, and the Gospel-Hump Wilderness. Designated wilderness areas are excluded from timber production and harvest. Recommended wilderness is NOT excluded in this step because it is re-evaluated as a part of revision; it would be excluded in Step 2 and may vary by alternative.
Wild and Scenic River Designations	57,891	The Nez Perce-Clearwater manages four congressionally designated wild and scenic river corridors: The Middle Fork Clearwater River, Rapid River, Saint Joe River, and Salmon River. These river corridors are unsuitable for timber harvest.
Designated Research Natural Areas	29,499	The Nez Perce-Clearwater has four existing research natural areas. The designation of research natural areas precludes suitability for timber production.
Idaho Roadless Rule	1,481,636	The Roadless Area Conservation Rule does not allow for timber production to be a management objective.
Special Geographic Areas	28,498	The Nez Perce-Clearwater manages the Gospel-Hump Multi-Purpose Area. This portion is managed as a roadless area and is not suitable for timber production.
National Historic Landmarks	55,760	The National Historic Landmarks Program was established in 1962 to encourage the preservation of sites illustrating the geological and ecological character of the United States, to enhance the scientific and educational value of sites thus preserved, to strengthen public appreciation of natural history, and to foster a greater concern for the conservation of the nation's natural heritage. The Lolo Trail National Historic Landmarks is located on the Nez Perce-Clearwater. These areas are not suitable timber production.
Total Acres	**2,792,343**	**Not applicable**

Recommended wilderness is not considered in Step 1 of timber suitability calculations. All recommended wilderness areas are currently designated as Idaho Roadless Rule designated areas. The amount of recommended wilderness varies by alternative. Differences in recommended wilderness designations between alternatives result in different acreages where timber harvest may be allowed to achieve other resource objectives based on Idaho Roadless Rule themes. Table 24 provides the recommended wilderness acreages by alternative.

Table 24. Recommended wilderness acres by alternative

Management Area	No Action Alternative	Alternative W	Alternative X	Alternative Y	Alternative Z	Preferred Alternative
Management Area 2	197,695	856,933	0	309,333	569,756	258,210

Next, a detailed data analysis was conducted to address requirements under 36 CFR 219.11(a) (iv), (v), and (vi)—lands for which the technology is not currently available to harvest without irreversible soil damage, where there is no reasonable assurance of re-stocking within five years after harvest, or where the land is non-forest land. Factors contributing to unsuitable lands in the category are non-National Forest System lands, lands developed for non-forest uses (road system and administrative facilities), lands not suitable for timber production due to technology or site considerations, where harvest operations may result in either irreversible damage, or lands where adequate restocking within five years is not assured. The acres of Management Area 3 lands which are unsuitable for timber production are provided in Table 25.

Table 25. Acres that may be suitable or are unsuitable for timber production in Management Area 3 under 6 CFR 219.11(a) (iv), (v), and (vi) by alternative

Management Area (MA)	No Action Alternative	Alternative W	Alternative X	Alternative Y	Alternative Z	Preferred Alternative
Total MA 3 Acres	1,217,794	1,239,017	1,244,441	1,220,062	1,233,217	1,240,451
MA 3 Unsuitable Acres	189,203	197,385	200,372	189,969	196,122	197,821
MA 3 Percent Unsuitable Lands	16%	16%	16%	16%	16%	16%
MA 3 lands that may be suitable for timber production	1,028,591	1,041,632	1,044,069	1,030,093	1,037,095	1,042,630

Step 2: Identify Lands that Are Suited for Timber Production

In Step 2, lands that are suited for timber production are identified by further subtracting from the lands identified as may be suitable (the results of Step 1), lands that are not suited for timber production based on specific plan components.

Table 26 summarizes acres of lands that were identified as unsuitable for timber production based on incompatibility of timber production with the desired conditions and objectives for those lands, by alternative. The lands that were removed due to plan components or area designations that vary across the alternatives, thereby leading to different amounts of land suitable for timber production. Due to the scale of analysis and data limitations, there are undoubtedly small inclusions of unsuitable areas in areas mapped as suitable, and vice versa. Site-specific suitability must be determined at the project level. It is also important to note that the plan may allow for timber harvest for purposes other than timber production as a tool to assist in achieving or maintaining one or more applicable desired conditions or objectives of the plan to protect other multiple-use values and for salvage, sanitation, or public health or safety. Examples of using timber harvest to protect other multiple use values may include improving wildlife or fish habitat, thinning to reduce fire risk, or restoring meadow or savanna ecosystems where trees have invaded.

Table 26: Additional acres unsuitable for timber production based on incompatibility of timber production with the desired conditions and objectives for those lands

Lands	No Action Alternative	Alternative W	Alternative X	Alternative Y	Alternative Z	Preferred Alternative
Eligible and Suitable Wild & Scenic Rivers Subject to Interim Protection	155,477	64,587	0	99,120	146,057	65,748

Lands	No Action Alternative	Alternative W	Alternative X	Alternative Y	Alternative Z	Preferred Alternative
Riparian Management Zones	369,306	369,306	369,306	369,306	369,306	369,306
Recommended Wilderness	197,695	856,932	0	309,332	569,755	258,210
Administrative Area	659	659	659	659	659	659
Total Acres	**723,137**	**1,291,484**	**369,965**	**778,417**	**1,085,777**	**693,923**

Note: Acres of each category will not match total acres within that designation if lands have been removed in a previous step of the suitability analysis. In addition, most of existing recommended wilderness areas were within an inventoried roadless area, so most of these areas were removed via the process listed in Table 23. This number will not match total recommended wilderness area acres.

The layer resulting after Step 1 and Step 2 depicts lands that are suited for timber production. The lands identified as “may be suitable for timber production” are listed by management area in Table 27 and summarized in Table 28. The total lands not suitable for timber production listed in Table 28 do not match the acres listed in Table 25 due to the differences in the amount of recommended wilderness acres allocated by alternative.

Table 27: Acres and percent lands suited for timber production by management area (MA) and alternative

Management Area	No Action Alternative	Alternative W	Alternative X	Alternative Y	Alternative Z	Preferred Alternative
MA 1 Suitable	0	0	0	0	0	0
MA 1 % Suitable	0%	0%	0%	0%	0%	0%
MA 2 Suitable	0	0	0	0	0	0
MA 2 % Suitable	0%	0%	0%	0%	0%	0%
MA 3 Suitable	1,028,480	1,041,522	1,043,959	1,029,983	1,037,058	1,042,520
MA 3 % Suitable	26%	26%	27%	26%	26%	26%

Data Source: GIS.

Table 28. Summary of acres suitable for timber production by alternative

Land Classification Category	No Action Alternative	Alternative W	Alternative X	Alternative Y	Alternative Z	Preferred Alternative
A. Total National Forest System lands in the plan area	3,939,167	3,939,167	3,939,167	3,939,167	3,939,167	3,939,167
B. Lands not suited for timber production—withdrawn lands.	1,231,638	1,231,638	1,231,638	1,231,638	1,231,638	1,231,638
C. Lands that may be suited for timber production (A minus B)	2,707,529	2,707,529	2,707,529	2,707,529	2,707,529	2,707,529
D. Total lands suited for timber production because timber production is compatible with the desired conditions and objectives established by the plan	1,028,480	1,041,522	1,043,959	1,029,983	1,037,058	1,042,520

Land Classification Category	No Action Alternative	Alternative W	Alternative X	Alternative Y	Alternative Z	Preferred Alternative
E. Lands not suited for timber production because timber production is not compatible with the desired conditions and objectives established by the plan (C minus D)	1,679,049	1,666,008	1,663,571	1,677,547	1,670,471	1,665,010
F. Total lands not suited for timber production (B plus E)	2,910,687	2,897,645	2,895,208	2,909,184	2,902,109	2,896,647

Data Source: GIS.

PRISM Assumptions and Model Formulation

The following sections detail the use of the PRISM model, data sources used to generate input data for the model, and assumptions needed to allow the model to formulate a solution for each alternative. This document represents the guide used by the Land Management Plan team to formulate needed data sources and to model the specific differences between alternatives and display each alternative's ability to achieve the desired conditions illustrated in the Land Management Plan.

Vegetation Management Strategy

The vegetation management strategy is to manage landscapes to maintain or restore ecological integrity by applying silviculture principles to trend vegetation towards the range of desired conditions for species composition and forest structure. Alternatives are designed to analyze a range of potential forest restoration scales and management intensities. Each alternative proposes a different pace and scale to move toward a common set of desired conditions. Timber outputs and sustainability of timber harvest levels is a result of management intensities and scales. Some species and size classes are more abundant than desired, while others are less abundant. Management to move toward desired conditions will also provide for conditions that are more resilient to disturbance and in line with historic fire regimes.

Objective Function

Objective functions drive the model toward a specified end result. Desired conditions were identified for dominance type and size class, and desired timber outputs were also specified. Desired conditions should be attained within each management area, rather than for the national forest as a whole. This is discussed further in the "Alternatives" section of this document. For alternative analysis, PRISM was structured as a Goal Programming model, where the goals were to attain desired conditions and achieve a desired timber output with the model assigning penalties for not achieving desired conditions. This process resulted in achieving varying amounts of timber outputs as a result of achieving desired conditions within the timeframes specified in each alternative.

Planning Horizon

To ensure that the model is solvable, to be consistent with other forests in the Region, and to ensure a timeframe of sufficient length to demonstrate sustainability, the planning horizon is set at 150 years.

Assumptions Common across All Alternatives

Constrain prescribed burning for site preparation to accomplish 70 percent of those acres scheduled for final harvest. This more accurately reflects actual accomplishments in the field.

Formulation of Alternatives

For the Final Environmental Impact Statement, a No Action Alternative and five action alternatives will be analyzed within the PRISM model. The No Action Alternative is based on the current management of the Forests under the existing Forest Plans and is discussed in detail in Chapter 2 of the Final Environmental Impact Statement. The differences between the action alternatives are noted throughout this document. Variables within alternatives that will affect vegetation are listed below. Along with these variables, there are also spatial differences between the alternatives that are reflected in the Analysis Unit files. These spatial differences are the result of land use allocations, which affect the lands suitable for timber productions as well as management limitations associated with unsuitable lands.

No Action Alternative

- Use the same desired conditions and management areas as the action alternatives, with attainment of desired conditions tracked separately for each management area.
- Projected timber sale quantity (PTSQ) level is 50–60 million board feet (MMBF) per year and should be used as the cap for timber produced, meeting merchantability standards. Use non-declining flow constraint with this level of harvest.
- Target for regeneration harvest is 3,000 acres per year. Only one percent of this target is applied to unsuitable acres where harvest may occur to achieve other resources objectives in Management Area 2.
- Cap prescribed burning acres not associated with harvest units (broadcast burn, jackpot burn, and underburn) to 25,000 acres per year.

Alternative W

- Perform timber harvest and prescribed burning such that attainment of desired conditions in Management Area 2 and Management Area 3 are maximized in 30 years.
- PTSQ level is 221–241 MMBF per year. This PTSQ level should be achieved for three decades. Amounts of timber may vary between 221 and 241 MMBF per year but may not exceed 241 MMBF per year. Allow departure from non-declining flow for the first three decades, then use non-declining flow constraints after the first three decades.
- Objective function: Achieve desired conditions for Management Area 3 in 30 years.
- Target for regeneration harvest is 12,600 acres per year. Only one percent of this target is applied to Management Area 2.
- Of the acres burned in the warm dry potential vegetation type in Management Area 2, plant 500 acres per decade in Ponderosa pine.
- Of the acres burned in the warm moist potential vegetation type in Management Area 2, plant 250 acres per decade in western white pine and 250 acres per decade in western larch.
- Of the acres burned in the cool moist potential vegetation type in Management Area 2, plant 2,000 acres per decade with whitebark pine.
- Of the acres burned in the cold potential vegetation type in Management Area 2, plant 2,000 acres per decade with whitebark pine.
- Cap prescribed burning not associated with harvest units at 15,000 acres per year. Allocate 10,000 acres to Management Area 2 and 5,000 acres to Management Area 3.

Alternative X (Departure Alternative)

- Perform timber harvest and prescribed burning to maximize attainment of desired conditions in Management Area 2 and Management Area 3 in 20 years.
- PTSQ level is 241–261 MMBF per year for 20 years. After the first 20 years, institute non-declining flow constraint.
- Objective function: PTSQ number above must be reached. Maximizing timber output for 20 years.
- Target for regeneration harvest is 14,000 acres per year. Only one percent of this target is applied to Management Area 2, totaling 140 acres per year.
- Of the burned acres in the warm dry potential vegetation type in Management Area 2, plant 500 acres per decade in Ponderosa pine.
- Of the burned acres in the warm moist potential vegetation type in Management Area 2, plant 250 acres per decade to western white pine and 250 acres per decade to western larch.
- Of the acres burned in the cool moist potential vegetation type in Management Area 2, plant 2,000 acres per decade in whitebark pine.
- Of the acres burned in the cold potential vegetation type in Management Area 2, plant 2,000 acres per decade to whitebark pine.
- For stands in the warm moist potential vegetation type group where regeneration harvest will occur:
- Following regeneration harvest, send 70 percent to the white pine plantations pathway and 30 percent to the grand fir, cedar, and hemlock natural growth pathway.
- Regenerate the grand fir, cedar, and hemlock stands at culmination of mean annual increment (CMAI), again following the natural growth pathway.
- Certification of stands is occurring at lower numbers than what would be required to achieve white pine or western larch dominance types (FW-STD-TBR-03); it is assumed that a proportion of these stands (30 percent) would not change dominance types.
- Cap prescribed burning not associated with harvest units at 15,000 acres per year. Allocate 10,000 acres to Management Area 2 and 5,000 acres to Management Area 3.

Alternative Y

- Perform timber harvest and prescribed burning to maximize attainment of desired conditions in Management Area 2 and Management Area 3 in 50 years.
- Projected timber sale quantity (PTSQ) level is 130–150 million board feet (MMBF) per year for 50 years. Non-declining, even flow constraint is applied for all projected decades.
- Objective function: attainment of forest vegetation desired conditions in Management Area 2 and Management Area 3.
- Target for regeneration harvest is 7,500 acres per year. Only one percent of this target is applied to Management Area 2, totaling 75 acres per year.
- Of the burned acres in the warm dry potential vegetation type in Management Area 2, plant 500 acres per decade in Ponderosa pine.
- Of the burned acres in the warm moist potential vegetation type in Management Area 2, plant 250 acres per decade in western white pine and 250 acres per decade in western larch.

- Of the acres burned in the cool moist potential vegetation type in Management Area 2, plant 2,000 acres per decade in whitebark pine.
- Of the acres burned in the cold potential vegetation type in Management Area 2, plant 2,000 acres per decade to whitebark pine.
- Cap prescribed burning not associated with harvest units at 15,000 acres per year. Allocate 10,000 acres to Management Area 2 and 5,000 acres to Management Area 3.

Alternative Z

- Perform timber harvest and prescribed burning to maximize attainment of desired conditions in Management Area 2 and Management Area 3 in 100 years.
- Projected timber sale quantity (PTSQ) level is 60–80 million board feet (MMBF) per year for 100 years. Non-declining even flow constraint is applied for all projected decades.
- Objective function: attainment of forest vegetation desired conditions in Management Area 2 and Management Area 3.
- Target for regeneration harvest is 3,700 acres per year. Only one percent of this target is applied to Management Area 2, totaling 37 acres per year.
- Of the burned acres in the warm dry potential vegetation type in Management Area 2, plant 500 acres per decade in Ponderosa pine.
- Of the burned acres in the warm moist potential vegetation type in Management Area 2, plant 250 acres per decade in western white pine and 250 acres per decade in western larch.
- Of the acres burned in the cool moist potential vegetation type in Management Area 2, plant 2,000 acres per decade in whitebark pine.
- Of the acres burned in the cold potential vegetation type in Management Area 2, plant 2,000 acres per decade in whitebark pine.
- For stands in the warm moist potential vegetation type group where regeneration harvest will occur:
    - Following regeneration harvest, send 70 percent in the white pine plantations pathway and 30 percent to the grand fir, cedar, and hemlock natural growth pathway.
    - Regenerate the grand fir, cedar, and hemlock stands at culmination of mean annual increment (CMAI), again following the natural growth pathway.
    - Certification of stands is occurring at lower numbers than what would be required to achieve white pine or western larch dominance types; it is assumed that a proportion of these stands (30 percent) would not change dominance types.
- Cap prescribed burning not associated with harvest units at 15,000 acres per year. Allocate 10,000 acres to Management Area 2 and 5,000 acres to Management Area 3.

Preferred Alternative

- Perform timber harvest and prescribed burning such that attainment of desired conditions in Management Area 2 and Management Area 3 are maximized between 35 and 40 years.
- PTSQ level is set at 190-210 MMBF per year. This PTSQ level should be achieved for four decades. Beginning in Decade 5, timber harvest will average between 190 and 210 MMBF per year, as measured on a decadal basis. Annual timber harvest may exceed the average for any given year but

may not exceed 241 MMBF per year. Allow departure from non-declining flow for the first four decades, then use non-declining flow constraints after the first 4 decades to maintain harvest levels between 145 and 160 MMBF per year.

- Objective function: Maximize potential to achieve desired conditions for Management Area 2 and Management Area 3 between 35 and 40 years.
- Target for regeneration harvest is 75 percent of total harvest acres per year. Only one percent of Management Area 2 acres are subject to timber harvest per decade.
- Of the acres burned in the warm dry potential vegetation type, plant 500 acres per decade in Management Area 2 in Ponderosa pine.
- Of the acres burned in the warm moist potential vegetation type in Management Area 2, plant 250 acres per decade to western white pine and 250 acres per decade to western larch.
- Of the acres burned in the cool moist potential vegetation type in Management Area 2, plant 2,000 acres per decade with whitebark pine.
- Of the acres burned in the cold potential vegetation type in Management Area 2, plant 2,000 acres per decade in whitebark pine.
- For stands in the warm moist potential vegetation type group where regeneration harvest will occur:
    - Following regeneration harvest, send 70 percent to the white pine plantations pathway and 30 percent to the grand fir, cedar, and hemlock natural growth pathway.
    - Regenerate the grand fir, cedar, and hemlock stands at culmination of mean annual increment (CMAI), again following the natural growth pathway.
    - Certification of stands is occurring at lower numbers than what would be required to achieve white pine or western larch dominance types, it is assumed that a proportion of these stands (30 percent) would not change dominance types.
- Cap prescribed burning not associated with harvest units at 15,000 acres per year. Allocate 10,000 acres to Management Area 2 and 5,000 acres to Management Area 3.
- Constrain treatments in conservation watershed networks to 30 percent of the area in openings created through harvesting in existing forested cover types. An opening is defined as size class transitional or seedling and sapling.
- Constrain treatments in wildland-urban interface and lynx intersections to 15 percent of area in openings regardless of disturbance type. An opening is defined as size class transitional or seedling and sapling.

Snag Retention

Snag retention is provided for within plan component MA2 and MA3-GDL-FOR-05 as applied for regeneration harvest prescriptions. In regeneration prescriptions, reserve trees and snags were incorporated and tracked in the yield tables. Alternative Z will have additional snags and live leave trees retained, beyond those required by the other action alternatives. There is no known way with the current PRISM modeling to show the difference in snags retained or the difference made by using a different scale for measurement of snag retention. It is thought that the difference made to timber volumes would be negligible and, if it is necessary to calculate a difference caused by varying the snag guidelines, this calculation will be completed outside of PRISM.

Within the PRISM model, the number of snags per acre were tracked for two diameter classes (10–19.9 inch and 20+ inch). For Alternative Z, snag retention is specified only for snags greater than 10 inches in diameter. The 10-19.9 inches class is inclusive of two diameter classes, including 10–14.9 inches and 15–19.9 inches. Additional analysis is required to estimate the number of snags per acre within the 15–19.9 inches class. Snags should be tracked by the potential vegetation type group and biophysical setting.

Landscape Classification and Model Structure

Model formulations in PRISM allow up to six map themes to delineate the landscape. These themes include vegetation types in the forest, land area management units, suitability of timber production and harvest, resource management constraints, and dominant overstory vegetation, and the size class. The six map themes must be specific enough to allow for the plan direction of each alternative to be considered, yet not so specific as to cause the model to be more complex than the high-level planning effort being analyzed. Together, combinations of these six “layers” define the analysis areas (aa) used in the PRISM model formulation. These layers and attributes are described below. For each layer, a table that includes “Code” and “aaname” is included. “Code” is the attribute used in the spatial map data and “aaname” is the code used in the PRISM input file.

Analysis Units

Analysis units in the PRISM model are landscape units with similar spatial and non-spatial characteristics. For the Nez Perce-Clearwater, they were composed of six layers of information, as follows:

- Level ID 1: Northern Region Broad Potential Vegetation Type Groups
- Level ID 2: Management Areas
- Level ID 3: Timber Suitability
- Level ID 4: Resource Constraints
- Level ID 5: Dominance Type
- Level ID 6: Size Class

Superimposed on each other, the combination of classes in each layer creates a repeatable land unit with unique characteristics. Each analysis unit may have a different suite of management actions available for application within the model that yields a variety of outputs.

Level ID 1: Northern Region Broad Potential Vegetation Type Groups (both upland and riparian)

The Nez Perce-Clearwater has been delineated into five broad potential vegetation type groups, as per the Northern Region classifications. Of these five, one of the potential vegetation type groups is called non-forestlands. Non-forestlands are delineations of non-forested cover types. Non-forested cover types are not analyzed with the PRISM model but included to account for the spatial distribution of potential vegetation type groups. The four forested potential vegetation type groups classified on the Nez Perce-Clearwater, and non-forested lands, are listed in Table 29. Each broad potential vegetation type group is categorized as either upland or riparian to give context to the modeling differences in successional pathways and disturbance regimes between the riparian and upland ecotones. The broad potential vegetation type group level provides a meaningful context for analysis and comparison of alternatives. These, along with the management areas, will be included as a layer that defines desired conditions for forested landscapes of the Nez Perce-Clearwater. Refer to Appendix A for details on the desired conditions by potential vegetation type group and management areas.

Table 29. Level ID 1: Northern Region codes (L1_aaname) for upland and riparian areas by broad potential vegetation type

Potential Vegetation Type	Upland	Riparian
Warm Dry	WDU	WDR
Warm Moist	WMU	WMR
Cool Moist	CMU	CMR
Cold	CDU	CDR
Non-forested	NFU	NFR

Level ID 2: Timber Suitability and Management Areas

Three timber suitability codes were defined for the model. Non suitable (N) is associated with lands withdrawn from management actions, such as wilderness and wild and scenic river corridors. The low suitability code (L) is used to identify lands which are classified as unsuitable lands where management may occur to accomplish other resource objectives, such as wildlife habitat management. Lands suitable for timber production (S) are managed to produce sustainable yields of commercial sized timber and other resource objectives. Lands suitable for timber production are only associated with Management Area 3. The codes are presented in Table 30.

Table 30. Level ID 2: Northern Region codes (L2_aaname) for timber suitability by management area

Timber Suitability	Management Area 1	Management Area 2	Management Area 3
Not suitable	N1	N2	N3
Low suitability	L1	L2	L3
Suitable	Not applicable	Not applicable	S3

Suitability for timber production was determined following the process presented in 36 CFR 219.11 (a) (i), (ii), (iv), (v,) and (vi) and further described in sections 61.11 to 61.14 of FSH 1909.12. Timber suitability classification for the purposes of modelling was grouped into classes with similar timber production objectives. The Sustained Yield Limit Methodology paper dated December 27, 2017 (See the project record, Chin, 2017) outlines the process for determining lands suitable for timber production; other lands where harvest may occur for purposes other than timber production are classified as unsuitable lands where timber harvest may occur to achieve other resource objectives, as per the 2012 Planning Rule. Suitability is defined by three classes including unsuitable lands for timber production or harvest (N); unsuitable lands where harvest may occur to achieve other resource objectives, with a low level of harvest expected (L); and suitable for timber production (S). The land base within each category varies by alternative. Table 31 is used for the No Action Alternative and Table 32 is used for all action alternatives, though the area in each category will vary under the different action alternatives.

Table 31. Summary of timber suitability by management area under the No Action Alternative

Timber Production Suitability Class	Suitability	Constraints
Lands not suited for timber production or harvest: Selway-Bitterroot Wilderness Gospel Hump Wilderness River of No Return Wilderness Wild River corridors (both designated and those found eligible for "Wild River" classification in the 1987 Plans) Idaho Roadless Rule—Wildland Recreation theme lands Established Research Natural Areas Non-forested landtypes Not capable of producing commercial wood Riparian Conservation Areas (PIBO)	Not Suitable	No harvest
Suitable for Timber Harvest for other Resource Objectives—Very low level of harvest expected: Idaho Roadless Rule Backcountry Restoration, Special Areas of Historic or Tribal Significance (SAHTS), Primitive, Backcountry without Community Protection Zones Lolo Trail National Historic Landmark (outside of Idaho Roadless Rule lands) Scenic and Recreational River corridors (both designated and those found eligible for these classifications under the 1987 Plans)	Low Suitability	No more than 1% of area harvested per decade
Suited for Timber Production: All other lands	Suitable	Only limited by other constraints

Table 32. Summary of timber suitability by management area for all action alternatives

Timber Production Suitability Class	Suitability	Constraints
Unsuitable Lands—No harvest allowed: Selway-Bitterroot Wilderness Gospel Hump Wilderness River of No Return Wilderness Designated Wild River corridors Rivers found suitable for Wild River classification* Idaho Roadless Rule—Wildland RecreationTheme Recommended Wilderness (varies by alternative) Research Natural Areas (established and proposed) Forest Special Use Areas—Non-forested landtypes	Not Suitable	No harvest

Timber Production Suitability Class	Suitability	Constraints
Not capable of producing commercial wood Lolo Trail National Historic Landmark Riparian Management Zones (Inner Zone)		
Unsuitable lands where timber harvest is allowed to achieve other Resource Objectives – Very low level of harvest expected: Idaho Roadless Rule Backcountry Restoration, Special Areas of Historic or Tribal Significance (SAHTS), and Primitive Themes Designated Scenic and Recreational River corridors Rivers found suitable for Scenic or Recreational River classification[1] Riparian Management Zones (Outer Zone)[2]	Low Suitability	No more than one percent of area harvested per decade
Suited for Timber Production All other lands	Suitable	Only limited by other constraints

[1] These will vary by alternative. Analysis units contain delineations of river segments, as identified in the alternatives table above. For Alternative X, assume no additional restrictions beyond the riparian management zone boundaries.

[2] Plan components allow timber harvest in the outer zone of riparian management zones (RMZs) to meet other resource objectives (similar to harvest levels in L). For the purposes of the PRISM modelling, the National Hydrologic Data (NHD) GIS data will be used. The National Hydrologic Data for the Nez Perce-Clearwater has been updated to incorporate the stream category assigned to each stream segment.

Riparian Management Zones

Riparian management zones are defined both within and without Conservation Watershed Network designations. Buffer widths for riparian management zones are a function of the stream category defined for each stream segment, as illustrated in Table 33. The inner riparian management zones' buffer width has a timber suitability classification of "N" for all management areas. The outer riparian management zones' buffer width has a classification of" L" for Management Area 3 only and a classification of "N" for Management Areas 1 and 2.

Table 33. Riparian management zone (RMZ) buffer size by stream category

RMZ Category	Inner RMZ Buffer Width (in feet)	Outer RMZ Buffer Width (in feet)
Category 1	150	150
Category 2	75	75
Category 3	75	75
Category 4	50	50

Although not suitable for timber production, plan components allow timber harvest within the outer riparian management zones to meet other resource objectives. For the purposes of PRISM modelling, the National Hydrologic Data (NHD) GIS layer was used and correlated with the National Wetland Inventory dataset to inform the spatial extent of riparian zones on the Nez Perce-Clearwater.

Level ID 3: Conservation Watershed Network and Wildland-Urban Interface

The Conservation Watershed Network (CWN) offers a constraint on proposed silviculture prescriptions and the rate of desired condition attainment. Watershed management requirements are defined by Resource Condition Zone (the level 3 identifier). Conservation Watershed Networks identified at the

HUC 12 scale will have no more than 30 percent of each identified and mapped CWN in openings per decade. Openings are defined as any vegetation treatment method or stand replacing fire which results in an average size class of less than 5.0 inches diameter at breast height.

The Wildland-Urban Interface (WUI) is a mapped layer derived from Idaho counties which have identified community protection zones (CPZs). These CPZs are generally considered to be priority treatment areas to protect property and improve firefighter safety. Standards detailed in the Northern Rockies Lynx Management Direction (U.S. Department of Agriculture 2007b, a) allow for limited management of lynx habitat occurring within the WUI. Vegetation management within the WUI and lynx habitat intersection is limited by Level ID 4 Resource Constraints.

The following Table 34 lists the Level 3 codes, which identify and label if a proposed treatment polygon is within a CWN or not and if the polygon is within the WUI or not. Status codes are used to identify and summarize the level of vegetation treatments and disturbances occurring within these designated areas.

Table 34. Status codes for conservation watershed network and wildland urban interface

CWN and WUI Status Code	L3_aaname	Constraint
Conservation watershed network not in wildland-urban interface	CN	CWN constraint applies
Conservation watershed network within the wildland-urban interface	CW	CWN constraint applies and Level 4 resource constraint applies
Non conservation watershed network not in wildland urban interface	NN	No constraints other than management area constraints
Non-conservation watershed network within the wildland urban interface	NW	Level 4 constraint applies

Level ID 4: Resource Constraints

Resource constraints were identified to reflect specific areas where resource management objectives modify timber harvest schedules. Resource constraints include the following:

- The Northern Rockies Lynx Management Direction standards Veg-S1 and S-2 limit the amount of regeneration harvest that may occur. Standard VEG S1 requires that, if more than 30 percent of the lynx habitat in a lynx analysis unit is currently in a stand initiation structural stage that does not yet provide hare habitat during winter, no additional habitat may be regenerated by vegetation management. Standard VEG S2 requires that timber management shall not regenerate more than 15 percent of lynx habitat on National Forest System lands in a lynx analysis unit in a ten-year period. Status codes for Level 4 Resource Constraints are illustrated in Table 35.
- Lynx Analysis Units constrain proposed silvicultural prescriptions and the rate of desired condition attainment. For lynx habitat (labeled with an “L” in Level 4), limit all vegetation treatment to no more than 15 percent of identified and mapped lynx habitat per decade.
- Lynx Wildland-Urban Interface (WUI) Analysis Units constrain proposed silviculture prescriptions and are modified to allow for fuels management objectives within the WUI portions of lynx habitat. All areas within the lynx habitat and WUI intersection are subject to management, but treatments are limited to shelterwood and seed-tree treatments only.

Table 35. Lynx analysis units

Status Code	L4_aaname	Constraint
Lynx Analysis Unit	L	Used in conjunction with Level 3 to constrain treatment level

Status Code	L4_aaname	Constraint
Non-Lynx Analysis Unit	N	Lynx constraints do not apply

In addition to the lynx habitat constraints described above, management constraints for fisher habitat are also included in the PRISM model. Fisher habitat is not a mapped feature and, therefore, is not coded in association with the VMap product. Fisher habitat is defined as a combination of habitat type group, tree size, density, and the area required to support a fisher home range. Fisher habitat changes dynamically over time and must be modeled at each time step in the model projection.

Fisher habitat is only modeled for Alternative Z and the Preferred Alternative. Constraint occurs on proposed silviculture prescriptions and the rate of desired condition attainment. Fisher habitat is associated with specific habitat types and defined as mature forest with an average stand height of at least 25 meters and a minimum canopy density of at least 40 percent. For the purposes of PRISM modelling, the minimum 82-foot tree height is approximated by limiting habitat selection to stands with a minimum size class of 10-14.9 inches diameter at breast height or larger. Fisher habitat will have no more than 10 percent in openings per decade. An opening is defined as mature forest with less than 10 percent canopy cover. This means that shelterwood harvest and intermediate treatment should be allowable in any amount but clearcutting and seed-tree cutting would be subject to the 10 percent constraint. The minimum habitat threshold to support fisher persistence is estimated to be 600,000 acres based on the natural range of variation analysis. This represents the minimum areas of fisher habitat forestwide that are required to maintain fisher. Therefore, a minimum of 600,000 acres of mature forest with a minimum of 40 percent canopy cover with less than 10 percent of this area in openings and arranged in home range patches of approximately 6 square miles must be maintained in each decade.

Level ID 5: Dominance Type

The following Table 36 illustrates the dominance types used to model the timber strata. The strata were identified from spatial data from the R1 VMap and the regional potential vegetation type map using the Dom Mid 40 field. Each of these dominance types is tied to a yield table via the transition pathways. Specific VMap cover type codes are associated with riparian habitats defined in Level 1.

Table 36. Dominance types modeled in PRISM

VMap Code	Description	L5_aaname*
ABGR	Grand fir	WDGF
ABGR	Grand fir	WMGF
ABGR	Grand fir	CMGF
PICO	Lodgepole pine	WDLP
PICO	Lodgepole pine	WMLP
PICO	Lodgepole pine	CMLP
PICO	Lodgepole pine	CDLP
PIPO	Ponderosa pine	WDPP
PIPO	Ponderosa pine	WMPP
PSME	Douglas-fir	WDDF
PSME	Douglas-fir	WMDF
PSME	Douglas-fir	CMDF
PSME	Douglas-fir	CDDF
PIMO	Western white pine	WDWP

VMap Code	Description	L5_aaname*
PIMO	Western white pine	WMWP
PIMO	Western white pine	CMWP
PIMO	Western white pine	CDWP
ABLA	Subalpine fir	WMSF
ABLA	Subalpine fir	CMSF
ABLA	Subalpine fir	CDSF
PIEN	Engelmann spruce	WMES
PIEN	Engelmann spruce	CMES
PIEN	Engelmann spruce	CDES
THPL	Western red cedar	WMRC
LAOC	Western larch	WDWL
LAOC	Western larch	WMWL
LAOC	Western larch	CMWL
PIAL	Whitebark pine	CMWB
PIAL	Whitebark pine	CDWB
THME	Mountain hemlock	CMMH
THME	Mountain hemlock	CDMH
Hardwoods	Various species	WDHW
Hardwoods	Various species	WMHW
Hardwoods	Various species	CMHW
Herb or Shrub	Various species	WDHS
Herb or Shrub	Various species	WMHS
Herb or Shrub	Various species	CMHS
Herb or Shrub	Various species	CDHS

*WD=Warm Dry, WM=Warm Moist, CM=Cool Moist, CD=Cold

Rules for Dominance Type Classification

Some polygons in VMap were classified as a hardwood mix. These polygons were combined into the hardwood (HW) strata and associated with broad potential vegetation type groups. There were very few of these polygons, which equated to a negligible number of acres at the forestwide scale. This stratum is tracked specifically to describe species composition for riparian habitats.

Herb and shrub stay as herb and shrub for all management areas. The herb and shrub strata are tracked to quantify the acres of herb and shrub which will emerge as a forest cover type through succession. Non-forest areas are not included in this category. Successional pathways for herb and shrub vary by potential vegetation type group. Desired conditions for species composition include desirable percentages of open early seral conditions informed by the natural range of variation estimates.

- TMIX – Polygons classified as tolerant mix are re-classified as the following:
  - PSME in the warm dry potential vegetation type group
  - ABGR if in the warm moist potential vegetation type group
  - ABLA if in the cool moist or cold potential vegetation type groups
- IMIX – Polygons classified as intolerant mix are re-classified as the following:

  - PIPO in the warm dry potential vegetation type group
  - PIMO in the warm moist potential vegetation type group
  - LAOC in the cool moist potential vegetation type group
  - PICO in the cold potential vegetation type group
- TFOR – Polygons classified as transitional forest proceed into:
  - PIPO dominance type in the warm dry potential vegetation type group
  - PIMO in the warm moist potential vegetation type group
  - PIEN-ABLA in the cool moist potential vegetation type group
  - PICO in the cold potential vegetation type group

Polygons classified as “sparse veg” (SPVEG), URBAN, and WATER are not forested and were removed from the model.

Level ID 6: Size Class

Timber size classes were used to model vegetation structure, as illustrated in the following Table 37. The same size classes will be used in both the PRISM and SIMPPLLE models. Size classes were derived from the Northern Region VMap spatial data and correspond to the size classes in the National Technical Guide. “NFOR,” or non-forested, is a category in Level 6 but is not used in the PRISM model to analyze changes in forested vegetation.

Table 37. Size class descriptions and ranges

Size Description	Size Class Range	L6_aaname
Seedling or Sapling	0–4.9”	S
Small	5–9.9”	P
Medium	10–14.9”	M
Large	15–19.9”	L
Ver Large	20+”	V
Transition forest	0”	T
Non-forest	None	N

Additional Model Input and Considerations

Management Requirements

Harvest Policy

Harvest from lands suited for timber production (S) and lands suited for timber harvest for other resource objectives (L) will contribute towards projected timber sale quantity (PTSQ). Harvest volumes that do not meet utilization standards will be added to the PTSQ to estimate the potential wood sale quantity (PWSQ) to reflect the amount of firewood and biomass. The standing volume between 3.0 and 7.0 inches will not be included in the PWSQ volume, but top wood will be included for intermediate treatments. As per a conversation with Mark Craig, a Timber Contracting Officer for the Nez Perce-Clearwater, about 16 percent of sawlog volume may be added when performing intermediate treatments to account for top wood volume.

Budget Constraint

PTSQ numbers for all alternatives are determined to be within the Unit's fiscal capability. To respond to public comments, a way to achieve a departure from the sustained yield limit within the Nez Perce-Clearwater's fiscal capability was determined. This yielded a maximum PTSQ of 261 MMBF annually. Because this was determined to be possible, PTSQ numbers for all alternatives are determined to be possible within the Nez Perce-Clearwater's budget. Therefore, meeting the PTSQ numbers is no longer constrained by the budget. For more information, see the document titled "Fiscal Capability Assumptions for an Alternative that Departs from Sustained Yield Limit" dated July 12, 2018. The model was run without a budget constraint to identify the sustained yield limit.

Management Actions

Management actions describe the series of silvicultural practices available by analysis area. Kris Hazelbaker (silviculturist) developed the management actions (silvicultural prescriptions) with input from other Forest Service specialists and units. Marcus Chin, the Nez Perce-Clearwater Land Management Plan silviculturist, refined the management actions and the dominance types in which the various prescriptions were available. The prescriptions were refined with the assumption that, in practice, some variation may occur from what is in Table 38, but the table shows where the prescriptions are generally thought to be appropriate. Between April to June of 2018, Marcus Chin also revised the Transition Pathways that were originally developed by Kris Hazelbaker and later revised by Rob Schantz (former Nez Perce-Clearwater Forest Silviculturist). The Transition Pathways were revised using the process outlined in the Transition Pathway Updates process paper dated June 4, 2018.

Salvage harvest will not be tracked in the PRISM model as a management action. Salvage of dead trees from natural disturbance events will be estimated outside the model based on the estimated acres of natural disturbance given in the "Natural Disturbance" section of this document. Table 38 illustrates the silviculture prescriptions assigned to each dominance type and broad potential vegetation type group combination. Table 38 does not list all possible prescription options for a given stand. These prescription scenarios represent the most common type of prescription applied to each group and are used to simplify both model inputs and projected output data.

Table 38. Available prescription options used in the PRISM model

Prescription Group or Dominance Type	Broad PVT group	Even-aged - CC or ST*	Even-aged - SW*	Intermediate - IMPR*	Prescribed Fire -RXBO* - MA2 and MA3, all alternatives
Ponderosa pine	Warm Dry		X	X	X
Ponderosa pine	Warm Moist	X		X	X
Ponderosa pine	Cool Moist	X			
Ponderosa pine	Cold	X			
Douglas-fir	Warm Dry		X	X	X
Douglas-fir	Warm Moist	X			X
Douglas-fir	Cool Moist	X		X	X
Douglas-fir	Cold	X		X	X
Grand fir	Warm Dry		X	X	X
Grand fir	Warm Moist	X			X
Grand fir	Cool Moist	X			X
Western white pine	Warm Moist	X		X	X

Prescription Group or Dominance Type	Broad PVT group	Even-aged - CC or ST*	Even-aged - SW*	Intermediate - IMPR*	Prescribed Fire -RXBO* - MA2 and MA3, all alternatives
Western red cedar (includes western hemlock)	Warm Moist	X			X
Lodgepole pine	Warm Dry	X			X
Lodgepole pine	Warm Moist	X			X
Lodgepole pine	Cool Moist	X			X
Lodgepole pine	Cold	X			X
Mountain hemlock	Cool Moist		X		
Engelmann spruce and Subalpine fir	Warm Moist		X		X
Engelmann spruce and Subalpine fir	Cool Moist		X		X
Engelmann spruce and Subalpine fir	Cold		X	X	X
Whitebark pine	Cold			X	X

*CC or ST = clearcut with reserves or seed tree with reserves; SW = shelterwood; IMPR = any type of intermediate harvest such as commercial thin or improvement cut; RXBO = prescribed burn only, X = Included in PRISM model as a planned treatment

Group selection was modeled previously for some forest types. However, due to the Nez Perce-Clearwater seldom, if ever, using this as a harvest method, group selection is not being included in the model due to model size limitations. Group selection may be considered after modeling is complete and, if desired, it can be assumed to be a portion of the even-aged acres. This is thought to be a reasonable way to model group selection because group selection would not be dissimilar from even aged harvest except in the scale at which it is performed. For instance, a group selection opening may resemble a clearcut, but the group selection would only be one to two acres in size, whereas the clearcut could be tens of acres.

Similarly, Individual Tree Selection is an uneven-aged regeneration method, which is not modelled due to complex modelling requirements. This prescription is highly flexible and approximates forest structures similar to a shelterwood prescription. The primary difference is that trees representing all diameter classes may be retained to promote multi-canopy structure.

Yield Tables and Volume Estimation

“Yield Table” is a term used to describe the vegetation conditions of a stand through time associated with a particular management regime. Historically, they were used to predict timber yields, but they can describe any number of metrics, such as fire risk, snags, or wildlife suitability. The Forest Vegetation Simulator (FVS variant NI-15) was used to estimate growth and yield based on Forest Inventory and Analysis (FIA) tree data. The Forest Management Service Center constructed the growth and yield tables used in the PRISM model with the assistance of Forest staff. The following attributes are tracked in the yield tables:

- Merchantable cubic foot volume—National Policy to use this measure to calculate projected timber sale quantity (PTSQ), potential wood sale quantity (PWSQ), sustained yield limit (SYL), and non-declining flow
- Merchantable board feet (Scribner, Decimal C)—This will be a conversion from cubic foot volume

- Diameter of removal and residual stand
- Fire risk from the Fire and Fuels Extension
- Dominance type and size class
- Insect risk
- Snags

Volume Modifications

Prescriptions that were used for the Forest Vegetation Simulator runs informed the inputs for PRISM. The specified retention amounts for certain prescriptions were considerably higher than the minimums specified by each of the action alternatives. Due to the variation of specified retention for the alternatives, there is a need to show differences and actual effects by modifying volumes that are produced based on the differing practices in the action alternatives. To correct this over estimation of volume, existing yield table volumes are modified by using the following multipliers for the various scenarios:

- For clearcut or seedtree harvest in the mesic intolerants group, use a volume multiplier of 1.42 for the No Action Alternative and Alternatives W, X, Y, and the Preferred Alternative.
- For clearcut or seedtree harvest in the mesic intolerants group, use a volume multiplier of 1.34 for Alternative Z.
- For clearcut or seedtree harvest in the grand fir and cedar prescription group, use a volume multiplier of 1.23 for the No Action Alternative and Alternatives W, X, Y, and the Preferred Alternative.
- For clearcut or seedtree harvest in the grand fir and cedar prescription group, use a volume multiplier of 1.18 for Alternative Z.
- For clearcut or seedtree harvest in lodgepole pine stands, use a volume multiplier of 1.21 for the No Action Alternative and Alternative W, X, Y, and the Preferred Alternative.
- For clearcut or seedtree harvest in lodgepole pine stands, use a volume multiplier of 1.18 for Alternative Z.

Merchantable Diameter

Construction of the yield tables from the Forest Vegetation Simulator projections used a minimum diameter specification of three inches for cubic feet calculations; the minimum diameter specification for board feet calculations was seven inches for all tree species, except lodgepole pine, which has a minimum diameter of six inches. In commercially thinned stands, the top wood volume added non-sawlog material in the amount of about 16 percent of the sawlog volume. This top volume should be tracked as small diameter volume in the amount of 16 percent of sawlog volume when performing commercial thinning in the model. The top volume is typically only used on the Palouse District where there is a facility to process this material, but it will be useful to track all of this volume and it will be added to the projected timber sale quantity (PTSQ) as part of the potential wood sale quantity (PWSQ).

Costs for Management Activities

Management treatment cost is an input to the model, which is used with the overall budget to determine how much management can happen within budget. Costs were developed for sale preparation and sale administration (lumped), reforestation, timber stand improvement (TSI), and prescribed burn activities. Estimates for the Nez Perce-Clearwater are listed in the Table 39.

Table 39. Nez Perce-Clearwater costs for the PRISM model

Activity	Units	Cost	Production Coefficient	Timing
Sale Prep and Admin[1]	CCF	$24.16	1 per CCF harvest	Cost includes NFMA through harvest
Reforestation[2]	Acre	$300.00	1 per acre regeneration harvest	Immediately after harvest
TSI (pre-commercial thin)[2]	Acre	$150.00	1 per acre regeneration harvest	2 decades after harvest
Prescribed Burn[3]	Acre	$120.00-MA3 $30-MA2	1 per acre burned	Timing for prescribed burn
Pile burning	Acre	$99.00	1 per acre burned	Immediately after harvest

[1] Assumptions used to arrive at this number are given in detail in the “Fiscal Capability Assumptions for an Alternative that Departs from Sustained Yield Limit” dated 7/12/18.
[2] From Beth Wood, Nez Perce-Clearwater Silviculturist.
[3] From Justin Pappani, Nez Perce-Clearwater Land Management Plan Fire Ecologist.

Timber Stumpage Values

Stumpage values for timber were developed by Scott Godfrey, Nez Perce-Clearwater (Vegetation and Stewardship Staff Officer), and updated in June 2020 with adjusted values from Colin Sorenson, Northern Region Economist. The stumpage value species group was cross walked to PRISM species strata. Table 40 displays the average stumpage value for all logging systems. These values were tracked in the model but did not influence the scheduling of any management activities.

Table 40. Estimated sawlog values

PRISM Species Mix	Non-Saw per MBF*	Sawlog per MBF	Other
PP Mix	$2.00	$155.84	Estimated 80% yellow and 20% bull for products sold
DF/GF	$2.00	$110.44	Based on 50% DF/WL and 50% GF/WH
LPP	$2.00	$71.93	
DF/L	$2.00	$133.67	
GF Mix	$2.00	$87.20	
SF Mix	$2.00	$74.34	
WRC	$2.00	$401.50	

*Thousand board feet

Transition Pathways

Transition pathways were developed for each cover type and prescription combination and for natural growth pathways, as illustrated in Table 41. Transition pathways for riparian vegetation were adapted from upland pathways for selected cover type-potential vegetation type group combinations. The following Table 41 summarizes the transitions that are included. There are separate documents for each transition. Because the Nez Perce-Clearwater uses dominance types to define desired conditions, each document assumes a dominance type following a given treatment or non-treatment. The yield tables that were constructed for the Nez Perce-Clearwater were developed prior to using the dominance types for desired conditions, so the transition pathways point to the yield table with the best fit for the dominance type. For transitional National Forest System lands burned recently and not yet regenerated (TFor), transitions follow the natural growth transitions with a one-decade delay in regeneration.

Table 41. PRISM cover type transition changes

Treatment	PRISM Species
Natural Growth	Lodgepole pine in Warm Dry PVT*
Natural Growth	Logepole pine in Warm Moist PVT
Natural Growth	Lodgepole pine in Cool Moist or Cold PVT
Natural Growth	Douglas-fir or grand fir in the Warm Dry PVT
Natural Growth	Douglas-fir, western white pine, western larch, or Ponderosa pine in the Warm Moist PVT
Natural Growth	Western redcedar and western hemlock in Warm Moist PVT
Natural Growth	Ponderosa pine in Warm Dry PVT
Natural Growth	Subalpine fir, Engelmann spruce, mountain hemlock all PVT groups
Natural Growth	Douglas-fir and western larch in Cool Moist or Cold PVT
Even-aged Harvest	Subalpine fir, Engelmann spruce, mountain hemock Upland and Riparian in Cool Moist PVT
Even-aged Harvest	Subalpine fir, Engelmann spruce, mountain hemock in Cold PVT
Even-aged Harvest	Douglas-fir and western larch in Cool Moist or Cold PVT
Even-aged Harvest	Douglas-fir and grand fir Upland and Riparian in the Warm Dry PVT
Even-aged Harvest	Grand fir and western redcedar Upland and Riparian in Warm Moist PVT
Even-aged Harvest	Lodgepole pine in all PVT groups
Even-aged Harvest	Douglas-fir Upland and Riparian in Warm Moist PVT
Even-aged Harvest	Western white pine restoration in Warm Moist PVT
Even-aged Harvest	Ponderosa pine Upland and Riparian in Warm Dry PVT
Prescribed Burn	Subalpine fir, Engelmann spruce, mountain hemlock in Cool Moist and Cold PVT
Prescribed Burn	Subalpine fir, Engelmann spruce, mountain hemlock in Cool Moist and Cold PVT with planting of whitebark pine
Prescribed Burn	Grand fir, western redcedar, western hemlock in Warm Moist PVT
Prescribed Burn	Grand fir, western redcedar, western hemlock in Warm Moist with planting of white pine and larch
Prescribed Burn	Douglas-fir and grand fir in Warm Dry PVT
Prescribed Burn	Douglas-fir, Ponderosa pine, western larch in Warm Moist PVT
Prescribed Burn	Douglas-fir and western larch in Cool Moist or Cold PVT
Prescribed Burn	Lodgepole pine in all PVT groups
Prescribed Burn	Ponderosa pin in all PVT groups

*potential vegetation type

Natural Disturbance

The amount of natural disturbance was determined using average fire return intervals for typical fire regimes in each setting. Disturbance levels were input into the PRISM model, requiring a certain number of acres to undergo natural disturbance every decade. The amount varies by cover type (Level ID 5) and size class (Level ID 6), and natural disturbance events (fire, insects, and pathogens) are estimated from historic data.

The acres of natural caused wildfire (low severity, mixed severity fire or stand-replacing fire) by potential vegetation type strata were determined through analysis of several local and national level data sets. Fire severity (1984 through 2018) and fire history polygon data from 1870 through 2021 was used to calibrate the model. Local fire starts data covering 1970 through 2017 was intersected through GIS to yield a forest level picture of fire frequency and fire intensity. Fire history reconstruction was performed by Justin

Pappani, the Nez Perce-Clearwater Land Management Plan Fire Ecologist, and the GIS analysis was performed by Sam Martin, the Nez Perce-Clearwater Land Management Plan GIS Specialist.

When mixed severity fire occurs, use the prescribed fire pathway for the type in which it occurs. When stand replacing fire occurs, use the natural growth transition pathway and assume that, when it occurs, the stand goes to the seedling or sapling table for natural growth.

PRISM Model Calibration for Management Area 1 and Management Area 2

Warm Dry Potential Vegetation Type

Wildfire was not apportioned by dominance types but allowed to affect dominance types based on stand conditions and climate. The amount and type of wildfire is apportioned only by the successional stages. This makes the following assumptions:

- Dominance types are assigned to successional stages. For example, when an acre of the 0-4.9 inches size class burns, that acre is associated with a dominance type and, when that acre of 0-4.9 inches size class burns, the associated dominance type is affected.
- It is assumed that most warm dry sites experiencing mixed and stand replacing fire are in Fire Group 2 (Smith and Fischer 1997), as Fire Group 1 primarily experiences low severity fire, which is not modeled with PRISM.
- The 0-4.9 inches size class experiences wildfire only in the form of re-burns and these are all high severity fire with 10 percent of the high severity fire occurring here. This acknowledges that re-burns happen in the smallest size class but that fuels do not build up as quickly and promote re-burns in this size class in this warm dry potential vegetation type to the same extent that they occur in other potential vegetation type groups.
- 60 percent of the stand replacing fire occurs in the “Very Large” size class because, in Fire Group 2, stand replacing fires occur infrequently so it is assumed that they occur primarily in the largest size class. The remaining 30 percent of stand replacing fire occurs in the “Large” size class, as some sites may not support reaching the “Very Large” size class.
- Mixed severity fire increases as the size class increases because the stand becomes increasingly likely that it will experience wildfire as the stand progresses down the successional pathway without burning and getting toward the upper bound or outside of the historic fire regime.
- Low severity fire is not modelled in PRISM but included in the following tables to illustrate the relative amount of low severity fire which is expected to occur within each potential vegetation type group. This fire severity class does not typically change the size class of a unit but may reduce total density.

Table 42. Acres of wildfire in the warm dry potential vegetation type group by fire severity type for Management Area 1 and Management Area 2

Fire Type	Total Fire in Warm Dry in Management Area 1 (acres per decade)	Total Fire in Warm Dry in Management Area 2 (acres per decade)
Low Severity	21,063	25,819
Mixed Severity	11,545	14,151
High Severity	14,151	9,550

Table 43. Acres of wildfire in the warm dry potential vegetation type group affecting size classes for Management Area 1 and Management Area 2

Strata—Level 6	Mixed Severity—Management Area 1	Stand Replacing—Management Area 1	Mixed Severity—Management Area 2	Stand Replacing—Management Area 2
Seedling and Sapling	0	1,415	0	955
Small	1,154	0	1,415	0
Medium	2,309	0	2,830	0
Large	3,464	4,245	4,245	2,865
Very Large	4,618	8,491	5,660	5,730

Warm Moist Potential Vegetation Type

Assumptions:

- Sites are primarily in Smith and Fischer’s (1997) Fire Group 7, with some in Group 8 and some in Group 9.
- Because stand replacing fire often happens at very wide intervals within these fire groups, it is assumed that the vast majority of stand replacing fire occurs in the largest size class.
- The “Medium” size class is thought to be when most stands enter the shorter end of the fire return interval for the typical mixed severity fire regime associated with these fire groups; thus, stands begin to experience mixed severity fire in the “Medium” size class.
- The mixed severity split is even between “Large” and “Very Large”: size classes because a portion of the “Very Large” size class would be in Fire Group 8 and, therefore, would be more apt to see stand replacing fire at a longer interval.
- The “Very Large” size class is thought to be the most likely to experience stand replacing fire due to the historic fire regimes that functioned within these fire groups, but it is recognized that some re-burns occur in the seedling or sapling class and some stand replacing fire may occur within the “Large” size class as well.
- The seedling or sapling and the small categories are unlikely to experience wildfire on these highly productive sites, as they are in these categories at a younger age than what is typically the lower end of the fire return interval in these systems.

Table 44. Acres of wildfire in the warm moist potential vegetation type group by fire severity type for Management Area 1 and Management Area 2

Fire Type	Total Fire in Warm Moist in Management Area 1 (acres per decade)	Total Fire in Warm Moist in Management Area 2 (acres per decade)
Low Severity	36,381	44,597
Mixed Severity	19,941	24,443
High Severity	13,457	16,496

Table 45. Acres of wildfire in the warm moist potential vegetation type group effecting size classes for Management Area 1 and Management Area 2

Strata—Level 6	Mixed Severity—Management Area 1	Stand Replacing—Management Area 1	Mixed Severity—Management Area 2	Stand Replacing—Management Area 2
Seedling or Sapling	0	1,346	0	1,650
Small	0	0	0	0
Medium	3,988	0	4,889	0
Large	7,976	1,346	9,777	1,650
Very Large	7,976	10,766	9,777	13,197

Cool Moist Potential Vegetation Type

Assumptions:

- The most common type in which stand replacing fire occurs is in the mature lodgepole pine, which is represented most commonly by the medium size class but occasionally by the large size class; therefore, these two size classes are allotted the most stand replacing fire.
- Re-burns occur in the seedling or sapling stage as the lodgepole pine snags fall; therefore, some stand replacing fire occurs in the seedling or sapling stage.
- Generally, stands within the small size class are younger than the minimum fire return interval; therefore, they are not assumed to experience an appreciable amount of wildfire.

Table 46. Acres of wildfire in the cool moist potential vegetation type group by fire severity type for Management Area 1 and Management Area 2

Fire Type	Total Fire in Cool Moist in Management Area 1 (acres per decade)	Total Fire in Cool Moist in Management Area 2 (acres per decade)
Low Severity	22,020	26,993
Mixed Severity	12,069	14,795
High Severity	8,145	9,984

Table 47. Acres of wildfire in the cool moist potential vegetation type group effecting size classes for Management Area 1 and Management Area 2

Strata—Level 6	Mixed Severity—Management Area 1	Stand Replacing—Management Area 1	Mixed Severity—Management Area 2	Stand Replacing—Management Area 2
Seedling and Sapling	0	815	0	998
Small	0	0	0	0
Medium	4,828	4,887	5,918	5,990
Large	6,034	1,629	7,396	1,997
Very Large	1,207	815	1,480	998

Cold Potential Vegetation Type

Assumptions:

- The most common type in which stand replacing fire occurs is in the mature lodgepole pine, which is represented most commonly by the medium size class but occasionally by the large size class; therefore, these two size classes are allotted the most stand replacing fire.
- Re-burns occur in the seedling or sapling stage as the lodgepole pine snags fall; therefore, some stand replacing fire occurs in the seedling or sapling stage.
- Generally, stands within the small size class are at the very beginning of the minimum fire return interval. They generally do not have sufficient fuel for stand replacing fire.
- A limited amount of wildfire occurs within the “Very Large” size class because very few stands reach this size.

Table 48. Acres of wildfire in the cold potential vegetation type group by fire severity type for Management Area 1 and Management Area 2

Fire Type	Total Fire in Cold in Management Area 1 (acres per decade)	Total Fire in Cold in Management Area 2 (acres per decade)
Low Severity	11,489	14,083
Mixed Severity	6,297	7,719
High Severity	4,250	5,209

Table 49. Acres of wildfire in the cold potential vegetation type group effecting size classes for Management Area 1 and Management Area 2

Strata – Level 6	Mixed Severity—Management Area 1	Stand Replacing—Management Area 1	Mixed Severity—Management Area 2	Stand Replacing—Management Area 2
Seedling and Sapling	0	425	0	521
Small	1,259	0	1,544	0
Medium	2,456	1,233	3,010	1,511
Large	2,519	2,550	3,088	3,125
Very Large	63	43	77	52

PRISM Model Calibration for Management Area 3

Warm Dry Potential Vegetation Type

Assumptions:

- See previous assumptions for fire in the warm dry potential vegetation type group.

The amount of fire in Management Area 3 is considerably less than the other two management areas. This is likely caused by a combination of fire suppression and the effect of active management changing the pattern on the landscape.

Table 50. Acres of wildfire in the warm dry potential vegetation type group by fire severity type for Management Area 3

Fire Type	Total Fire in Warm Dry in Management Area 3 (acres per decade)
Low Severity	21,063
Mixed Severity	11,545
High Severity	7,791

Table 51. Acres of wildfire in the warm dry potential vegetation type group effecting size classes for Management Area 3

Strata—Level 6	Mixed Severity— Management Area 3	Stand Replacing—Management Area 3
Seedling and Sapling	0	779
Small	1,154	0
Medium	2,309	0
Large	3,464	2,337
Very Large	4,618	4,675

Warm Moist Potential Vegetation Type

Assumptions:

- See previous assumptions for fire in the warm moist potential vegetation type group.

Table 52. Acres of wildfire in the warm moist potential vegetation type group by fire severity type for Management Area 3

Fire Type	Total Fire in Warm Moist in Management Area 3 (acres per decade)
Low Severity	36,381
Mixed Severity	19,941
High Severity	13,457

Table 53. Acres of wildfire in the warm moist potential vegetation type group effecting size classes for Management Area 3

Strata—Level 6	Mixed Severity— Management Area 3	Stand Replacing—Management Area 3
Seedling and Sapling	0	1,346
Small	0	0
Medium	3,988	0
Large	7,976	1,346
Very Large	7,976	10,766

Cool Moist Potential Vegetation Type

Assumptions:

- See previous assumptions for fire in the cool moist potential vegetation type group.

Table 54. Acres of wildfire in the cool moist potential vegetation type group by fire severity type for Management Area 3

Fire Type	Total Fire in Cool Moist in Management Area 3 (acres per decade)
Low Severity	22,020
Mixed Severity	12,069
High Severity	8,145

Table 55. Acres of wildfire in the cool moist potential vegetation type group effecting size classes for Management Area 3

Strata—Level 6	Mixed Severity— Management Area 3	Stand Replacing—Management Area 3
Seedling and Sapling	0	815

Strata—Level 6	Mixed Severity— Management Area 3	Stand Replacing—Management Area 3
Small	0	0
Medium	4,828	4,887
Large	6,035	1,629
Very Large	1,210	815

Cold Potential Vegetation Type

Assumptions:

- See previous assumptions for fire in the cold potential vegetation type group.

Table 56. Acres of wildfire in the cold potential vegetation type group by fire severity type for Management Area 3

Fire Type	Total Fire in Cold in Management Area 3 (acres per decade)
Low Severity	11,489
Mixed Severity	6,297
High Severity	4,250

Table 57. Acres of wildfire in the cold potential vegetation type group effecting size classes for Management Area 3

Strata—Level 6	Mixed Severity— Management Area 3	Stand Replacing—Management Area 3
Seedling and Sapling	0	425
Small	1,259	0
Medium	2,456	1,233
Large	2,519	2,550
Very Large	63	43

Findings and Recommendations

1. Because previous analysis showed that sustainability by individual national forest is not a concern, the model was collapsed into one Forest, which provided benefits in terms of modeling desired conditions for each management area.
2. In initial runs, budget was the most limiting constraint. Additionally, because the model was developed with the proclaimed forest boundaries, there were problems partitioning the budget constraint between the forests. Final model runs are performed without a budget constraint.
3. Modeling efforts indicate the sustained yield limit is approximately 241 million board feet (MMBF) per year.
4. Modeling for the Proposed Action in 2014 showed a Long-Term Sustained Yield Capacity (LTSYC) of 135 MMBF per year. The reason the LTSYC is different than the sustained yield limit calculation is that the LTSYC was calculated prior to the directives being released, so the calculation was performed differently. Notably, the LTSYC calculation considered multiple use objectives, such as a low level of harvest in lynx habitat, whereas the sustained yield limit calculated timber production capability from all lands that may be suitable for timber production and did not consider multiple use limitations.

5. The team previously found that there was not much difference in attaining desired conditions with a departure. The team previously modeled a harvest of 150 MMBF per year as a departure. The team found that departure was mostly helping attain size class goals (specifically creating seedling and sapling size class), not changes in cover types. A possible cause for this behavior was found to be that some of the transition pathways may not have created the changes in dominance types that were expected. This was part of the impetus for editing the transition pathways.
6. Based on initial findings, transitional pathways and the application of prescriptions were reviewed and updated to be consistent with current disturbance ecology concepts.

Desired Conditions

The following are the desired conditions by management area and by potential vegetation type group. The desired conditions were informed by SIMPPLLE modeling of the natural range of variation, which was further verified with empirical data from Forest Inventory and Analysis (FIA) and historical literature. The Forest leadership team also expressed a need to change some of the specific numbers associated with the desired conditions to meet multiple resource objectives. For more details on developing desired conditions that were somewhat different than the natural range of variation, see the paper titled, “Addendum Rationale and Methodology for Desired Conditions” dated July 7, 2020. Attainment should be measured individually for each management area. For instance, if the amount of Ponderosa pine for the warm dry potential vegetation type in Management Area 3 is 50 to 60 percent, then this is the objective for Ponderosa pine dominance type regardless of what happens in Management Area 1 or Management Area 2.

Table 58. LEVEL 5 IDENTIFIER—Warm Dry Potential Vegetation Group—Management Area 1 (L1 and N1)

Level 5 IDENTIFIER Dominance Type	Existing Condition %	Minimum %	Maximum %
Ponderosa pine (WDPP)	16	50	60
Douglas-fir (WDDF)	25	15	20
Douglas-fir and western larch (WDDF and WDWL)	4	1	4
Lodgepole pine (WDLP)	3	5	12
Grand fir (WDGF)	22	5	15
Western larch (WDWL)	0	1	2
Seral stage grass or shrub (WDHS)	28	2	10

Table 59. LEVEL 6 IDENTIFIER—Warm Dry Potential Vegetation Type Group—Management Area 1 (L1 and N1)

Level 6 IDENTIFIER Size Class	Existing Condition %	Minimum %	Maximum %
Seral grass or shrub (T)	33	2	10
Sd/sp (0–4.9”) (S)	4	10	25
Pole (5–9.9”) (P)	12	10	20
Medium (10–14.9”) (M)	14	12	20
Large (15–19.9”) (L)	19	20	35
Very Large (20+”) (V)	18	10	25

Table 60. LEVEL 5 IDENTIFIER—Warm Dry Potential Vegetation Type Group—Management Area 2 (L2 and N2)

Level 5 IDENTIFIER Dominance Type	Existing Condition %	Minimum %	Maximum %
Ponderosa pine	6	50	65
Douglas-fir	31	15	20
Douglas-fir and western larch	2	1	2
Lodgepole pine	13	5	15
Grand fir	25	2	10
Western larch	1	1	2
Seral stage grass or shrub	21	1	10

Table 61. LEVEL 6 IDENTIFIER—Warm Dry Potential Vegetation Type Group—Management Area 2 (L2 and N2)

Level 6 IDENTIFIER Size Class	Existing Condition %	Minimum %	Maximum %
Seral grass or shrub (T)	25	1	10
Sd/sp (0–4.9”)	0	7	25
Pole (5–9.9”)	18	7	20
Medium (10–14.9”)	27	10	25
Large (15–19.9”)	17	20	35
Very Large (20+”)	13	15	25

Table 62. LEVEL 5 IDENTIFIER—Warm Dry Potential Vegetation Type Group—Management Area 3 (L3, N3 and S3)

Level 5 IDENTIFIER Dominance Type	Existing Condition %	Minimum %	Maximum %
Ponderosa pine	17	50	60
Douglas-fir	14	15	20
Douglas-fir and western larch	3	1	2
Lodgepole pine	13	10	15
Grand fir	33	2	10
Western larch	2	1	2
Seral stage grass or shrub	17	1	10

Table 63. LEVEL 6 IDENTIFIER—Warm Dry Potential Vegetation Type Group—Management Area 3 (L3, N3 and S3)

Level 6 IDENTIFIER Size Class	Existing Condition %	Minimum %	Maximum %
Seral grass or shrub (T)	18	1	10
Sd/sp (0–4.9”)	4	5	25
Pole (5–9.9”)	26	10	20
Medium (10–14.9”)	24	10	20
Large (15–19.9”)	14	20	35
Very Large (20+”)	14	15	28

Table 64. LEVEL 5 IDENTIFIER—Warm Moist Potential Vegetation Type Group—Management Area 1 (L1 and N1)

Level 5 IDENTIFIER Dominance Type	Existing Condition %	Minimum %	Maximum %
Ponderosa pine (WMPP)	0	5	20
Douglas-fir (WMDF)	28	5	10
Douglas-fir and western larch (WMDF and WMWL)	4	5	10
Western larch (WMWL)	0	5	10
Lodgepole pine (WMLP)	0	1	2
Grand fir and western redcedar (modeled as 50/50 split) (WMGF and WMRC)	18	15	25
Western white pine (WMWP)	0	10	20
Subalpine fir and Engelmann spruce (modeled as any combination of these dominance types) (WMSF and WMES)	2	0	2
Grand fir (WMGF)	43	10	20
Seral stage grass or shrub (WMHS)	5	5	20

Table 65. LEVEL 6 IDENTIFIER—Warm Moist Potential Vegetation Type Group—Management Area 1 (L1 and N1)

Level 6 IDENTIFIER Size Class	Existing Condition %	Minimum %	Maximum %
Seral grass or shrub (T)	10	5	20
Sd/sp (0–4.9”)	4	10	25
Pole (5–9.9”)	14	10	20
Medium (10–14.9”)	20	10	20
Large (15–19.9”)	29	20	30
Very Large (20+”)	23	10	20

Table 66. LEVEL 5 IDENTIFIER—Warm Moist Potential Vegetation Type Group—Management Area 2 (L2 and N2)

Level 5 IDENTIFIER Dominance Type	Existing Condition %	Minimum %	Maximum %
Ponderosa pine	1	5	20
Douglas-fir	20	5	10
Douglas-fir and western larch	7	5	10
Western larch	1	5	10
Lodgepole pine	6	1	2
Grand fir or western redcedar (model as 50/50 split)	15	15	20
Grand fir	35	10	15
Western white pine	1	15	25
Subalpine fir and Engelmann spruce (model as any combination of these dominance types)	3	0	2
Seral stage grass or shrub	5	5	20

Table 67. LEVEL 6 IDENTIFIER—Warm Moist Potential Vegetation Type Group—Management Area 2 (L2 and N2)

Level 6 IDENTIFIER Size Class	Existing Condition %	Minimum %	Maximum %
Seral grass or shrub (T)	10	5	20
Sd/sp (0–4.9”)	4	10	25
Pole (5–9.9”)	14	12	20
Medium (10–14.9”)	20	12	20
Large (15–19.9”)	29	15	25
Very Large (20+”)	23	10	25

Table 68. LEVEL 5 IDENTIFIER—Warm Moist Potential Vegetation Type Group—Management Area 3 (L3, N3 and S3)

Level 5 IDENTIFIER Dominance Type	Existing Condition %	Minimum %	Maximum %
Ponderosa pine	2	10	20
Douglas-fir	11	2	5
Douglas-fir and western larch	5	5	10
Western larch	2	5	15
Lodgepole pine	2	1	2
Grand fir and western redcedar (model as 50/50 split)	17	10	20
Western white pine	3	25	40
Subalpine fir and Engelmann spruce (model as any combination of these dominance types)	4	1	2
Grand fir	45	5	15
Seral stage grass or shrub	10	1	5

Table 69. LEVEL 6 IDENTIFIER—Warm Moist Potential Vegetation Type Group—Management Area 3 (L3, N3 and S3)

Level 6 IDENTIFIER Size Class	Existing Condition %	Minimum %	Maximum %
Seral grass or Shrub (T)	11	1	5
Sd/sp (0–4.9”)	4	5	25
Pole (5–9.9”)	23	10	20
Medium (10–14.9”)	23	10	20
Large (15–19.9”)	21	20	35
Very Large (20+”)	19	15	25

Table 70. LEVEL 5 IDENTIFIER—Cool Moist Potential Vegetation Type Group—Management Area 1 (L1 and N1)

Level 5 IDENTIFIER Dominance Type	Existing Condition %	Minimum %	Maximum %
Douglas-fir (CMDF)	8	2	4
Lodgepole pine (CMLP)	10	20	30
Douglas-fir and Western larch (CMDF and CMWL)	0	1	2
Western larch (CMWL)	0	5	10

Level 5 IDENTIFIER Dominance Type	Existing Condition %	Minimum %	Maximum %
Grand fir and Mountain hemlock (CMGF and CMMH) (model as any combination of these dominance types)	1	1	2
Western white pine (CMWP)	0	5	10
Subalpine fir and Engelmann spruce (CMSF and CMES) (model as any combination of these dominance types)	53	25	40
Whitebark pine (CMWB)	0	2	10
Seral stage grass or shrub (CMHS)	28	5	25

Table 71. LEVEL 6 IDENTIFIER—Cool Moist Potential Vegetation Type Group—Management Area 1 (L1 and N1)

Level 6 IDENTIFIER Size Class	Existing Condition %	Minimum %	Maximum %
Seral grass or Shrub (T)	34	5	25
Sd/sp (0–4.9”)	3	15	30
Pole (5–9.9”)	15	10	25
Medium (10–14.9”)	27	10	20
Large (15–19.9”)	13	15	30
Very Large (20+”)	8	5	10

Table 72. LEVEL 5 IDENTIFIER—Cool Moist Potential Vegetation Type Group—Management Area 2 (L2 and N2)

Level 5 IDENTIFIER Dominance Type	Existing Condition %	Minimum %	Maximum %
Douglas-fir	12	2	4
Lodgepole pine	19	20	30
Douglas-fir and western larch	0	1	2
Western larch	3	5	10
Grand fir and Mountain hemlock (model as any combination of these dominance types)	9	1	2
Western white pine	0	5	10
Subalpine fir and Engelmann spruce (model as any combination of these dominance types)	41	25	40
Whitebark pine	1	2	10
Seral stage grass or shrub	16	5	25

Table 73. LEVEL 6 IDENTIFIER—Cool Moist Potential Vegetation Type Group—Management Area 2 (L2 and N2)

Level 6 IDENTIFIER Size Class	Existing Condition %	Minimum %	Maximum %
Seral grass or Shrub (T)	20	5	25
Sd/sp (0–4.9”)	5	15	30
Pole (5–9.9”)	23	10	25
Medium (10–14.9”)	32	10	20
Large (15–19.9”)	11	15	30
Very Large (20+”)	9	5	10

Table 74. LEVEL 5 IDENTIFIER—Cool Moist Potential Vegetation Type Group—Management Area 3 (L3, N3 and S3)

Level 5 IDENTIFIER Dominance Type	Existing Condition %	Minimum %	Maximum %
Douglas-fir	3	2	4
Douglas-fir and western larch	1	1	2
Lodgepole pine	12	20	30
Western larch	4	5	10
Grand fir and Mountain hemlock	9	1	2
Western white pine	0	5	15
Subalpine fir and Engelmann spruce (model as any combination of these dominance types)	60	25	35
Whitebark pine	0	2	10
Seral stage grass or shrub	10	5	25

Table 75. LEVEL 6 IDENTIFIER—Cool Moist Potential Vegetation Type Group—Management Area 3 (L3, N3 and S3)

	Existing Condition %	Minimum %	Maximum %
Seral grass or Shrub (T)	17	5	25
Sd/sp (0–4.9”)	3	15	30
Pole (5–9.9”)	23	10	25
Medium (10–14.9”)	32	10	20
Large (15–19.9”)	16	15	30
Very Large (20+”)	8	5	10

Table 76. LEVEL 5 IDENTIFIER—Cold Potential Vegetation Type Group—Management Area 1 (L1 and N1)

Level 5 IDENTIFIER Dominance Type	Existing Condition %	Minimum %	Maximum %
Subalpine fir or Engelmann spruce (CDSF / CDES) (model as any combination of these dominance types)	46	3	10
Lodgepole pine (CDLP)	28	30	40
Whitebark pine (CDWB)	0	35	50
Douglas-fir and western larch (CDDF and CDWL) (model as any combination of these dominance types)	4	0	5
Mountain hemlock (CDMH)	0	2	5
Seral stage grass or shrub (CDHS)	23	5	15

Table 77. LEVEL 6 IDENTIFIER—Cold Potential Vegetation Type Group—Management Area 1 (L1 and N1)

Level 6 IDENTIFIER Size Class	Existing Condition %	Minimum %	Maximum %
Seral grass or Shrub (T)	27	5	20

Level 6 IDENTIFIER Size Class	Existing Condition %	Minimum %	Maximum %
Sd/sp (0–4.9”)	6	15	30
Pole (5–9.9”)	33	5	25
Medium (10–14.9”)	26	5	15
Large (15–19.9”)	6	25	50
Very Large (20+”)	2	0	5

Table 78. LEVEL 5 IDENTIFIER—Cold Potential Vegetation Type Group—Management Area 2 (L2 and N2)

Level 5 IDENTIFIER Dominance Type	Existing Condition %	Minimum %	Maximum %
Subalpine fir or Engelmann spruce (model as any combination of these dominance types)	26	5	15
Lodgepole pine	34	30	35
Whitebark pine	1	35	50
Douglas-fir and western larch (model as any combination of these dominance types)	0	0	5
Mountain hemlock	22	0	5
Seral stage grass or shrub	16	5	15

Table 79. LEVEL 6 IDENTIFIER—Cold Potential Vegetation Type Group—Management Area 2 (L2 and N2)

Level 6 IDENTIFIER Size Class	Existing Condition %	Minimum %	Maximum %
Seral grass or Shrub (T)	17	5	15
Sd/sp (0–4.9”)	10	15	30
Pole (5–9.9”)	34	7	25
Medium (10–14.9”)	28	7	15
Large (15–19.9”)	10	25	50
Very Large (20+”)	2	0	5

Table 80. LEVEL 5 IDENTIFIER—Cold Potential Vegetation Type Group—Management Area 3 (L3, N3 and S3)

Level 5 IDENTIFIER Dominance Type	Existing Condition %	Minimum %	Maximum %
Subalpine fir or Engelmann spruce (model as any combination of these dominance types)	26	3	10
Lodgepole pine	56	30	40
Whitebark pine	0	35	50
Douglas-fir and western larch (model as any combination of these dominance types)	6	0	5
Mountain hemlock	0	2	5
Seral stage grass or shrub	14	5	15

Table 81. LEVEL 6 IDENTIFIER—Cold Potential Vegetation Type Group—Management Area 3 (L3, N3 and S3)

Level 6 IDENTIFIER Size Class	Existing Condition %	Minimum %	Maximum %
Seral grass or Shrub (T)	36	5	15
Sd/sp (0–4.9”)	11	15	30
Pole (5–9.9”)	28	10	25
Medium (10–14.9”)	22	5	15
Large (15–19.9”)	0	25	50
Very Large (20+”)	3	0	5

PRISM Results

The PRISM model was used to calculate timber volumes and management activities to move the Nez Perce-Clearwater toward the vegetation desired conditions while at the same time maintaining wildlife, watershed, and economic sustainability, as described above. Outputs for each alternative are shown in the following tables.

The array of alternatives is intentionally designed to allow for an analysis of effects associated with varying the pace and scale of forest restoration. Additionally, the effects of land use allocations between alternatives are reflected in the suitable acres available for forest restoration. Desired conditions are identical for each alternative. Attainment of desired conditions is projected to occur at varying rates (pace) across alternatives. Alternative X is scheduled to require 100 years to achieve desired conditions for forest vegetation while Alternative X requires 20 years. The scale of restoration is determined by the number of acres requiring restoration to achieve desired conditions. Acres requiring restoration are based on the natural range of variation analysis for all natural disturbance events. This is reflected in Table 82, which illustrates that each alternative requires a similar number of treatment acres to achieve desired conditions. Alternative Z is an exception due to the pace of restoration. As discussed in the *Prism Assumptions and Model Formulation* section, the objective function defined for each alternative dictate which metric is prioritized for attainment; PTSQ or desired conditions. The preferred alternative includes a minimum sustained yield target of 145 MMBF per year to avoid large swings in available timber output over time. This is illustrated in Figure 12.

Table 82. Output volumes and scheduled harvest activities in units per year. Average of five decades from PRISM projections

Item	No Action Alternative	Alternative W	Alternative X	Alternative Y	Alternative Z	Preferred Alternative
Even-aged Treatments[1]	3,057	9,193	9,106	7,752	4,252	9,085
Commercial Thinning	3,218	3,465	3,966	4,379	3,085	3,404
Prescribed Fire	14,317	7,345	8,332	8,017	6,450	6,799
Precommercial Thinning	1,703	2,918	2,522	2,859	1,118	3,437
Planting	5,442	4,129	4,315	4,261	4,457	4,893
Total Area Treated	27,737	27,051	28,240	27,268	19,372	27,618

Data Source: PRISM

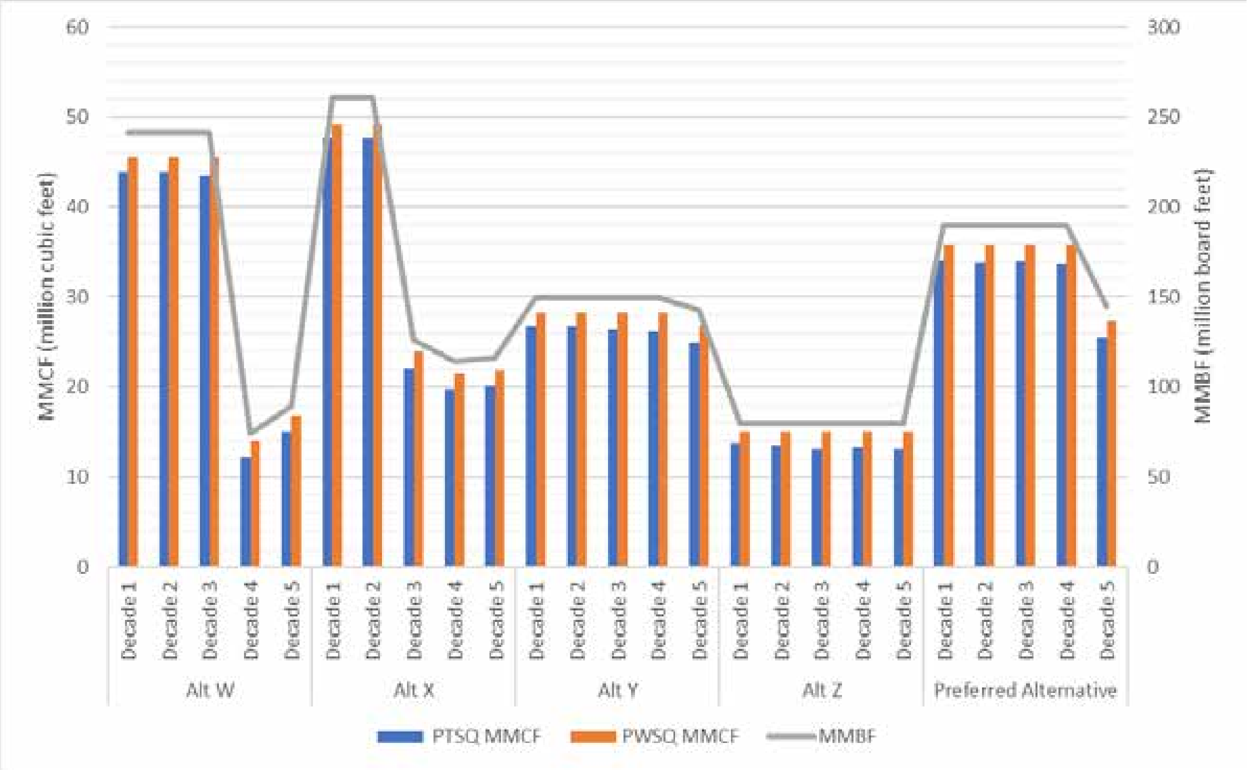

Figure 12. Projected timber sale quantity and projected wood sale quantity by alternative

Data Source: SIMPPLLE

Each alternative's effectiveness in achieving desired conditions is analyzed and compared within the PRISM model through a departure analysis. For each alternative, penalty points area assigned to each alternative for each projections period (decade) representing the number of acres requiring restoration. If desired conditions are met for a given pixel, then no penalty point is assigned for that pixel.

Figure 13 illustrates the departure analysis. Each line represents departure at each point in time. Bars represent cumulative departure over 10 decades. Alternatives W, X, and the Preferred Alternative indicate similar departure scores. The primary difference between these alternatives is the long-term timber outputs resulting from attainment of desired conditions.

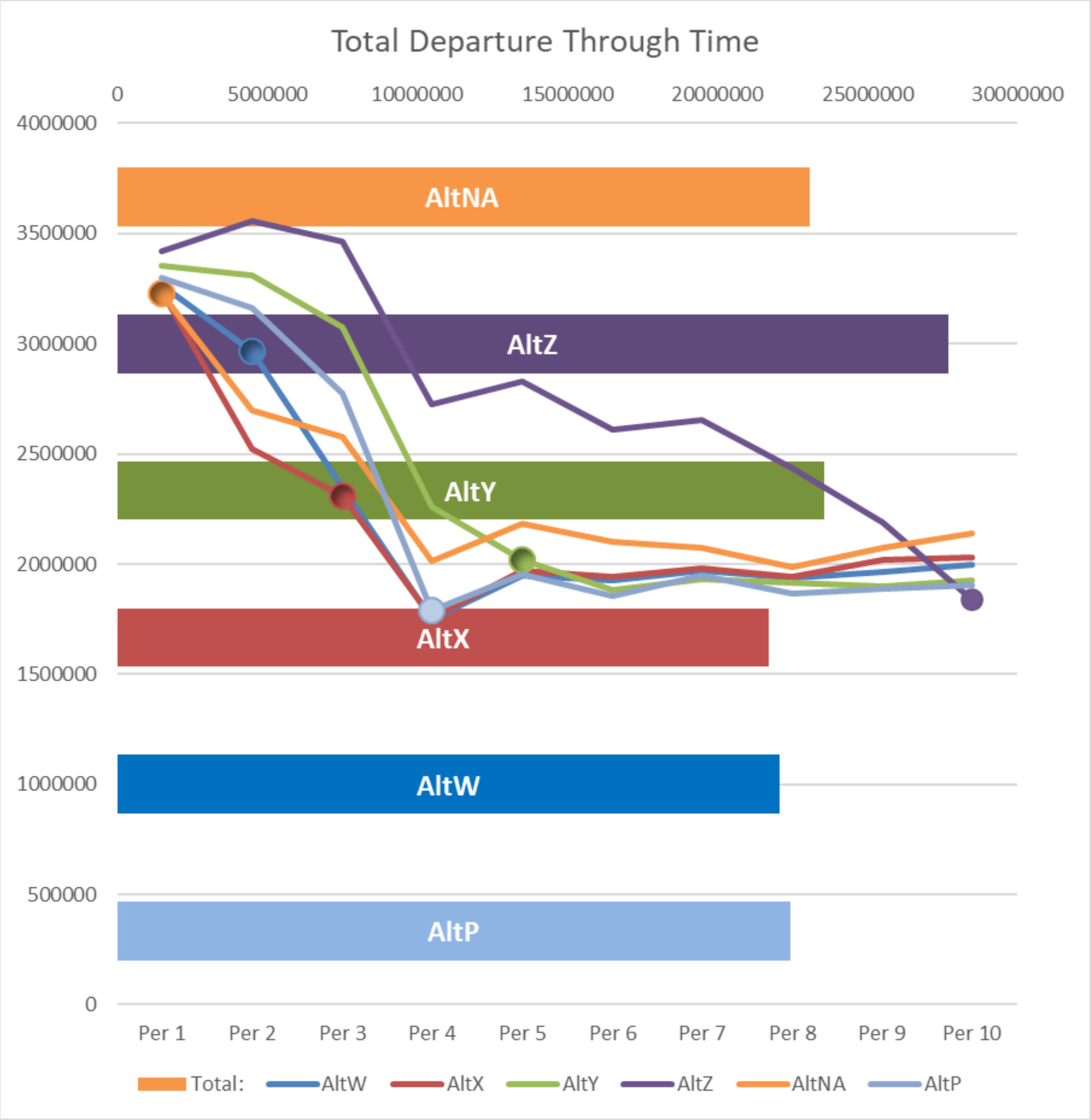

Figure 13. PRISM departure analysis

Modeling Future Vegetation Conditions with SIMPPLLE

Whereas the PRISM model is used to develop an optimal treatment schedule to move vegetation towards desired conditions, the SIMPPLLE model is used to simulate vegetation dynamics in response to these treatments, as well as other disturbances on the landscape that occur in an unpredictable or stochastic manner. While PRISM assumes that future disturbances occur in a static pattern (see Table 83 and Table 86), in reality, managers cannot accurately predict when and where disturbances will occur during the lifespan of the Land Management Plan. Therefore, for each alternative, treatments scheduled by the PRISM model are modeled on the landscape within the SIMPPLLE model in a spatial context of stochastic futures to measure combined effects of treatment and disturbance on the vegetation condition of the landscape into the future. Multiple simulations for each alternative create a range of possible futures that can be evaluated for trends and effects. For each alternative, twenty simulations of five decades each were modeled in SIMPPLLE.

Landscape Current Conditions

The current condition of the landscape for SIMPPLLE was compiled from the GIS layers used for the PRISM model. This included the landscape descriptor layers described above. Each Land Management Plan alternative incorporates a unique combination of GIS layers representing the pace and scale of vegetation treatments specific to each alternative, as well as land use allocation recommendations. Vegetation detail in SIMPPLLE is quite a bit finer-scale than in PRISM, but the vegetation information in SIMPPLLE can readily be aggregated into the types used by the Land Management Plan and the PRISM model.

In SIMPPLLE, the landscape was simulated in three management areas. Management Area 1 is composed of designated wilderness and wild and scenic river corridor areas. Management Area 2 is composed of areas designated under the 2008 Idaho Roadless Rule Act. Management Area 3 is composed of all other lands within the proclaimed forest boundaries not included in Management Area 1 or Management Area 2. These landscapes are simulated with five-acre pixels and they include areas of forest ownership, private inholdings, and a buffer around the landscape to allow for simulated fire spread from starts outside the forest boundary.

Treatments

A key component of using SIMPPLLE to depict the future condition is to incorporate projected vegetation treatments that would occur on the landscape under each alternative. To accomplish this, PRISM reports the management schedule of activities for each Analysis Area for the first five decades. PRISM schedules treatments by a) activity type, b) land allocation, and c) time period. Activity types are prescribed burning, thinning (both commercial and precommercial), and even-aged activities, such as clearcutting and shelterwood harvests. Land allocation is analogous to the “Analysis Areas” described in the PRISM document. It is a combination of management area; broad potential vegetation type group; timber suitability class; resource constraints, such as wildlife habitat classification (lynx, fisher, both, or neither); existing dominance type; and existing size and structure. There are approximately 9,187 uniquely recognized land allocations in each alternative. Treatments scheduled by PRISM for the first five time periods are modeled in the SIMPPLLE model for each alternative.

To integrate the two models, the land allocation map (Analysis Areas) for each alternative was used to assign the Analysis Area (AA) code to each pixel in the SIMPPLLE model. A treatment schedule input file for SIMPPLLE was developed for each of the three management areas for each alternative based on the PRISM treatment type and timing schedule of each Analysis Area. Land allocations or Analysis Area codes were not always spatially contiguous but are summarized at different scales including forestwide, management area, and broad potential vegetation type.

Assumptions of the resulting SIMPPLLE condition (dominance type, size, and density) were developed for each activity, based on transition pathways developed for each treatment type and desired dominance type. These same assumptions were used to modify SIMPPLLE conditions following past and recent activities for input file creation. Generally, even-aged treatments (clearcut, shelterwood) regenerated the stand, and intermediate treatments reduced the density and accelerated the stand in succession.

Future Fire and Climate

As explained in detail below, future climate for the Final Environmental Impact Statement was modeled using the Living Blended Drought Atlas (LBDA) Version 2 projected forward for the next 150 years. Each projected decade is assigned a climate code of either “warmer and drier,” “normal,” or “cooler and wetter” based on statistics derived from climate model projections of the last 1,000 years. All future time periods would experience a wildfire level (overall acres burned) and mix of fire severities that are based on the projected climate code. Thus, one key impact of climate change—change to disturbance regimes—was modeled directly by calibrating fire assumptions rather than directly fitting a set of climate assumptions to the future. Both the extent of wildfire (area burned) and fire severity type will differ by management area and broad potential vegetation type group. Given that Management Area 1 is composed of lands withdrawn from vegetation management, natural disturbance patterns and frequencies are allowed to play out. These lands have also not experienced the same degree of fire suppression as Management Areas 2 and 3 and are thought to be experiencing wildfire consistent with historic fire regimes. Management Area 2 has experienced a degree of fire suppression, as well as active management over the last 100 years. These lands are expected to experience an increase in area burned, as well as an increase in mixed and high severity fire. Management Area 3 has experienced the greatest degree of fire suppression and management activity over the last 100 years due to vegetation management emphasis for this area being timber production. Both fire suppression and active vegetation management have altered the successional pathways for all broad potential vegetation types, particularly for Management Areas 2 and 3. The following discussions document the rationale and decisions made regarding modeling projected fire regimes.

Area Burned

Projections for wildfire activity in the planning area under future climate scenarios have been accomplished with both statistical and mechanistic models. For example, a statistical modeling considering climate variables only, not fuel (vegetation) characteristics, was completed for the Greater Yellowstone Ecosystem Westerling et al (2011) projected changes in annual area burned and fire return intervals driven by climate scenarios from three global climate models under a medium-high emissions scenario (A2, similar to the RCP8.5 scenario). By 2075, annual area burned was predicted to exceed 1988 levels, with years with no large fires becoming rare by 2050. Mechanistic models include fuel characteristics, such as type, abundance, and moisture content, as dynamic components that influence modeled fire behavior. Clark et al (2017) used the mechanistic model FireBGCv2 to project future fire regimes under three future climate simulations (A2-low, A2-average, and A2-high) for a landscape in Yellowstone National Park (YNP). Annual area burned was projected to increase between 1.2 to 4.2 times more than historical simulation values under the coolest and warmest climate scenarios, respectively. Due to the uncertainty in future climates, the relative simplicity of statistical modeling approaches and the compounded error from model limitations, assumptions, and uncertainties in the mechanistic modeling, the levels of uncertainty are high for future fire projections.

These results are consistent with other studies in the western United States showing anthropogenic climate change has led to drier fuels and a significantly longer fire season, resulting in a doubling of forest fire area in the period 1984 to 2015 than would be expected in its absence (Abatzoglou and Williams 2016). Recent anthropogenic emissions of green-house gases are the highest in history and climate trends will continue to be warmer and drier in the planning area (Halofsky et al. 2018a, b). As such, the area burned in the SIMPPLLE model in future decades represents a 40 percent increase, or two times the average area burned per decade, during the period 1986-2015 based on Monitoring Trends in Burn Severity (MTBS) data. Based on recent literature, this represents a conservative estimate and falls within the average of the results below.

Historical Fire Disturbance within the Nez Perce-Clearwater National Forests

By understanding the historic fire frequency and severity for each of the broad potential vegetation groups, the ability to determine where, how, and when to treat existing dominant vegetation types can be considered when developing alternatives to meet desired conditions. Table 83 illustrates the historic fire regimes associated with each broad potential vegetation type and expected outcomes resulting from fire frequency and fire severity. Habitat types and species groups associated with each broad potential vegetation type are illustrated in Table 84. Northern Region Potential Vegetation Group Crosswalk (Milburn et al. 2015). See Milburn (2015) for definitions.. This table is useful to exhibit what species are associated with each broad potential vegetation type and what type of fire severity is affecting which species. Tree species differ in regard to the ability to withstand effects of wildland fire. Differences in tree physiology allow different species to withstand greater fire frequency and severity than others. Regeneration response and success also differs between species. For species considered to be fire adapted, such as Ponderosa pine, fire plays a key role in species persistence and stand structure. Subalpine fir is not a fire adapted species. Persistence of this species is more dependent on long fire return intervals sufficient to allow for the development of mature trees capable for producing viable seed. Differences in adaptation to fire for common species of the Nez Perce-Clearwater are illustrated in Table 85.

Table 83. Summary of the Northern Region broad potential vegetation type group fire disturbance descriptions

Broad Potential Veg Group	Habitat Type Group	Description
Warm Dry	Warm Dry	Ponderosa pine habitat types where Ponderosa dominates all phases and natural frequent fire would maintain open conditions. This group also contains the driest Douglas-fir habitat types, where open-grown Ponderosa pine or Douglas-fir with bunchgrasses would dominate given a natural frequent low severity fire regime; without disturbance, Douglas-fir eventually dominates. A natural fire free interval of 5–25 years on these sites maintained grassy and open park-like stands dominated by large and old Ponderosa pine and some Douglas-fir. Stand replacement fires were probably rare. This is best represented by Fire Group 1.
	Moderately Warm Dry	These habitat types were characterized in naturally functioning ecosystems by mixed species stands of Ponderosa pine, Douglas-fir, and western larch. Additional grand fir can occur without disturbance. Most of the sites normally occur at lower elevations on many aspects but are also found at higher elevations on more southerly and westerly aspects. Stands become dense and dominated by Douglas-fir and western larch over time with no disturbance. The natural fire regime would have been low to mixed severity burning every 5–50 years to create a mosaic of even-aged or open stands of Douglas-fir, Ponderosa pine, and western larch. This is best represented by Fire Group 2, with the drier sites represented by Fire Group 1.
Warm Moist	Moderately Warm & Moist	These are warm and moist habitats composed principally of grand fir habitat types. In western Montana and in some of the lower precipitation zones of northern Idaho, these types occur along the lower slopes and valley bottoms. In the moister environment of northern Idaho, these types occur on drier aspects at mid-elevations. The group is highly diverse and many of the conifer species in the area can occur on these types. Understory vegetation may be dominated by a wide variety of species. Fire free interval is wide from 50 years on the drier types to over 200 years on more moist types. All fire severities are possible on this type. Many fires are small surface fires that create a mosaic of condition. Under extreme conditions, stand replacing fires can occur, often ignited from adjacent drier site fires. Fire exclusion has shifted species composition away from early, fire-resistant, seral species to more shade tolerant types. This is best represented by Fire Group 7.
	Moderately Cool & Moist	These are upland cedar and hemlock habitat types –moderately cool and moist sites. They may contain the greatest diversity of species; common tree species include western red cedar, western hemlock, Douglas-fir, Engelmann spruce, grand fir, lodgepole pine, mountain hemlock, western larch, and western white pine. Very high basal areas can be achieved on these types. Fire frequency can be low due to the maritime influence on these sites. Fire severity can be highly

Broad Potential Veg Group	Habitat Type Group	Description
		variable due the most common moist conditions but is severe during periods of drought. Fire free intervals range from 50 to greater than 200 years. Variable fire regimes are common and often include both mixed severity fires on 50 to 85-year intervals as well as stand replacing fires on 150–250-year intervals. This is best represented by Fire Group 8.
	Moderately Cool & Wet	These are very wet sites. They are forested riparian areas along streams and are associated with wetlands or are found in an upslope position when there is water near the surface, and soils are saturated for at least part of the year. Due to this very wet condition, the fire free interval can be very long. Intervals are probably much longer than the majority of these fire groups. Habitat types include the wetter Ponderosa pine and Douglas-fir series, as well as grand fir and western red cedar. On the drier series (Ponderosa pine, Douglas-fir habitat types), fire free intervals range from 50 to greater than 200 years. For the western red cedar series, fire free intervals are commonly significantly in excess of 250 years. Stand replacing fires on upland sites may often become patchy, mixed, and low severity surface fires when they reach larger areas of these habitat types. Centuries may pass without stand replacement severe fire. Best represented by Fire Group 9.
Cool Moist	Cool Moist	These types are characterized by cool and moist site conditions. They typically have substantial herbaceous and shrub species. Species diversity can be high with western larch, Douglas-fir, western white pine, Engelmann spruce, lodgepole pine, subalpine fir, and grand fir. Other sites are dominated by lodgepole pine after stand replacement burns. Fire intervals are estimated at greater than 117 years for most sites. Fire Group 5 is best represented.
	Cool Wet	The moistest Engelmann spruce and subalpine fir habitat types. They are generally forested riparian areas along streams or associated with wetlands where the natural fire interval is usually long. Often the climax species dominate. Douglas-fir, lodgepole pine, aspen, or other hardwoods can be present. Fire return intervals for these types are 90 – 130 years and can exceed 150 years. Fire Group 5 is best represented.
	Cool Moderately Dry to Moist	These are the cool and drier subalpine fir habitat types within the area. The fire free interval of these types is 50–130 years. These periodic fire disturbances and the high amount of low to moderate fire intensity favors species such as lodgepole pine, Douglas-fir, and western larch. Subalpine fir and Engelmann spruce commonly dominate in late succession. Mixed severity fires were also common and can promote a mosaic of lodgepole pine, Douglas-fir, western larch, and possibly whitebark pine, although it tends to not have a competitive advantage. Stands dominated by lodgepole pine and over 80 years of age tend to build fuels to become a part of large stand replacement events encompassing thousands of acres. This habitat type group is best represented by Fire Groups 3 and 4.
Cold	Cold	These types are upper elevation cold moist to moderately dry sites. Most of these sites are above the cold limits where conifers such as Douglas-fir, western larch, and lodgepole pine are capable of being major stand components. Whitebark pine may be present with lodgepole pine, mountain hemlock, subalpine larch, subalpine fir, and Engelmann spruce. The fire free interval varies considerably from 35 to over 300 years. Stand replacement fires occur after intervals of more than 200 years. Most natural fires were low severity because of discontinuous fuels, although high severity occurred at long intervals. Whitebark pine would be favored with a natural fire regime. Abies or Tsuga habitat types are best represented by Fire Groups 3, 4, 5, and 6. Pinus contorta habitat types are best represented by Fire Group 3.
	Cold Timberline	These types are high elevation cold sites. They are near the timberline and above the cold limits of species such as Douglas-fir, grand fir, western white pine, and western larch. Common species are whitebark pine, mountain hemlock, subalpine fir, Engelmann spruce, and subalpine larch. Whitebark pine is usually both the existing and climax vegetation. The natural fire regime is variable, including low and mixed severity (generally 35–300+ year intervals) as well as stand-replacing

Broad Potential Veg Group	Habitat Type Group	Description
		fires at long (200+ year) intervals. These habitat types are best represented by Fire Group 6.

Data Source: (Smith and Fischer 1997), (Fischer and Bradley 1987), and R 1 Existing and Potential Vegetation Groupings used for Broad-level Analysis and Monitoring (Milburn et al. 2015)

Table 84. Northern Region Potential Vegetation Group Crosswalk (Milburn et al. 2015). See Milburn (2015) for definitions.

Broad PVT	Habitat Type Group	West MT and ID Bps 2005	R1 MT PVT[1]	R1 ID PVT[1]	ADP[2] Habitat Type
Warm Dry	Hot Dry	*Not applicable*	**pifl**	**pifl**	000, 040, 050, 050a, 051, 052, 070, 091, 092, 093, 094, 095
	Warm Dry	*1*	**pipo**	**pipo**	100, 110, 130, 140, 141, 142, 160, 161, 162, 180, 181, 182
				none	103, 104, 100032, 100033, 100034, 100035, 100037, 105, 106, 150
			psme1	**psme1**	200, 210, 220, 230
				none	205, 390
			psme2	psme2	311, 380
			psme3	psme3	321
	Mod Warm Dry	*2*	pipo	pipo	170, 171, 172, 190
			picea	picea	430
			abgr1	**abgr1**	505, 506, 507, 508
			none		41525
			psme2	**psme2**	240, 250, 260, 261, 262, 263, 280, 281, 282, 283, 292, 310, 312, 313
			psme3	**psme3**	360, 320, 322, 323, 324, 330, 350, 370, 340
	Mod Warm Mod Dry	*3*	**abgr2**	**abgr2**	510, 511, 512, 515, 590, 591, 592
			abgr3	abgr3	523
			psme2	psme2	290, 291, 293
Warm Moist	Mod Warm Moist	*4*	**abgr3**	**abgr3**	516, 517, 518, 519, 520, 521, 522, 524, 525, 526, 529
	Mod Cool Moist to Wet	*5*	thpl1	thpl1	555
			thpl2	**thpl2**	530, 531, 532, 533, 534, 535, 545, 546, 547, 548
			tshe	**tshe**	502, 565, 570, 571, 572, 573, 574, 575, 576, 577, 578, 579[3]
		6	**thpl1**	**thpl1**	540, 541, 542, 550, 560
Cool Moist	Cool Moist	*7*	**abla2**	**abla2**	620, 621, 622, 623, 624, 625, 660, 661, 662, 671, 673, 740
				abla4	670
			tsme1	tsme1	685, 686, 687
			tsme2	tsme2	682
				tsme3	680
			picea	**picea**	400, 420, 421, 422, 470, 460, 461, 462

Broad PVT	Habitat Type Group	West MT and ID Bps 2005	R1 MT PVT[1]	R1 ID PVT[1]	ADP[2] Habitat Type
				none	4, 472, 475
	Cool Wet	*8*	**abla1**	**abla1**	610, 630, 635, 636, 637, 650, 651, 652, 653, 654, 655
				none	631, 632
			tsme1	**tsme1**	675, 677
			picea	picea	410, 440, 480
	Cool Mod Dry to Moist	*9*	abla2	abla2	663
			abla3	**abla3**	640, 691, 693, 720, 750, 770, 780, 790, 791, 792
				abla4	690
				none	607, 745
			abla4	abla4	674
			picea	picea	450
			pico	**pico**	900, 910, 920, 930, 950
				none	960
			tsme2[5]	tsme2	710, 712
Cold (capable of WBP)	Cold	*10*	abla3	abla4	672, 692, 694, 731, 732, 733
			abla4	**abla4**	730, 810, 820, 830, 831, 832
			tsme1	tsme1	676
			tsme2	**tsme3**	681, 711, 840, 841, 842
			tsme3	tsme3	713
			pico	pico	925, 940
	Timberline	*11*	**laly**	**laly**	860
			pial	**pial**	850, 870, 890

[1] R1 PVTs based on “Jones” metadata and labels; [2] Automatic Data Processing Code (habitat type publications) - includes all codes from valid references in Region 1 for use with NRM FSVeg. Unless otherwise specified, codes are from 101 [Forest Habitat Types of Montana, (Pfister et al. 1977)] or 110 [Forest Habitat Types of Northern Idaho: a Second Approximation, (Cooper et al. 1991)] ; [3]579 is in Group 7, Cool & Moist, in R1 HTG (2005) but is included in the Warm/Moist Broad PVT to maintain a connection with the other Western red cedar types

Table 85. Relative fire resistance of major tree species in Northern Idaho

Species	Degree of Fire Resistance
Alpine Larch	Moderate
Douglas-fir	Very High
Engelmann spruce	Low
Grand fir	Medium
Lodgepole pine	Medium
Mountain hemlock	Low to (Medium)
Ponderosa pine	Very High
Subalpine fir	Very Low
Western hemlock	Low
Western larch	Most Resistant
Western redcedar	Medium
Western white pine	Medium

Species	Degree of Fire Resistance
Whitebark pine	Moderate

Data Source: (Flint 1925). Notes in parentheses indicate fire-resistance rankings in Minore et al. (1979) where different from Flint's evaluations. The following species were not included in either ranking: black cottonwood, Pacific yew, paper birch, and quaking aspen (Smith and Fischer 1997).

Fire severity

For fire severity, the literature is mixed (Parks et al. 2017) suggest that cold and moist forest types will see a reduction in severity and dry forests will see an increase by 2100. However, (Parks et al. 2016) suggest that fire severity is predicted to decrease throughout the west. Unfortunately, recent papers that predict future increases in the area burned do not quantify severity (Westerling et al. 2011, Barbero et al. 2015) or make simplified assumptions based on the historic fires (Spracklen et al. 2009, Yue et al. 2013). Moreover, historically, an increase in the area burned does not necessarily mean that these wildfires burn with higher severity (Kitzberger et al. 2017). Given the uncertainty in the literature, the current distribution from Monitoring Trends in Burn Severity (MTBS) of low to mixed to high into the future will be maintained.

Reburning

Reburning within the SIMPPLLE model environment follows a probabilistic algorithm where naturally ignited fires are generated on the landscape based on fire ignition probability zones. The extent to which fires burn and the resulting fire severity are functions of vegetation type and time of year, which controls temperature and humidity levels, as well as slope, aspect, and elevation. Reburns are constrained by the time since the previous disturbance and the vegetation type and fuels developed.

Within the SIMPPLLE model, a polygon is designated as a grass or forb vegetation type following a stand replacing fire for up to twenty years. After twenty years, the polygon develops through forest successional stages appropriate for the broad potential vegetation type group. Given the probabilistic and stochastic nature of the model, a reburn may occur at any point in the life of a stand and may reburn several times with different fire severities, including low intensity, mixed severity, or stand replacing fires.

Baseline Conditions

The Monitoring Trends in Burn Severity (MTBS) initiative represents the most accurate and consistent data on fire size and severity in recent decades. Unfortunately, MTBS does not have data before 1984. As such, the period from 1986–2015 will be used to represent the “current” fire regime. This would include 1988, which is a fire year that will be seen more frequently in the future (Westerling et al. 2011).

Based on the assumptions above, the following table was developed using a combination of MTBS and LANDFIRE data to calibrate the predicted occurrence of wildfire for all SIMPPLLE model runs. LANDFIRE data was used to generate the spatial context for wildfire on the landscape.

Table 86. Historic fire levels used to predict future fire levels for the Nez Perce-Clearwater

Fire Regime Group	Average Desired Acres Burned per Decade	Existing Average Acres Burned per Decade	Desired Fire Return Interval (Frequency)	Desired Fire Severity	Existing Low Severity Acres per Decade	Existing Moderate Severity Acres per Decade	Existing High Severity Acres per Decade
I	173,000 to 218,000	38,540	0–35 years	Low to mixed	23,273	10,344	4,924

Fire Regime Group	Average Desired Acres Burned per Decade	Existing Average Acres Burned per Decade	Desired Fire Return Interval (Frequency)	Desired Fire Severity	Existing Low Severity Acres per Decade	Existing Moderate Severity Acres per Decade	Existing High Severity Acres per Decade
II	9,000 to 11,000	2,540	0–35 years	High	2,242	272	28
III	286,000 to 325,000	81,900	35-200 years	Mixed to low	42,329	23,701	15,874
IV	70,000 to 91,000	100,000	35 to 200 years	High	29,769	32,547	37,705
V	600 to 1,100	2,440	200+ years	High to mixed to low	1,516	666	254
Total	538,600 to 646,100	225,420	Not applicable	Not applicable	99,129	67,530	58,785

Data Source: Estimating Burned Area Distribution of the Nez Perce-Clearwater (see project record)

Definitions Used to Describe Monitoring Trends in Burn Severity (MTBS) Ratings

Low—Areas where more than a small proportion of the site burned. Collectively, all strata are slightly altered from the pre-fire state. Duff, woody debris, and newly exposed mineral soil typically exhibit some change. Low vegetation (less than 1 meter) and shrubs or trees (1–5 meters) may show significant aboveground scorch, char, or consumption, and vegetation density or cover may be greatly altered. These pre-fire plants are generally still viable and recover quickly (within a year or two), with little change in species composition. An exception is western conifers, where sapling-sized trees may exhibit 50 percent or more mortality. Intermediate and large overstory trees may exhibit up to 25 percent mortality evidenced by crown char or scorch. Where charring does not kill tree crowns, as is common in the southeast, higher percentages of black char may occur. Char height from ground flames is typically less than 3 meters.

Mixed (Moderate) —The moderate class is difficult, if not impossible, to briefly describe. Indicators may be fairly consistent across biophysical strata and will exhibit traits between the low and high severity classes. On the other hand, numerous potential combinations of distinct low and high indicators may occur to yield a moderate classification overall within the minimum mapping unit. Conditions are transitional in magnitude and uniformity between the low and high characteristics described.

High—This class is characterized by fairly consistent effects across a site. In forested ecosystems, litter is totally consumed; duff is typically nearly entirely consumed. Medium and heavy woody debris are at least partially consumed and at least deeply charred with mostly ash and charcoal remaining. Overstory trees typically exhibit greater than 75 percent mortality. Biomass consumption and above-ground changes in carbon balances are significant. Crown char is frequently 100 percent from torching fire, and significant branch loss is evident at the highest crown levels. Where crown torching did not occur, char height from ground flames often exceeds 4 meters. Overstory tree effects are generally long lasting. New tree establishment may occur 1-3 years post-fire, but forest development often takes many decades. Herbaceous plants and shrubs are almost completely charred or consumed above ground, often with notable branch loss on taller shrubs, which may be reduced to small stubs. Resprouting from perennial plants, except grasses, is strongly reduced, as most individuals lose viability with a significant reduction in cover.

Calibrating Fire in SIMPPLLE

Fire calibration for the Final Environmental Impact Statement happened in two stages. In the first stage, the overall level of wildfire by broad potential vegetation type was adjusted to match the expected fire activity shown in Table 86. To simplify the analysis process and emulate actual fire suppression success rates, the fire suppression logic option in SIMPPLLE was used for Management Area 1 and Management Area 2 only. For Management Area 3, it was assumed that this area experiences only 40 percent of the fire that would be expected. This was a trial-and-error search and resulted in different suppression rates by broad potential vegetation type.

The second step of the calibration was to adjust wildfire activity to the expected severity mix outlined in the above table. To do this, the team examined which spread rules in SIMPPLLE were most commonly used to model naturally ignited fire on the landscape. Typically, these rules were rather general in nature. Consider a rule such as "if the site has trees, the fire will spread with a stand-replacing severity." This rule may be split to recognize circumstances where fire spread would be a different intensity; for example, sites with a lower density might have a lower severity, or different potential vegetation types might burn differently, or different sizes, species, and elevational position might be found. Fire spread rules were revised and refined until the expected burn severity mix by broad potential vegetation type was generally achieved.

Insect and Disease

Insect and disease outbreaks were modeled in SIMPPLLE to account for vegetation changes not accounted for by succession, naturally ignited fire, or treatment. The probability of occurrence varies by species, size, density, and disturbance history. Changes to species composition, size class, and density were associated with these infestations according to relevant literature and expert opinion, as described in the project record. SIMPPLLE was also able to capture some of the episodic nature of these disturbances by recognizing historic trends in increased susceptibility of certain species resulting from drought after a non-lethal fire event or resilience of a species for a period of time following an outbreak. The types of insect and disease disturbances modeled for each species is shown in Table 87. The probabilities of occurrence and effects of these disturbances are detailed in the project record.

Table 87. Modeled insect and disease processes for selected species

Process	PP	DF	GF	WRC	WP	WL	LP	ES	AF	WB
SEVERE-LP-Mountain pine beetle							X			
PP-Mountain pine beetle	X				X					
LIGHT-LP-Mountain pine beetle							X			
DF-BEETLE		X								
LIGHT-Western spruce budworm		X	X					X	X	
ROOT-DISEASE	X	X	X	X	X	X		X	X	
SEVERE-Western spruce budworm		X	X					X	X	
SPRUCE-BEETLE								X		
WBP-Mountain pine beetle										X

Successional Pathways for Environmental Impact Statement modeling

Final Environmental Impact Statement pathway modifications were made to better match the growth times and successional trajectories from the yield tables used for PRISM modeling. The Forest Vegetation Simulator (FVS) was used to project the influence of different potential management actions (such as prescribed fire, group selection, clearcut with reserves, etc.) on the vegetation types of the Nez Perce-Clearwater. These projections also included a “Natural Growth” run that included no management and no disturbance, which described how long a stand needed to grow through the different successional stages and size classes (Vandendriesche 2006). These results were compiled in a set of “yield tables,” which described, among other attributes, the timber volumes and vegetation conditions according to the Northern Region Classification System. Upon closer examination, it was clear that, in some instances, the amount of time it took to grow from a pole-sized (5 to 10 inches) stand to a medium stand (10 to 15 inches) and a medium stand to a large stand (15 to 20 inches) was longer in the FVS-derived yield tables than in the default SIMPPLLE assumptions. This is largely due to a difference in classification systems, where SIMPPLLE historically has recognized when the largest trees in the stand grow into the size class and the Northern Region Classification System quantifies size by considering the average size of all trees in the stand (Basal Area Weighted Mean Diameter). Therefore, the pathways in the SIMPPLLE model were adjusted to better reflect the Northern Region Classification System and the assumptions used in the PRISM scheduling model. Adjustments were dependent on the density class the stand was growing from and the size class the stand was growing into. The details of these assumptions are described in the project record.

SIMPPLLE Results

The SIMPPLLE model is used to project vegetation conditions on the Nez Perce-Clearwater 50 years into the future for each alternative. The projected treatment schedule resulting from the PRISM model analysis is applied within the SIMPPLLE model over a 50-year time period. The SIMPPLLE model was used to generate 30 iterations of each alternative to model and account for the stochastic nature of fires and other disturbances.

The results presented here display the range of projected outcomes for forest dominance types, size class, and patch size distribution. In addition, projection for canopy structure, wildfire and insect and disease occurrence are presented. In the end, the range in outcomes between alternatives was relatively narrow, mainly due to similar total acres treated by any alternative. In each figure, Decade 0 represents the current conditions. The natural range of variation estimates are illustrated to indicate movement toward desired conditions. Generally, more distant projections into the future (Decade 4 and Decade 5) show a broader range of possible vegetation conditions as uncertainty increases.

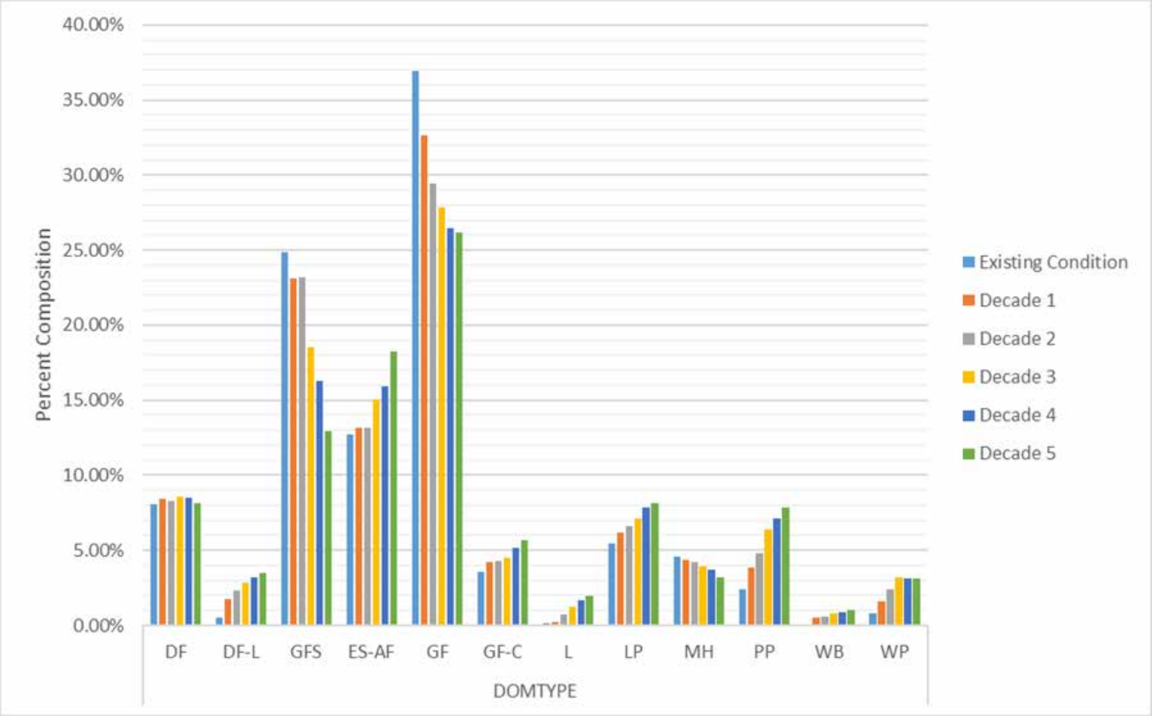

Figure 14. Projected forestwide dominance types for the Preferred Alternative

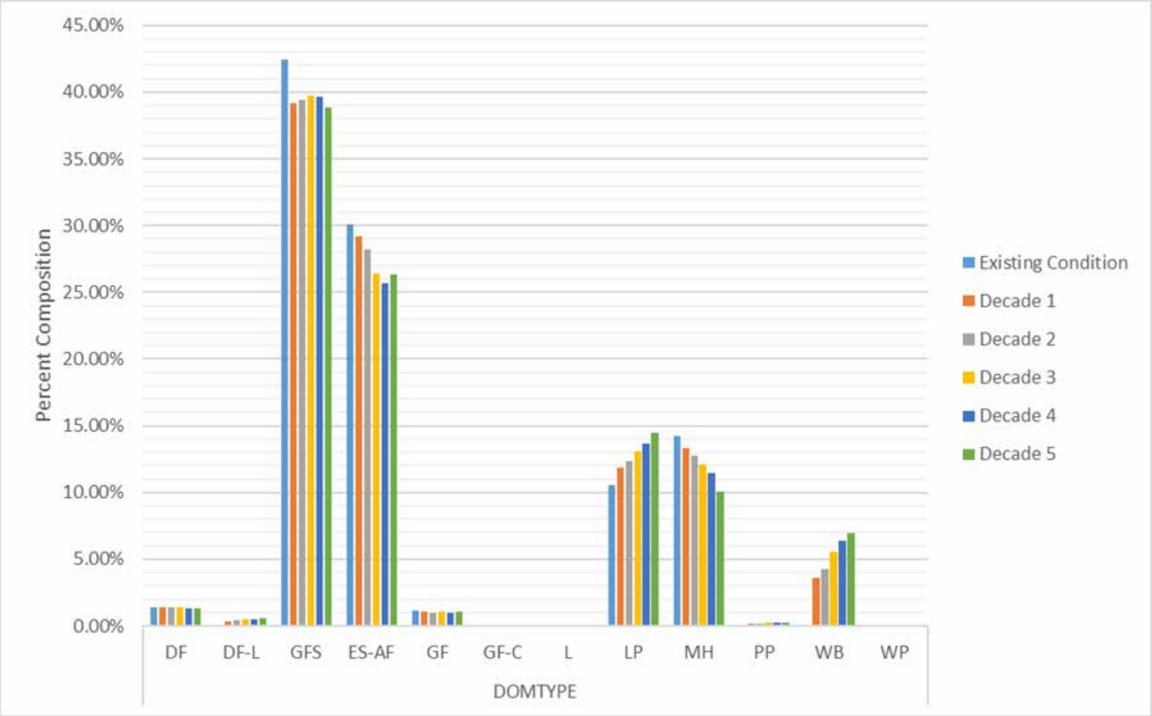

Figure 15. Projected forestwide dominance types for the Preferred Alternative for the cold potential vegetation type group

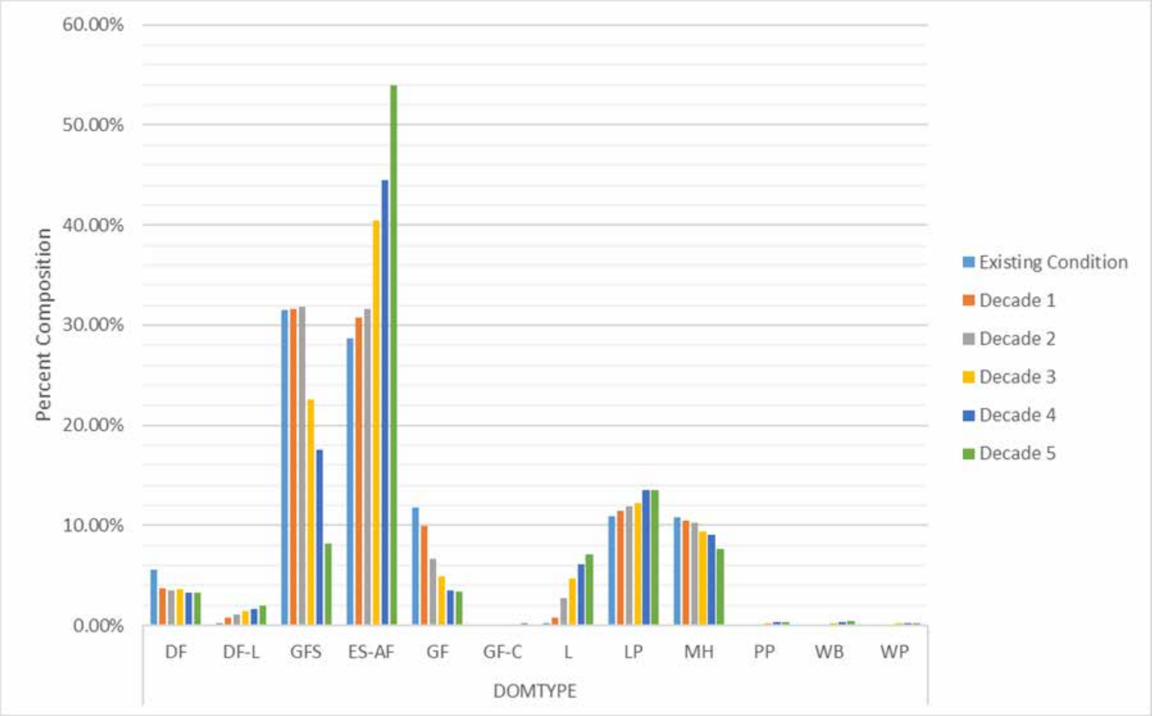

Figure 16. Projected forestwide dominance types for the Preferred Alternative for the cool moist potential vegetation type group

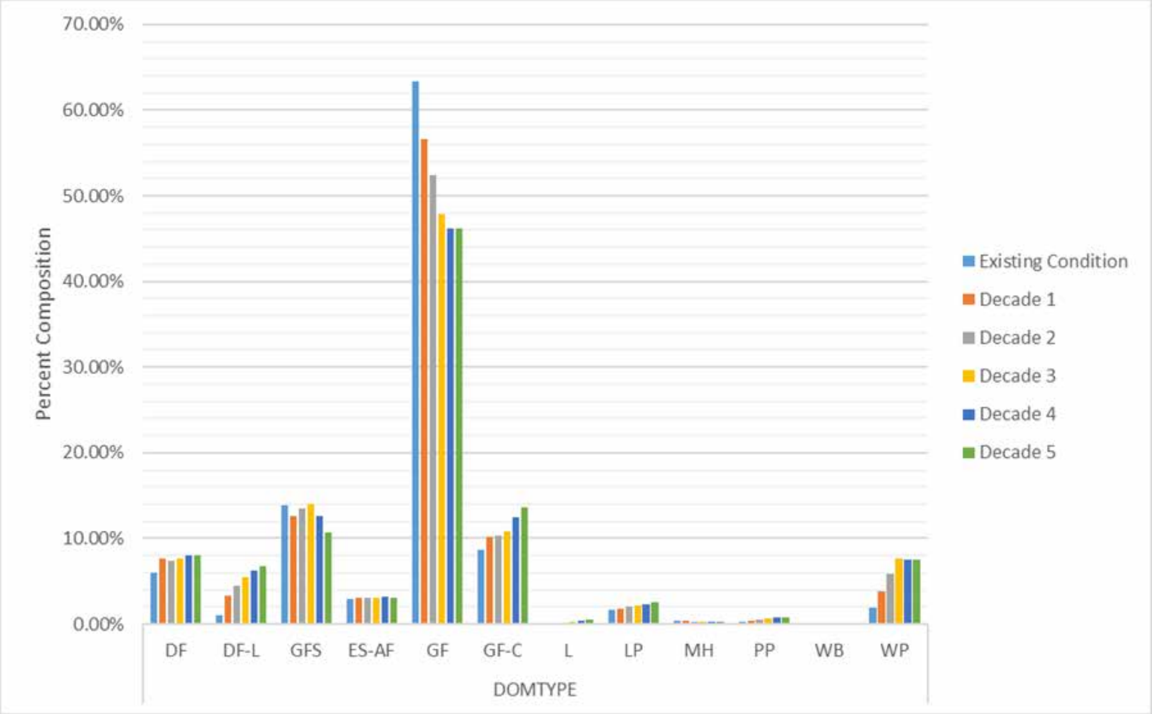

Figure 17. Projected forestwide dominance types for the Preferred Alternative for the warm moist potential vegetation type

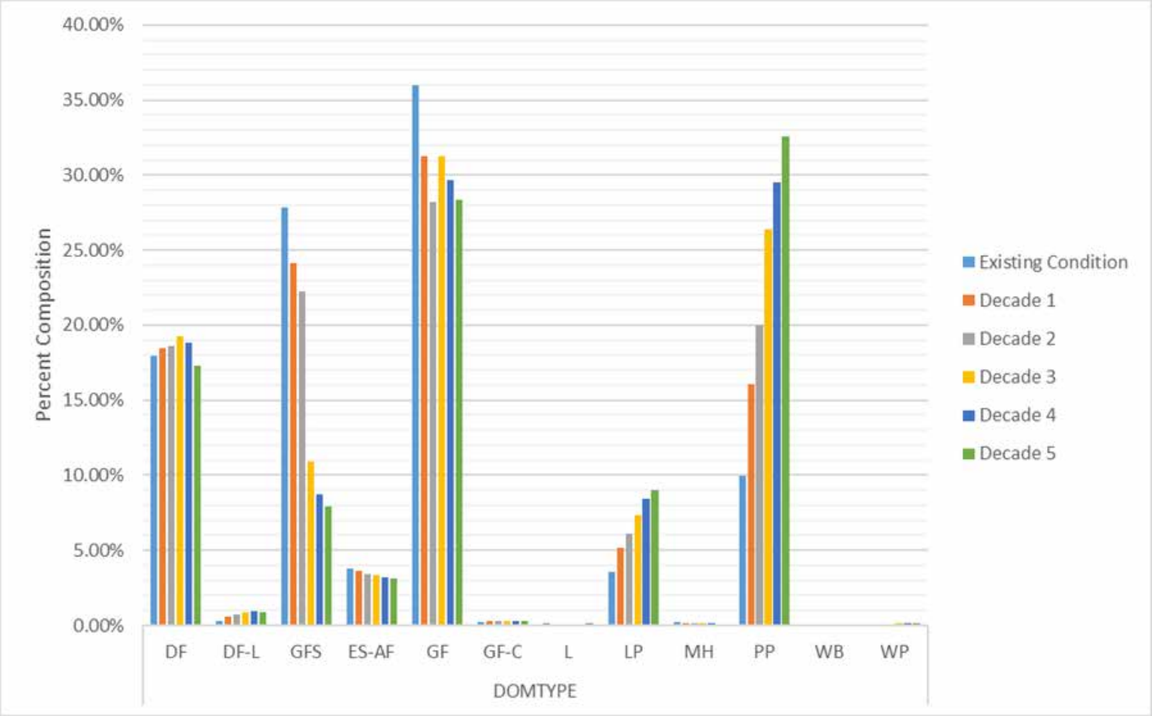

Figure 18. Projected forestwide dominance types for the Preferred Alternatives for the warm dry potential vegetation group

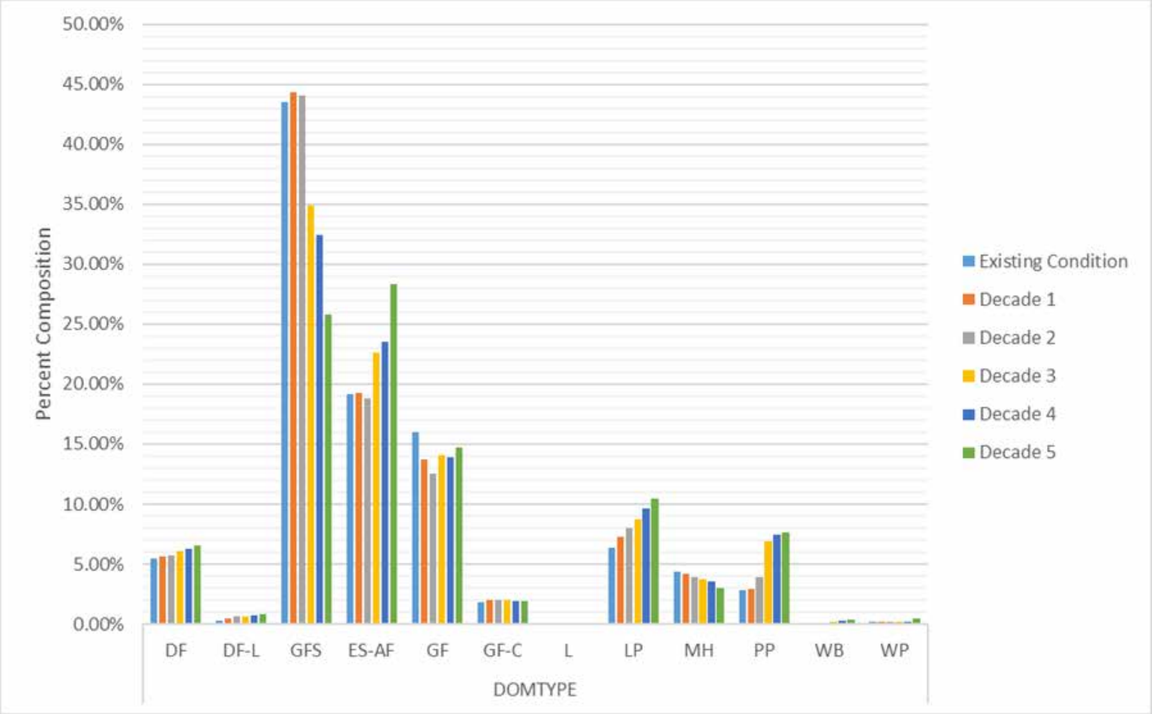

Figure 19. Projected dominance types for the Preferred Alternative for Management Area 1

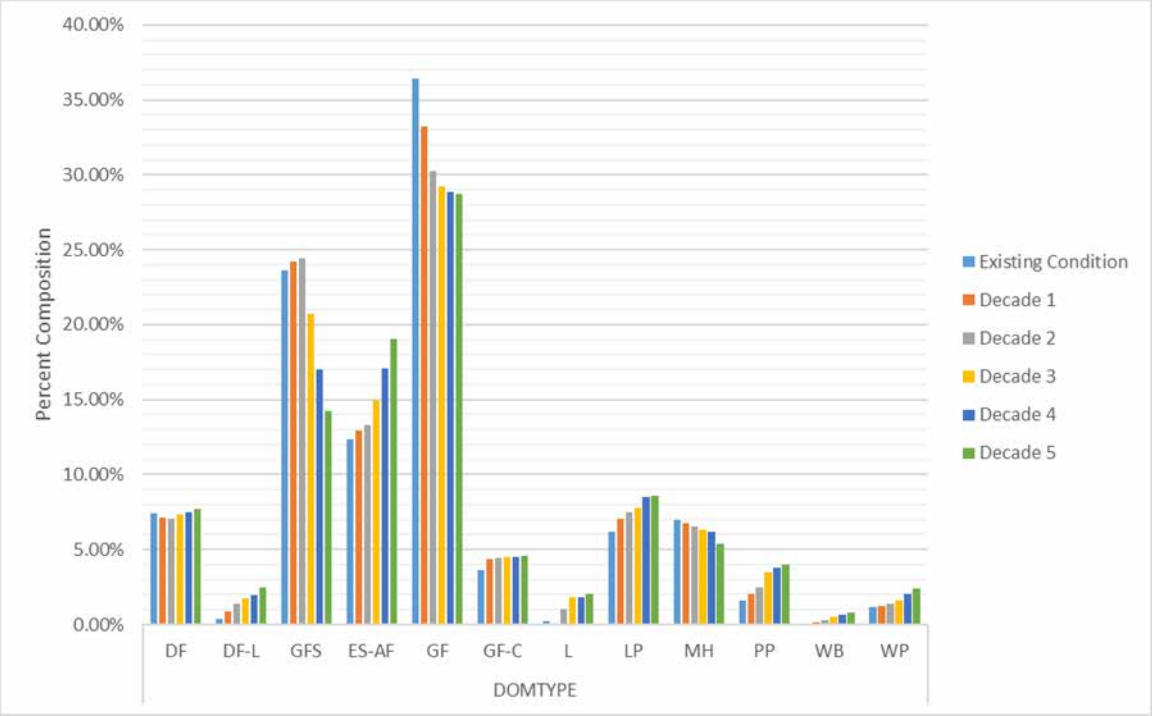

Figure 20. Projected dominance types for the Preferred Alternative for Management Area 2.

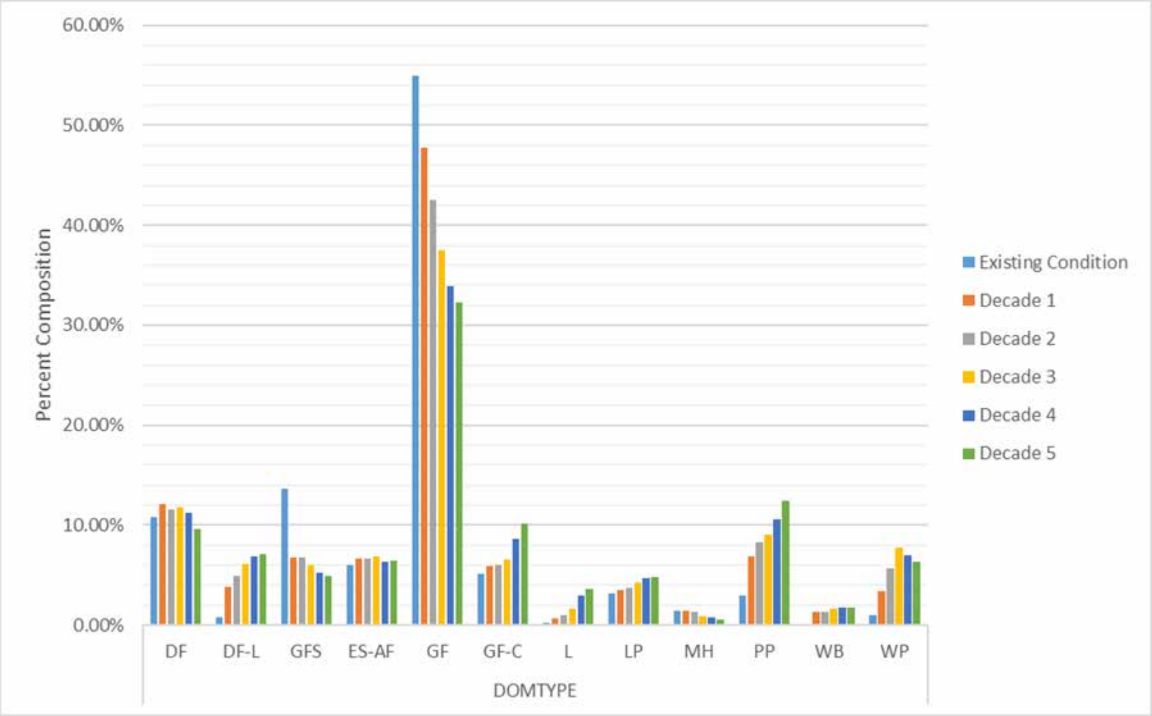

Figure 21. Projected dominance types for the Preferred Alternative for Management Area 3.

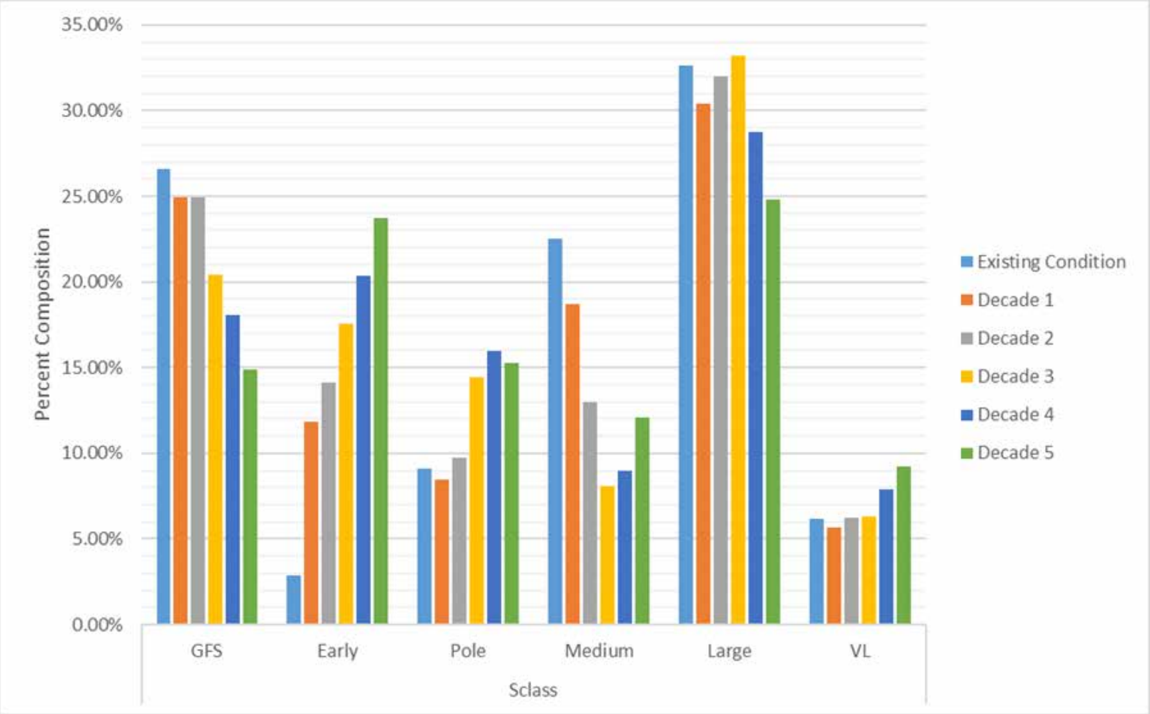

Figure 22. Projected forestwide percent size class distribution for the Preferred Alternative

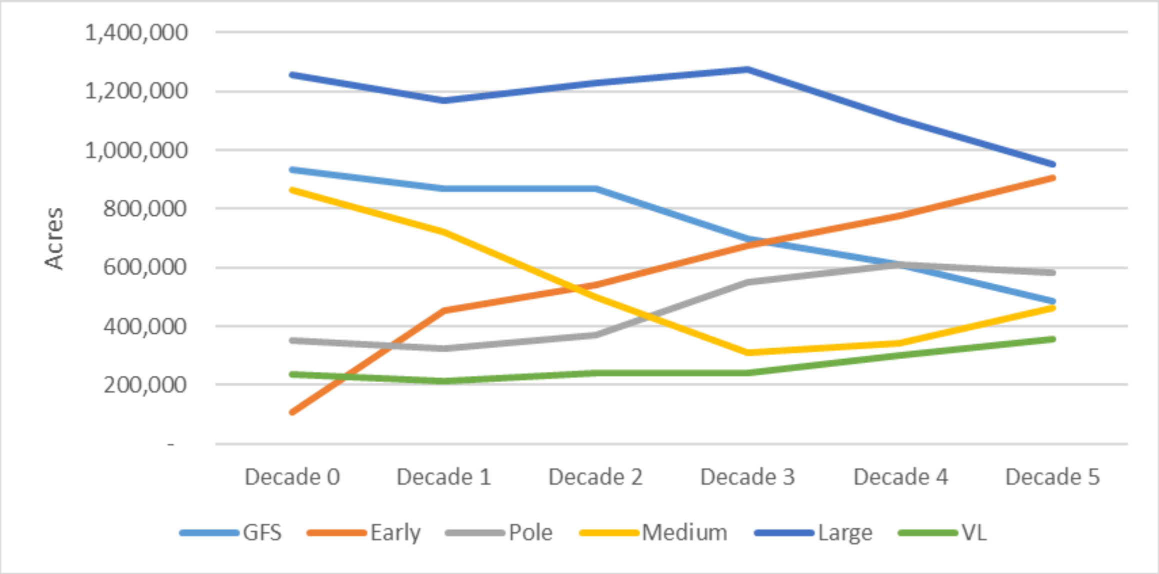

Figure 23. Projected forestwide size class distribution for the Preferred Alternative

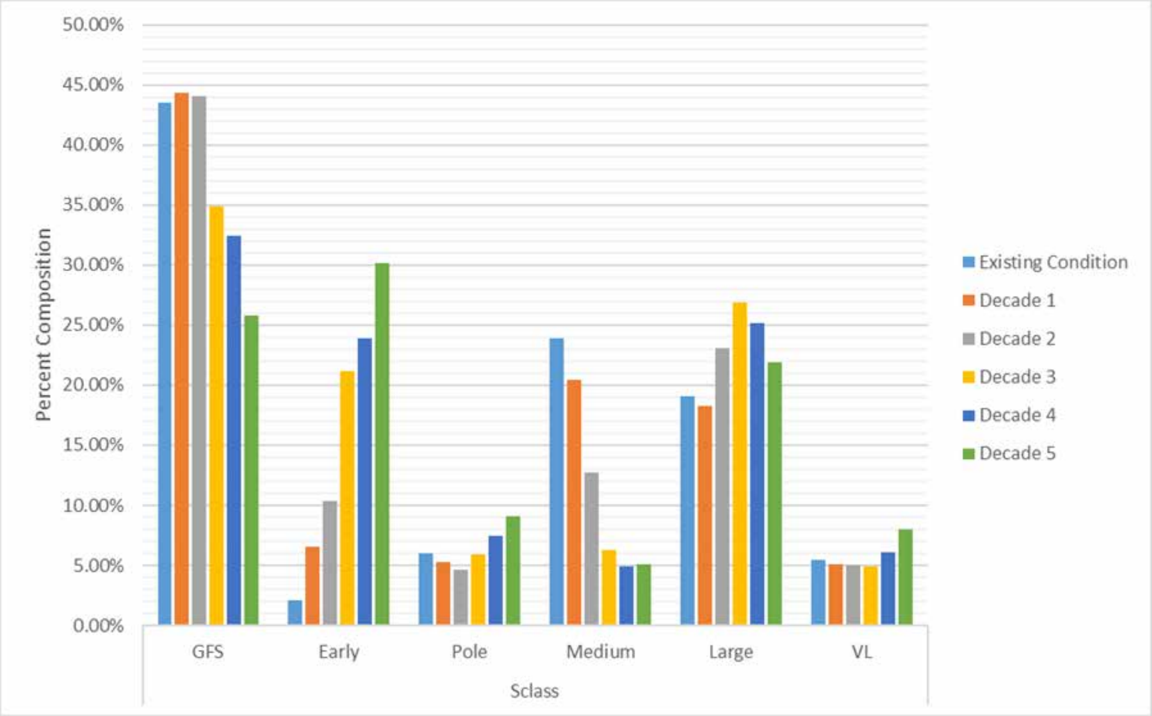

Figure 24. Projected percent size class distribution for Management Area 1

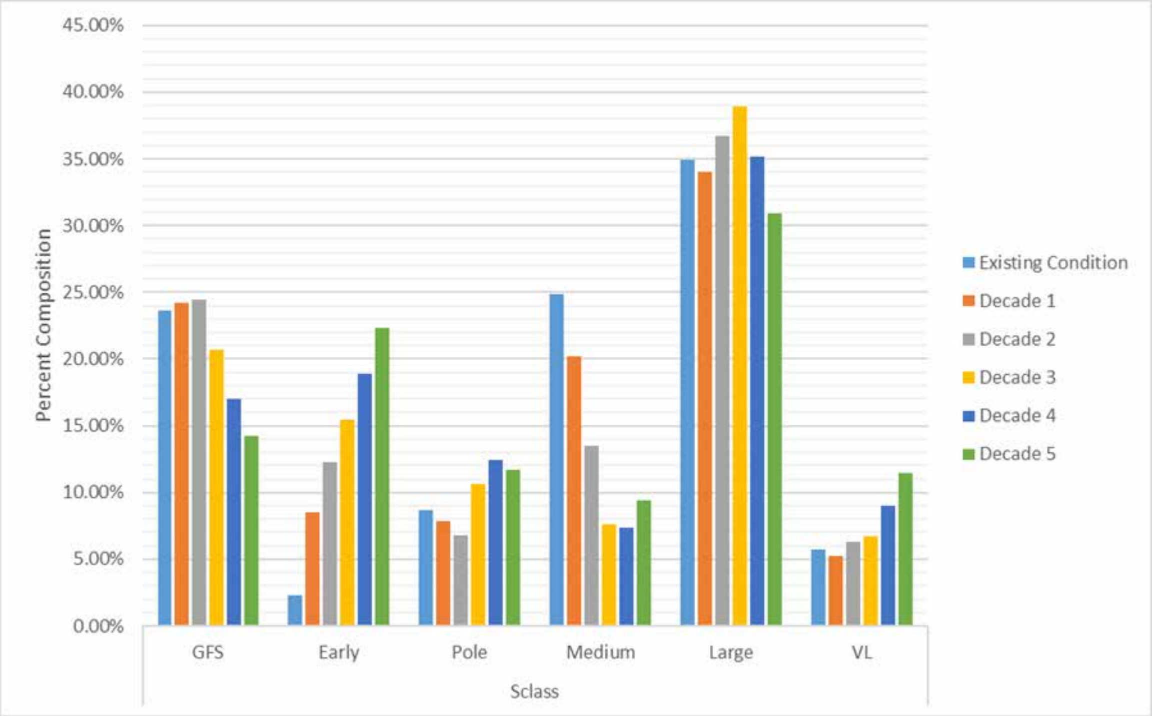

Figure 25. Projected percent size class distribution for Management Area 2

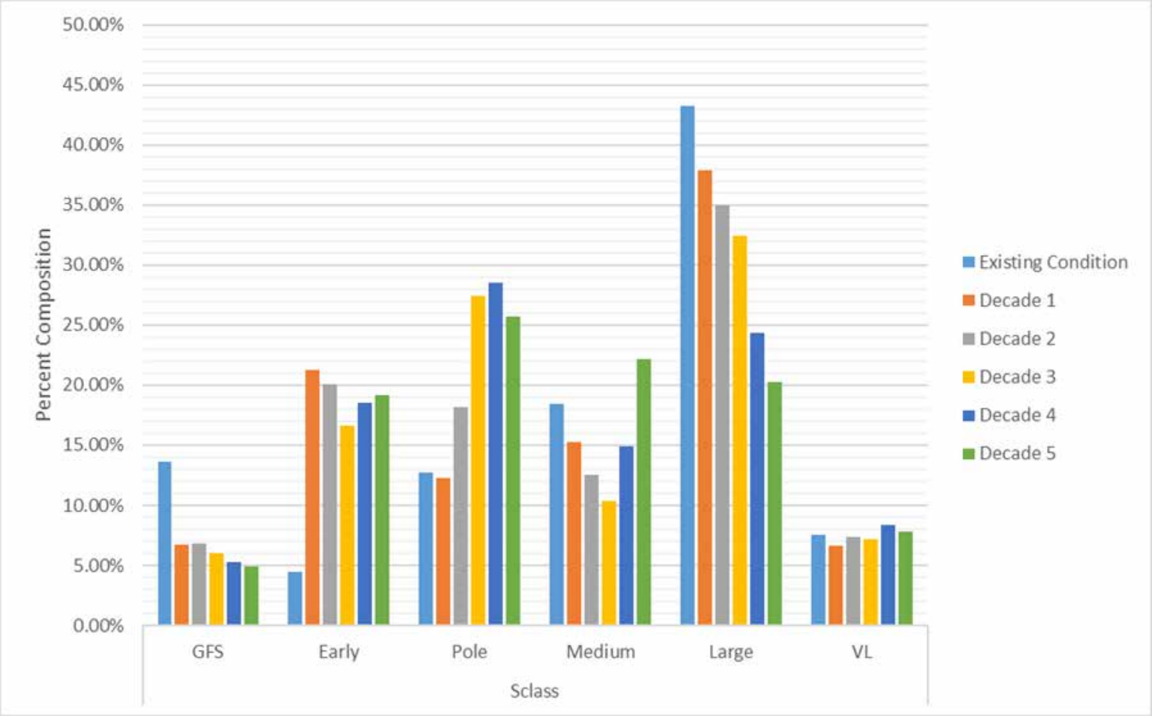

Figure 26. Projected percent size class distribution for Management Area 3

The following series of figures illustrate individual size classes for each broad potential vegetation type group compared to the natural range of variation.

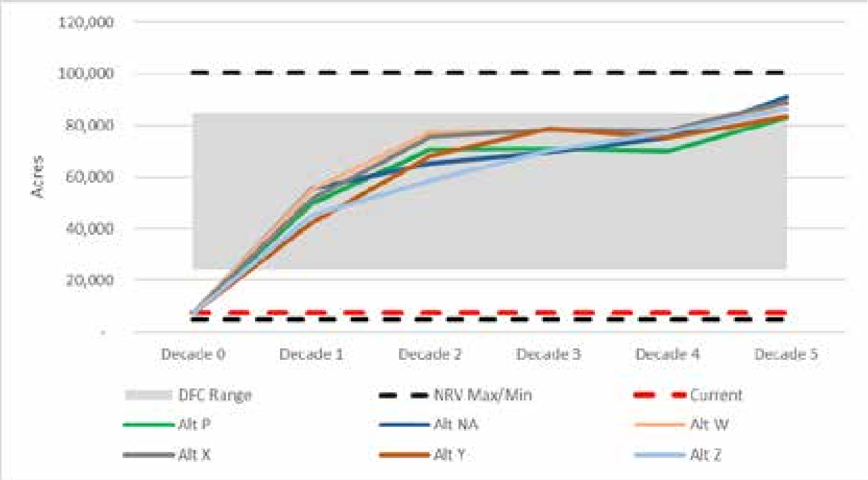

Figure 27. Projection of size classes by broad potential vegetation type (PVT) - Cold PVT—seedling or sapling size class

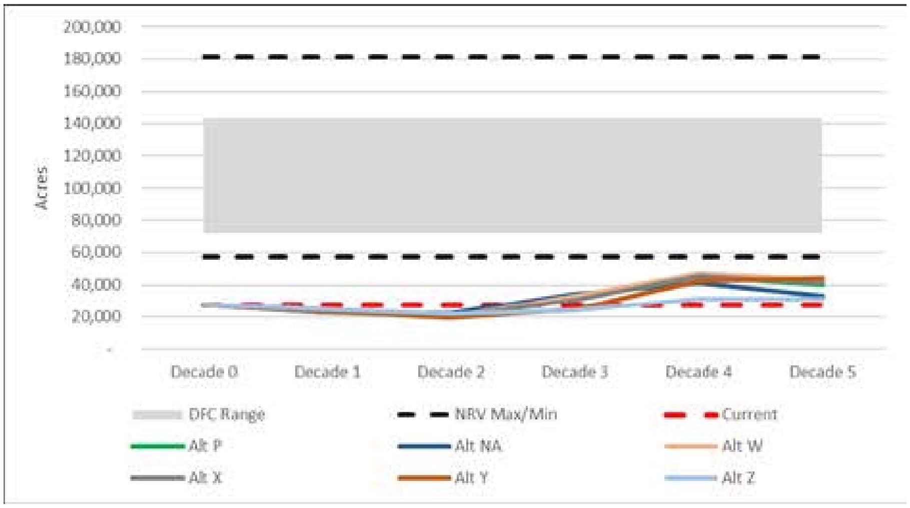

Figure 28. Projection of size classes by broad potential vegetation type (PVT) - Cold PVT—pole size class (5-to-9.9-inch DBH)

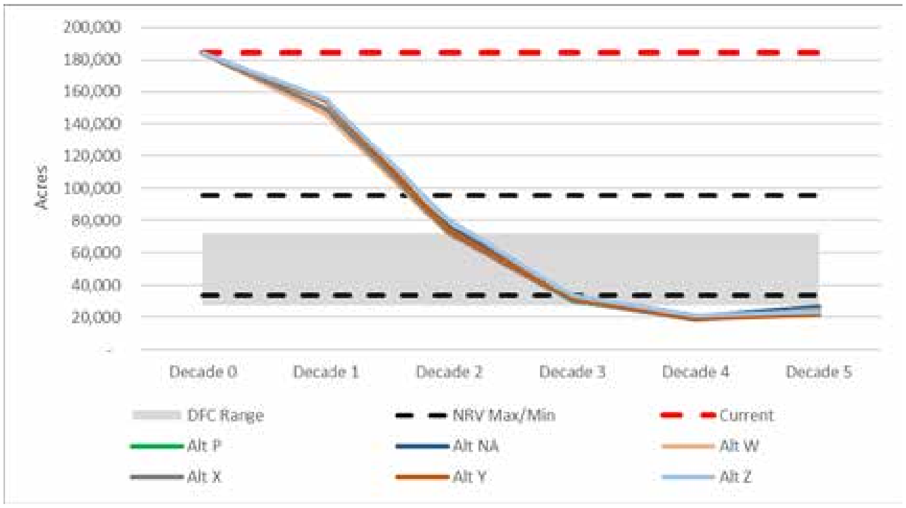

Figure 29. Projection of size classes by broad potential vegetation type (PVT) - Cold PVT—medium size class (10-to-14.9-inch DBH)

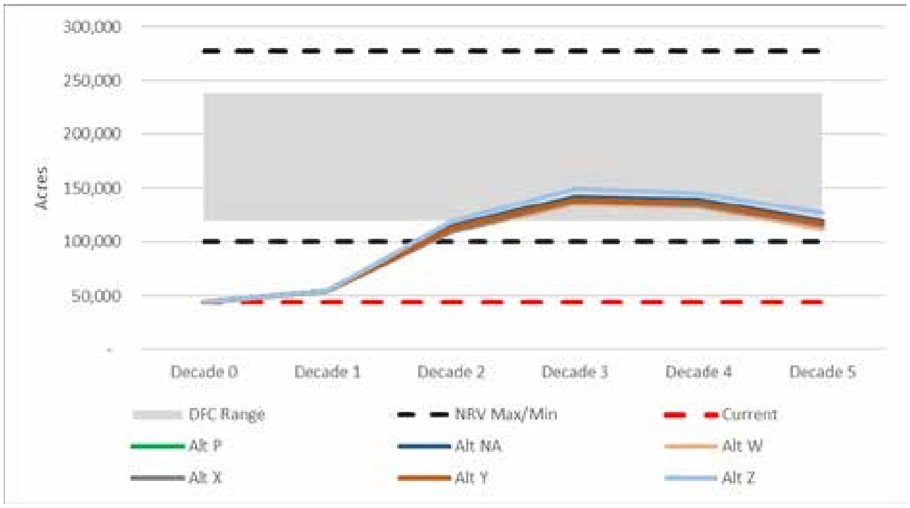

Figure 30. Projection of size classes by broad potential vegetation type (PVT) - Cold PVT—large size class (15-to-19.9-inch DBH)

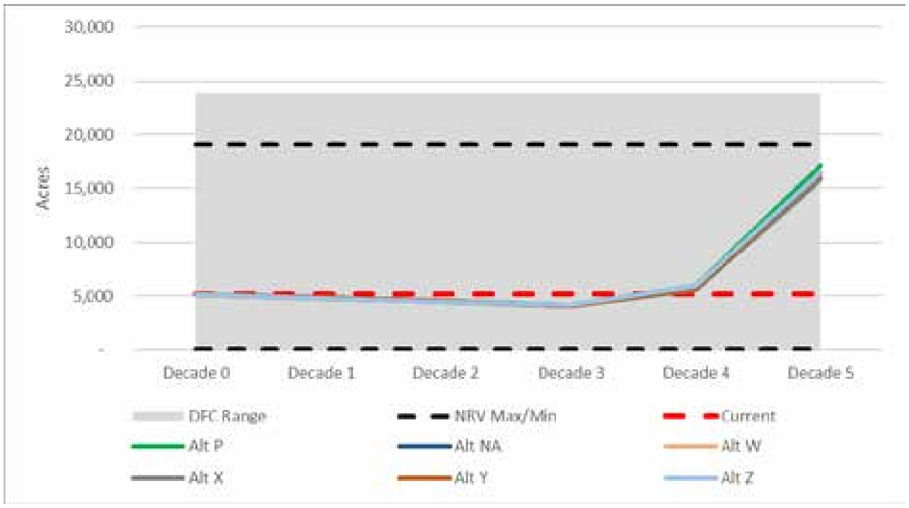

Figure 31. Projection of size classes by broad potential vegetation type (PVT) - Cold PVT—very-large size class (20+ inch DBH)

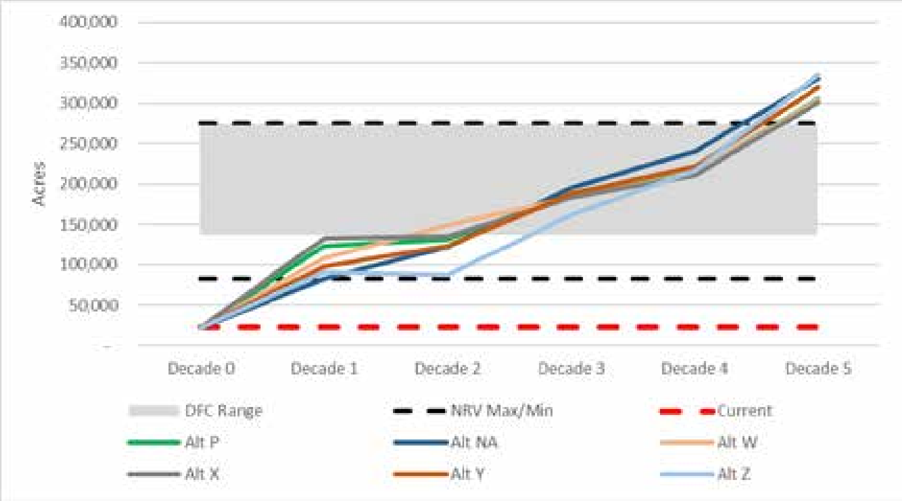

Figure 32. Projection of size classes by broad potential vegetation type (PVT) - Cool Moist PVT—seedling or sapling size class

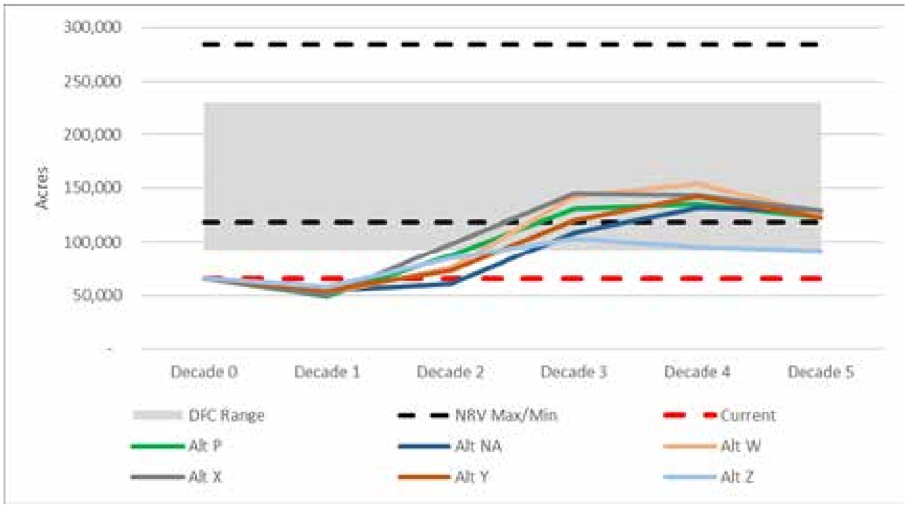

Figure 33. Projection of size classes by broad potential vegetation type (PVT) - Cool Moist PVT—pole size class (5-to-9.9-inch DBH)

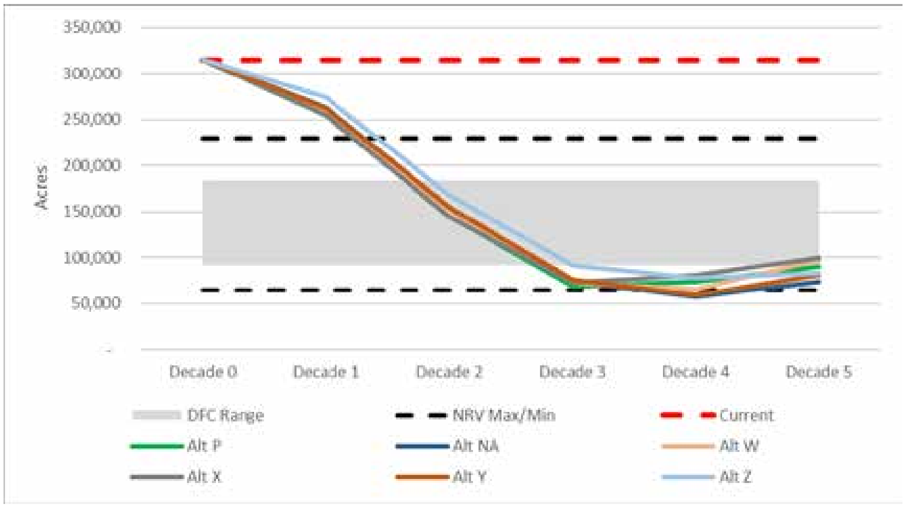

Figure 34. Projection of size classes by broad potential vegetation type (PVT) - Cool Moist PVT—medium size class (10-to-14.9-inch DBH)

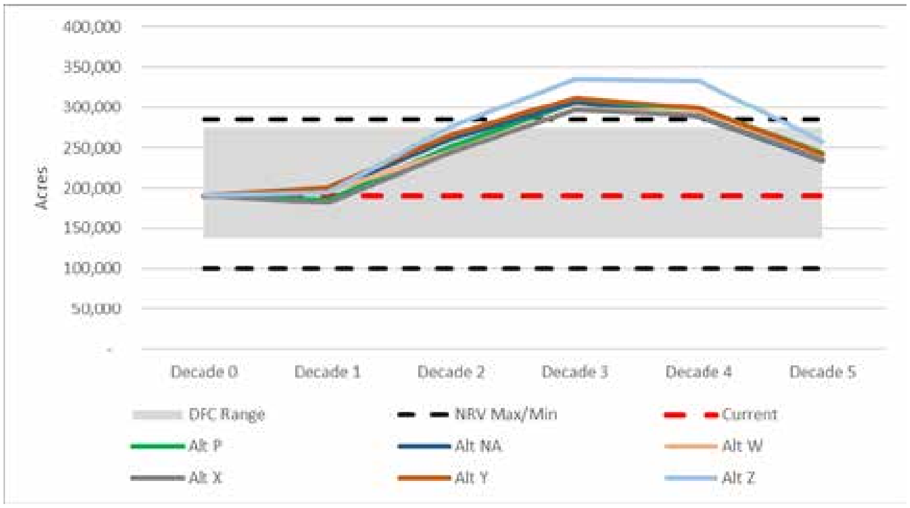

Figure 35. Projection of size classes by broad potential vegetation type (PVT) - Cool Moist PVT—large size class (15-to-19.9-inch DBH)

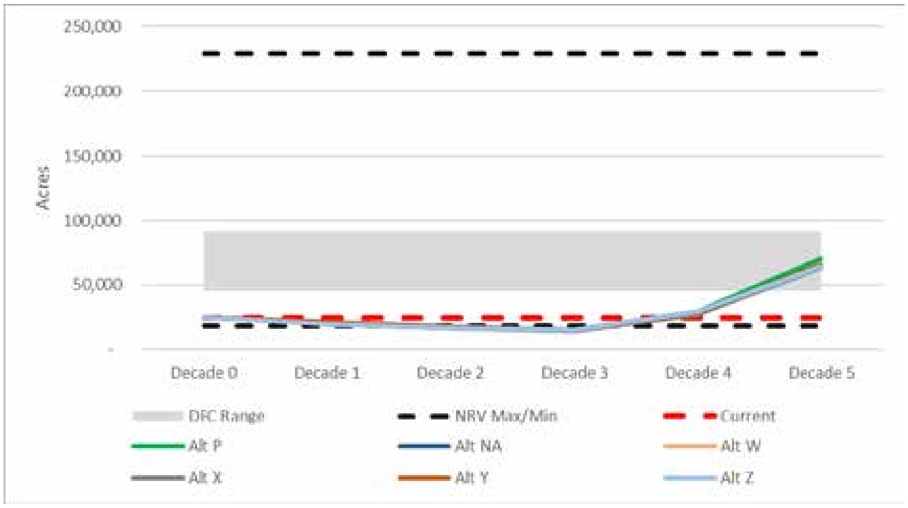

Figure 36. Projection of size classes by broad potential vegetation type (PVT) - Cool Moist PVT—very-large size class (20+ inch DBH)

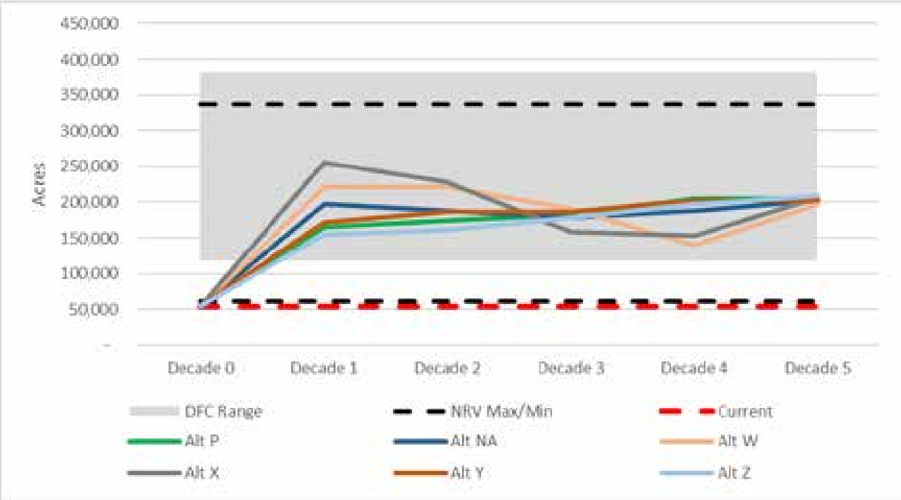

Figure 37. Projection of size classes by broad potential vegetation type (PVT) - Warm Moist PVT—seedling or sapling size class

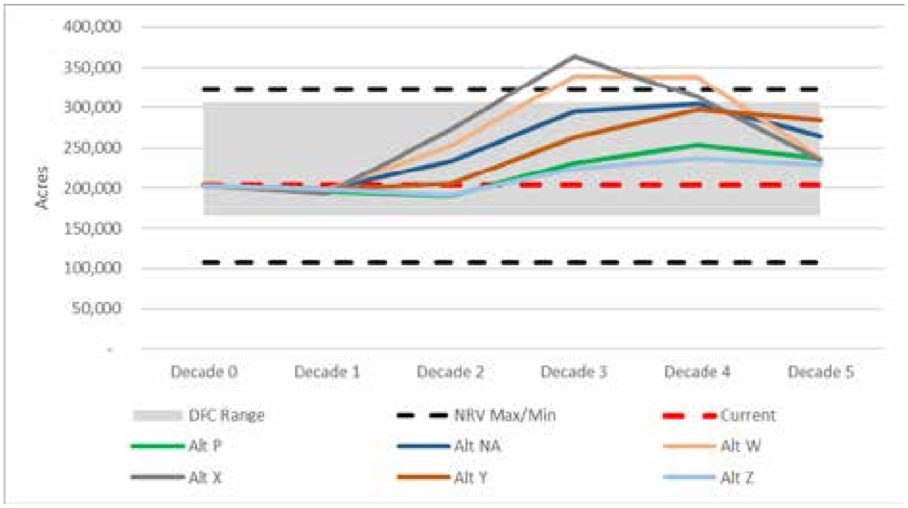

Figure 38. Projection of size classes by broad potential vegetation type (PVT) - Warm Moist PVT—pole size class (5-to-9.9-inch DBH)

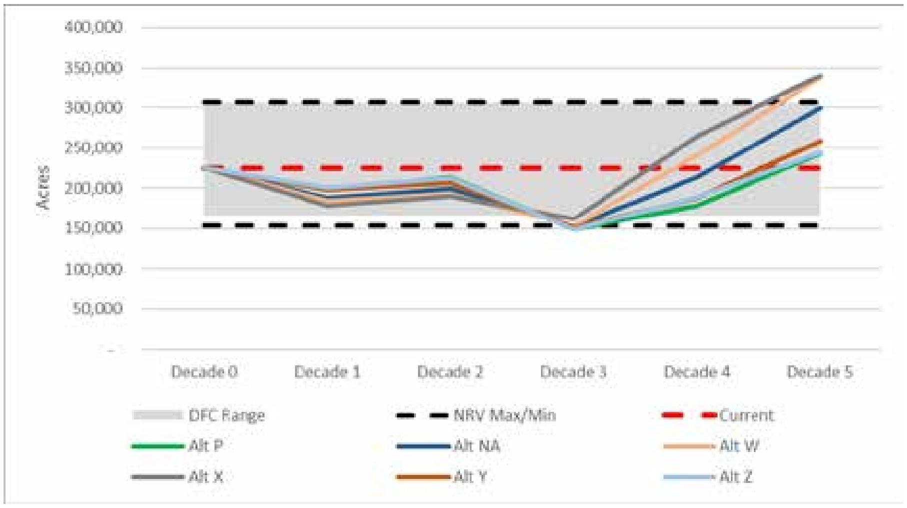

Figure 39. Projection of size classes by broad potential vegetation type (PVT) - Warm Moist PVT—medium size class (10-to-14.9-inch DBH)

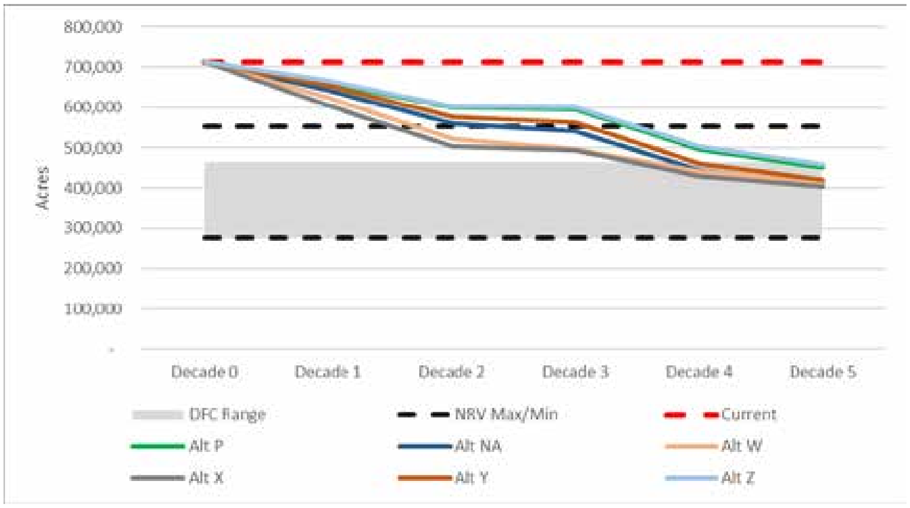

Figure 40. Projection of size classes by broad potential vegetation type (PVT) - Warm Moist PVT—large size class (15-to-19.9-inch DBH)

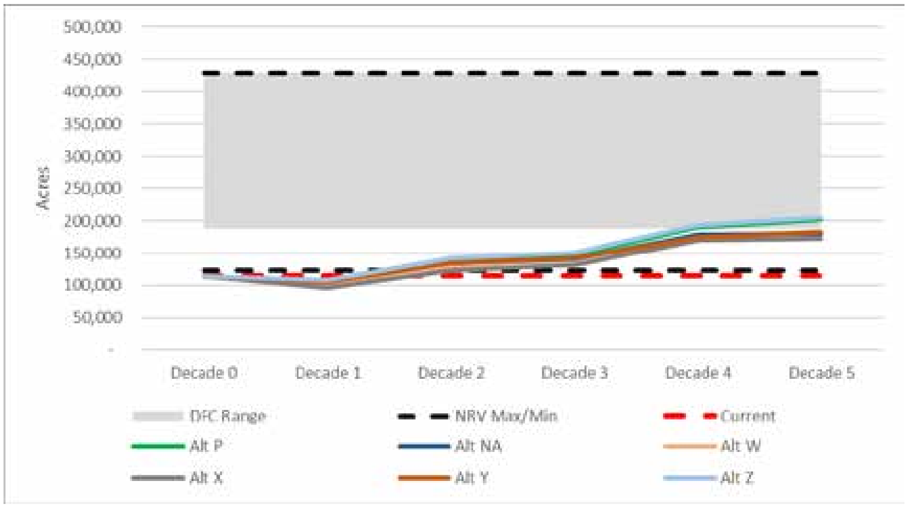

Figure 41. Projection of size classes by broad potential vegetation type (PVT) - Warm Moist PVT—very-large size class (20+ inch DBH)

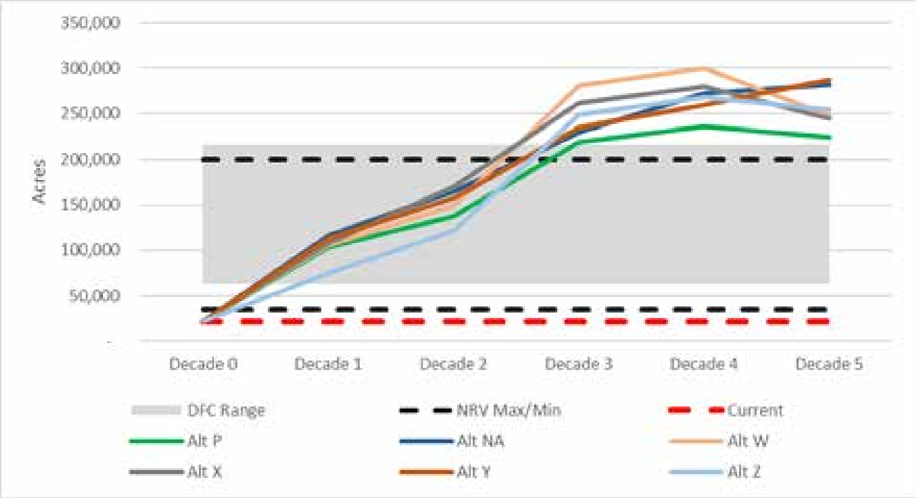

Figure 42. Projection of size classes by broad potential vegetation type (PVT) - Warm Dry PVT—seedling or sapling size class

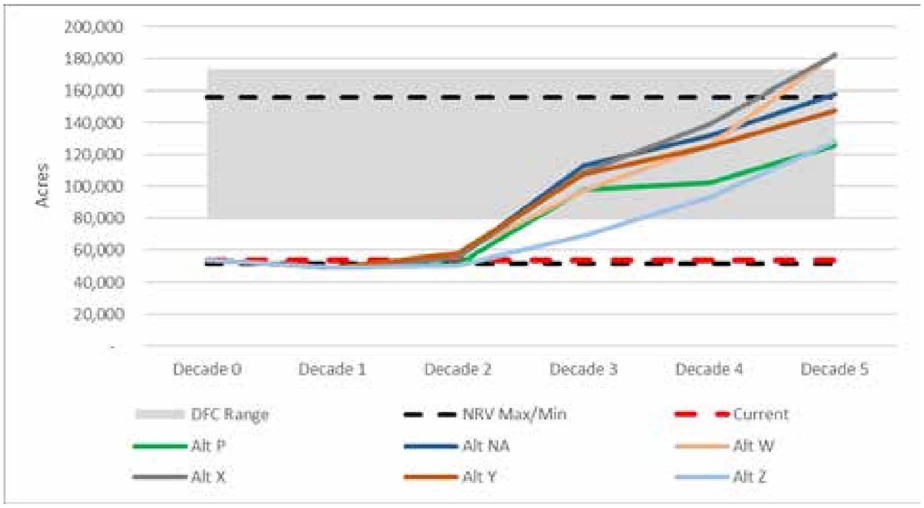

Figure 43. Projection of size classes by broad potential vegetation type (PVT) - Warm Dry PVT—pole size class (5-to-9.9-inch DBH)

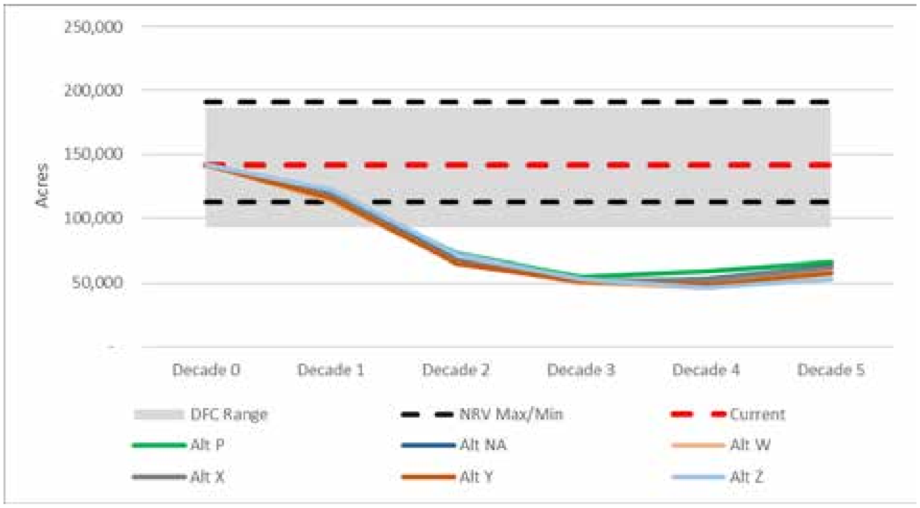

Figure 44. Projection of size classes by broad potential vegetation type (PVT) - Warm Dry PVT—medium size class (10-to-14.9-inch DBH)

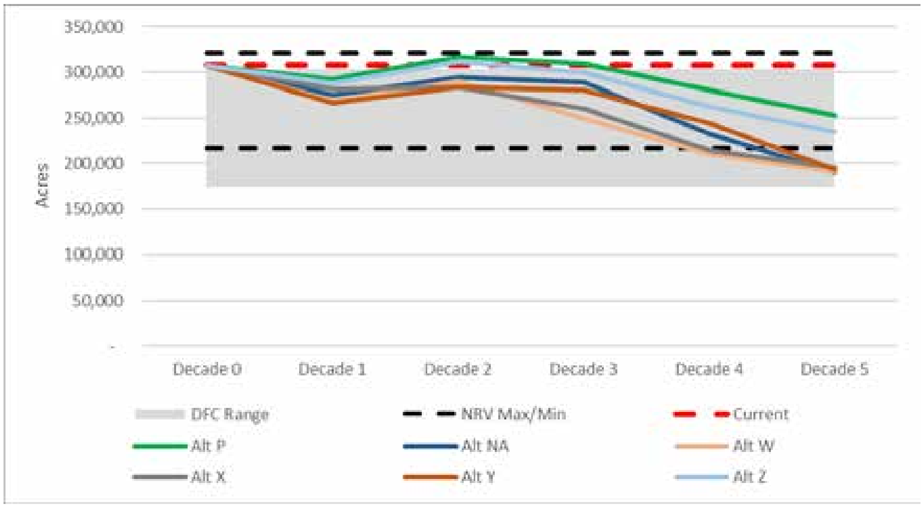

Figure 45. Projection of size classes by broad potential vegetation type (PVT) - Warm Dry PVT—large size class (15-to-19.9-inch DBH)

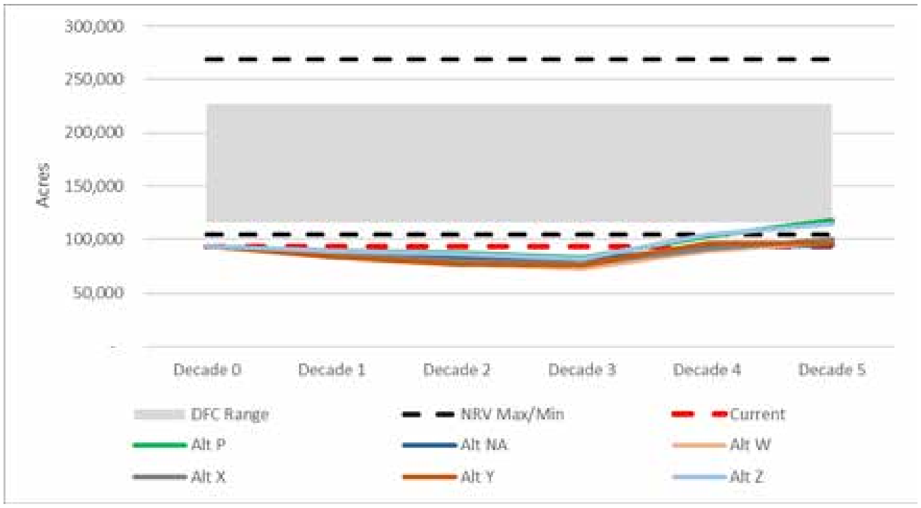

Figure 46. Projection of size classes by broad potential vegetation type (PVT) Warm Dry PVT—very-large size class (20+ inch DBH)

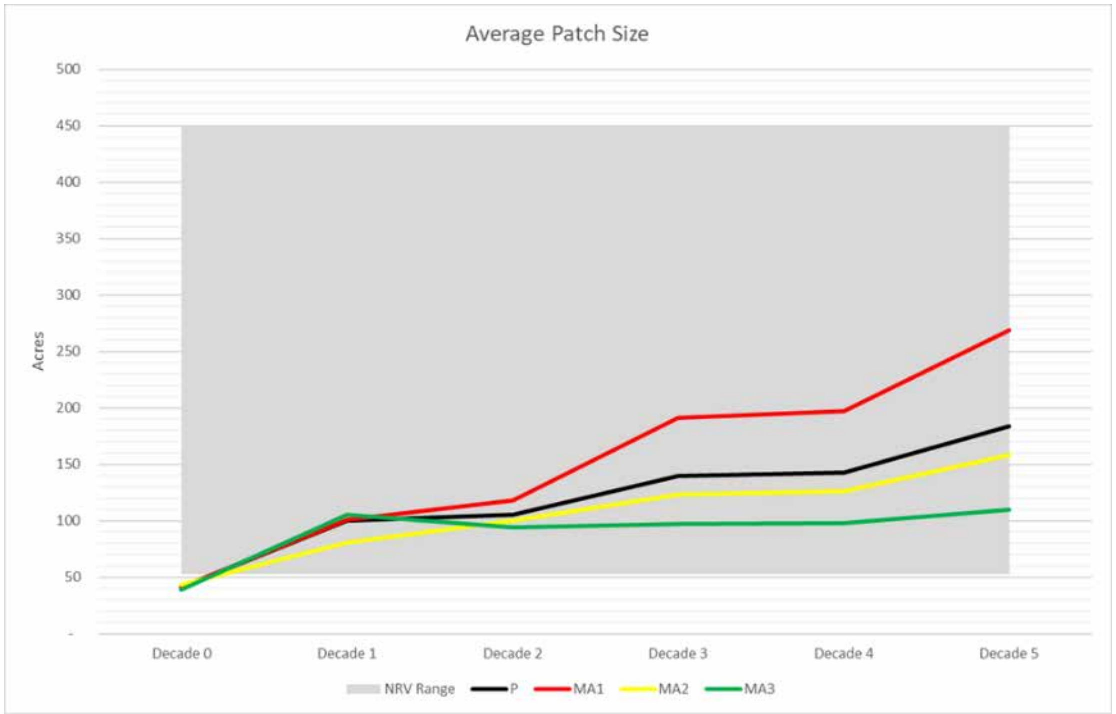

Figure 47. Projected forestwide average patch size for the Preferred Alternative compared to the average patch size for each management area

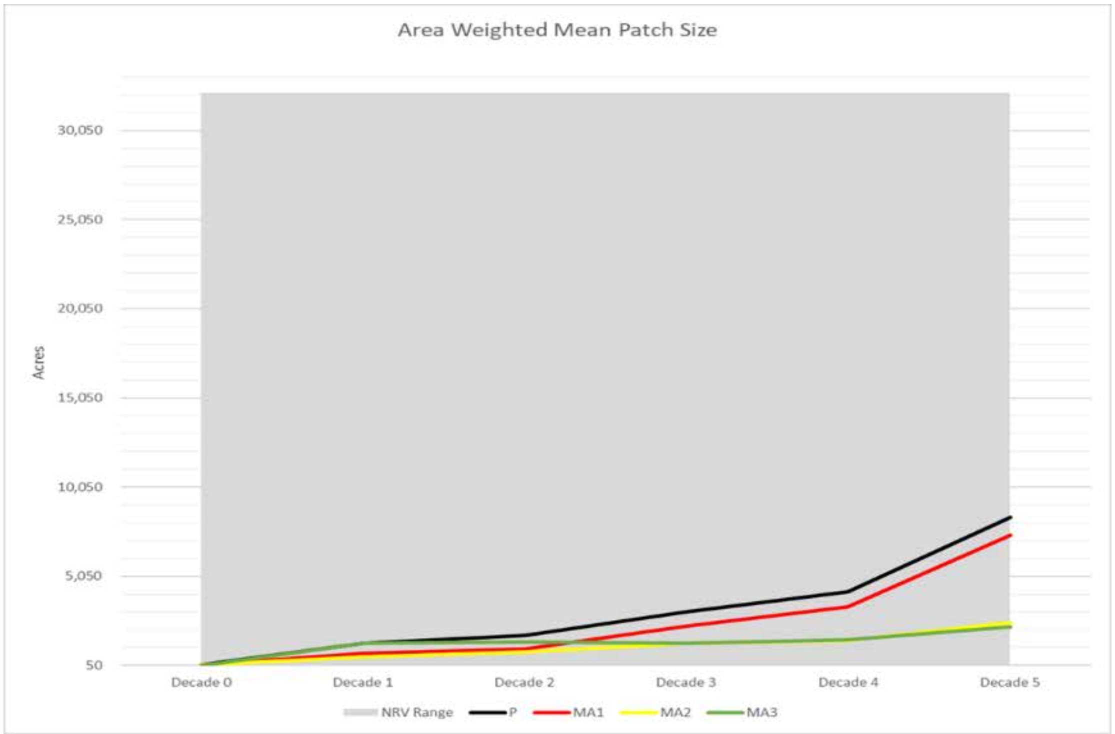

Figure 48. Projected forestwide area weighted mean patch size for the Preferred Alternative compared to the average patch size for each management area

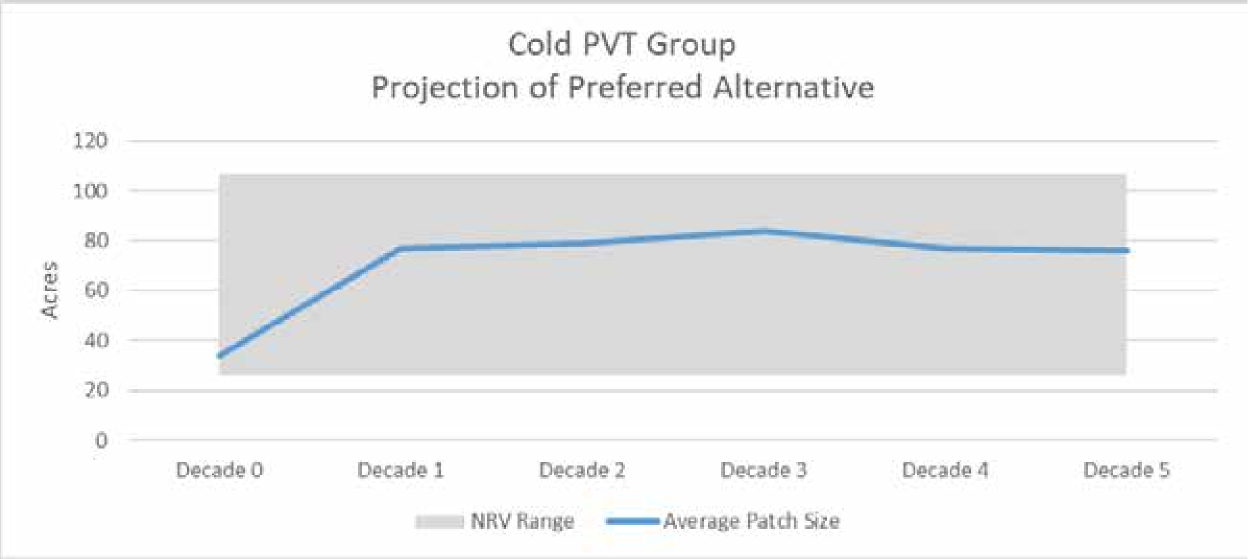

Figure 49. Projected average patch size for the cold potential vegetation type (PVT) group

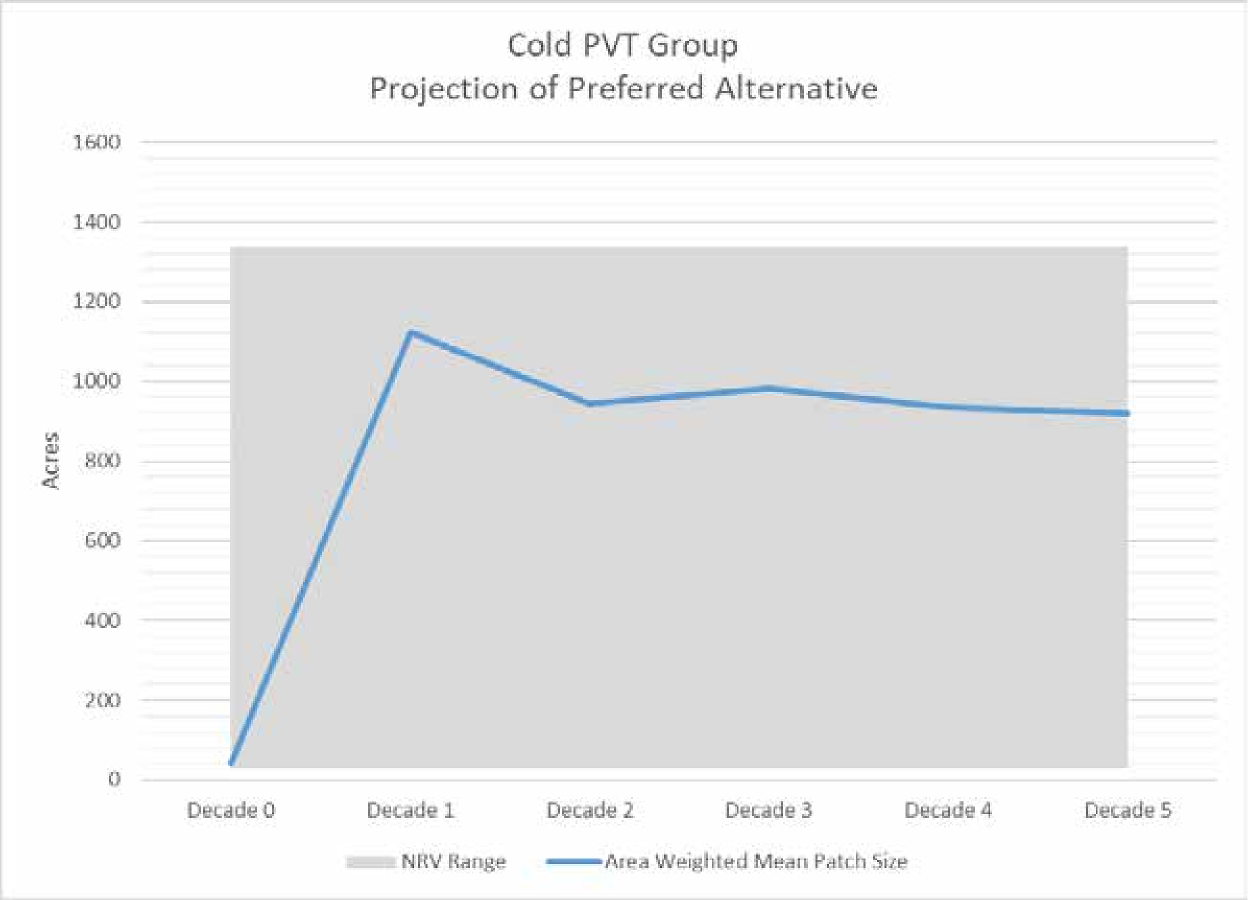

Figure 50. Projected area weighted mean patch size for the cold potential vegetation type (PVT) group

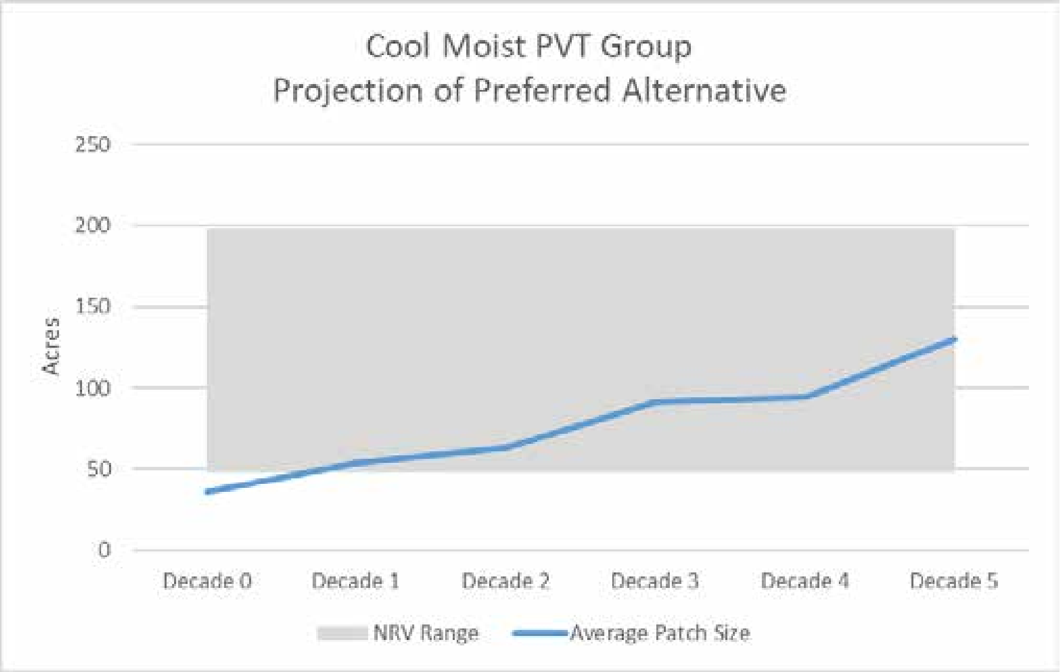

Figure 51. Projected average patch size for the cool moist potential vegetation type (PVT) group

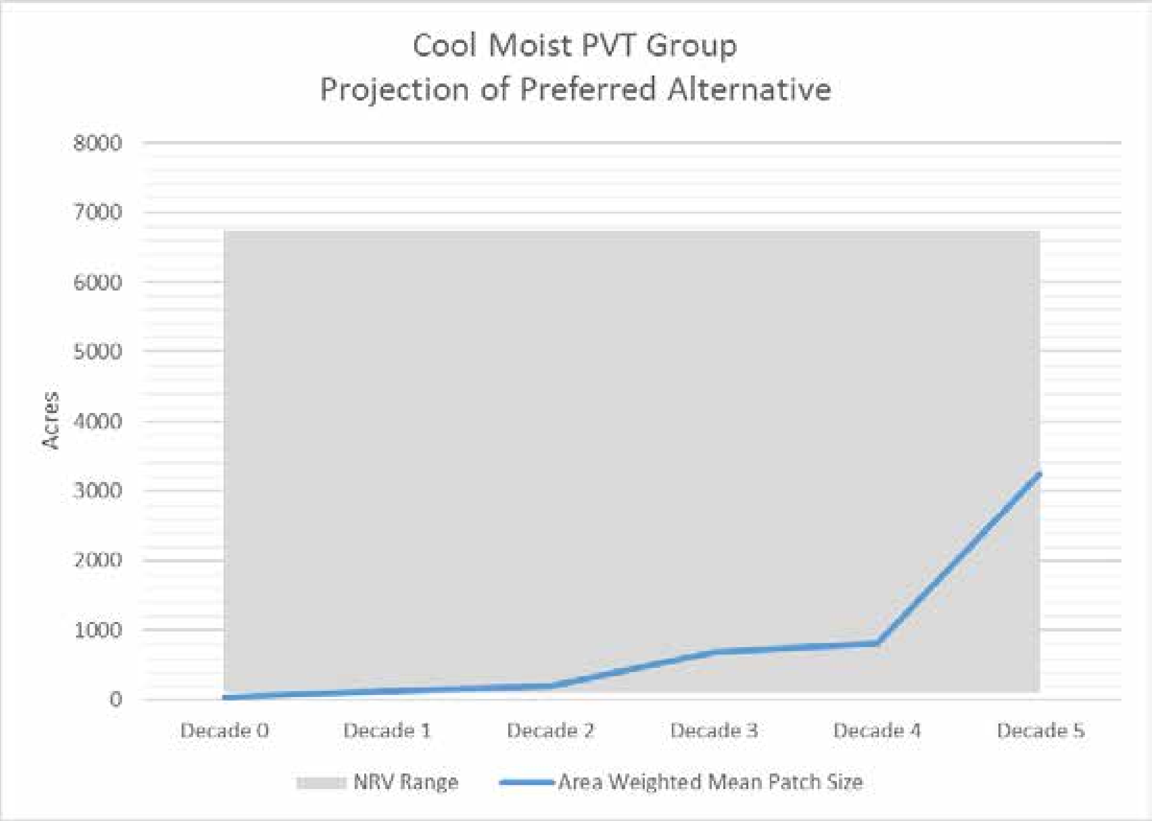

Figure 52. Projected area weighted mean patch size for the cool moist potential vegetation type (PVT) group

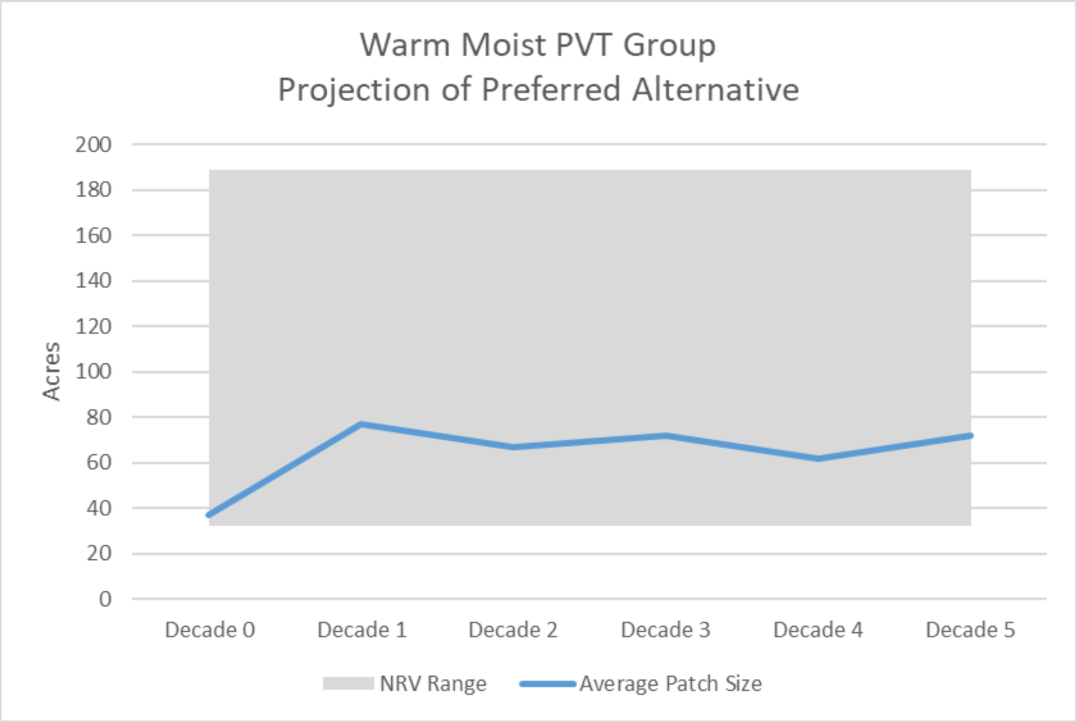

Figure 53. Projected average patch size for the warm moist potential vegetation type (PVT) group

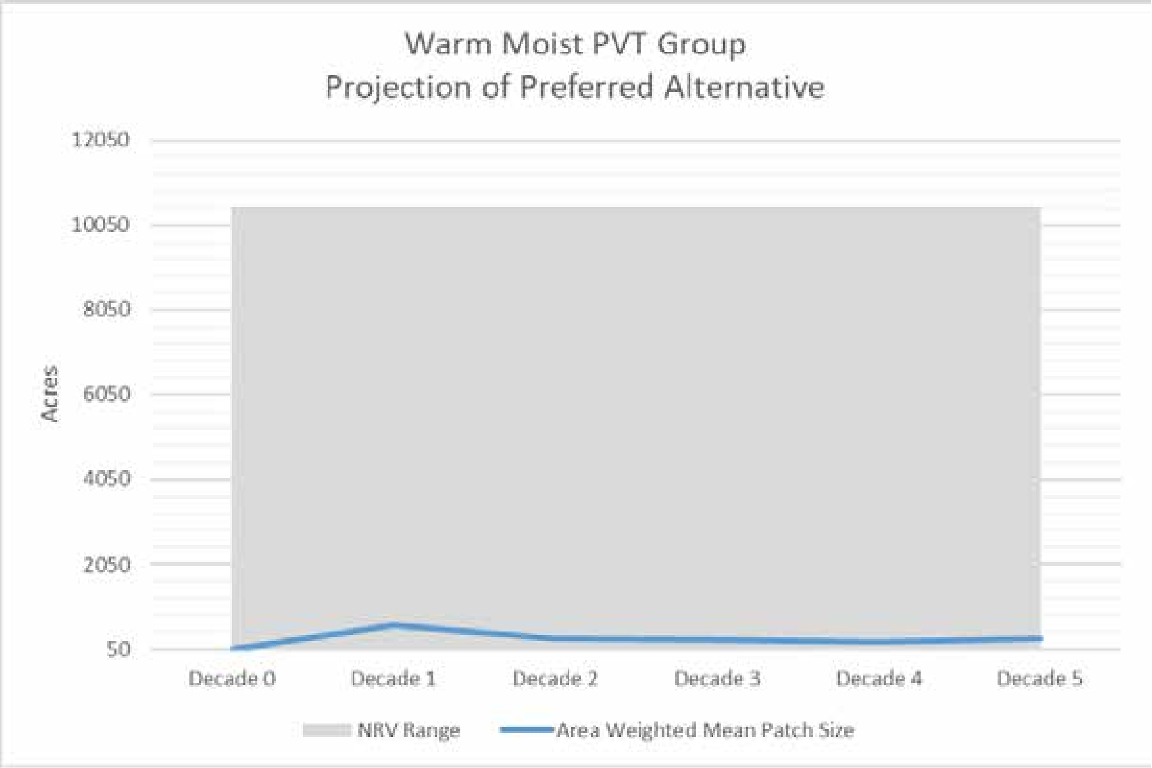

Figure 54. Projected area weighted mean patch size for the warm moist potential vegetation type (PVT) group

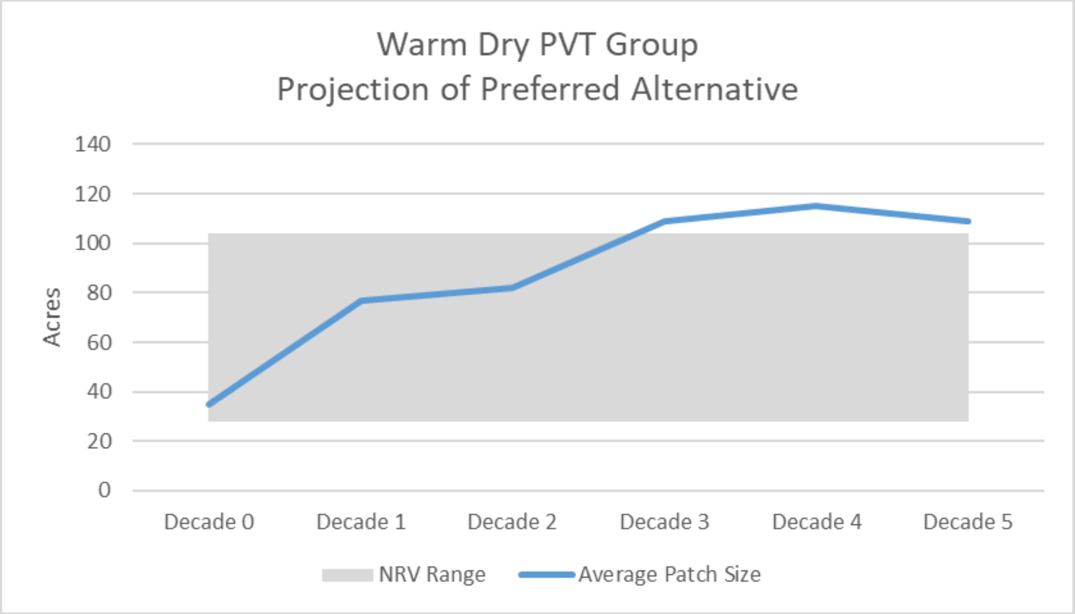

Figure 55. Projected average patch size for the warm dry potential vegetation type (PVT) group

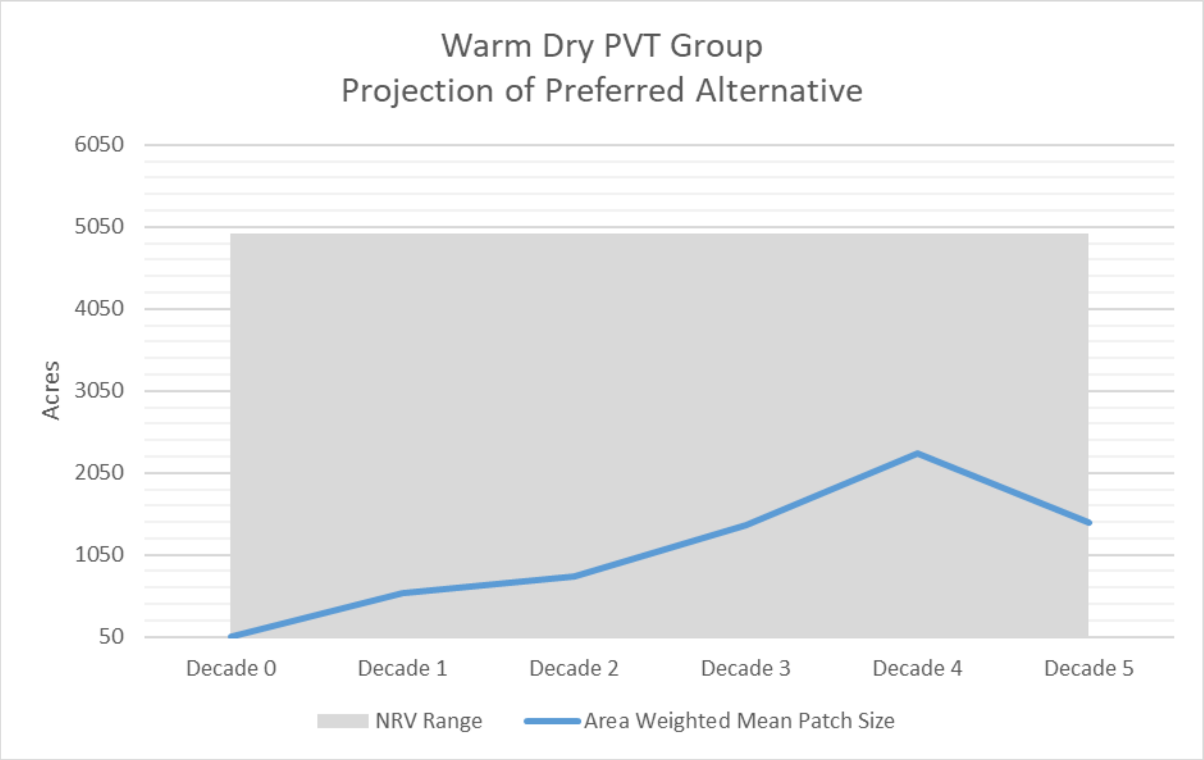

Figure 56. Projected area weighted mean patch size for the warm dry potential vegetation type (PVT) group

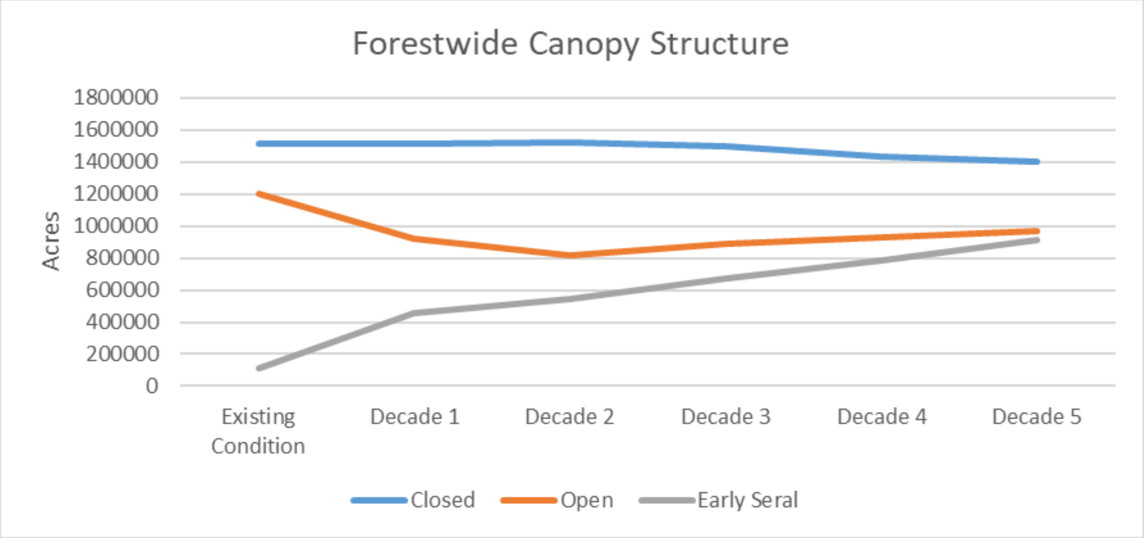

Figure 57. Projected forestwide canopy structure

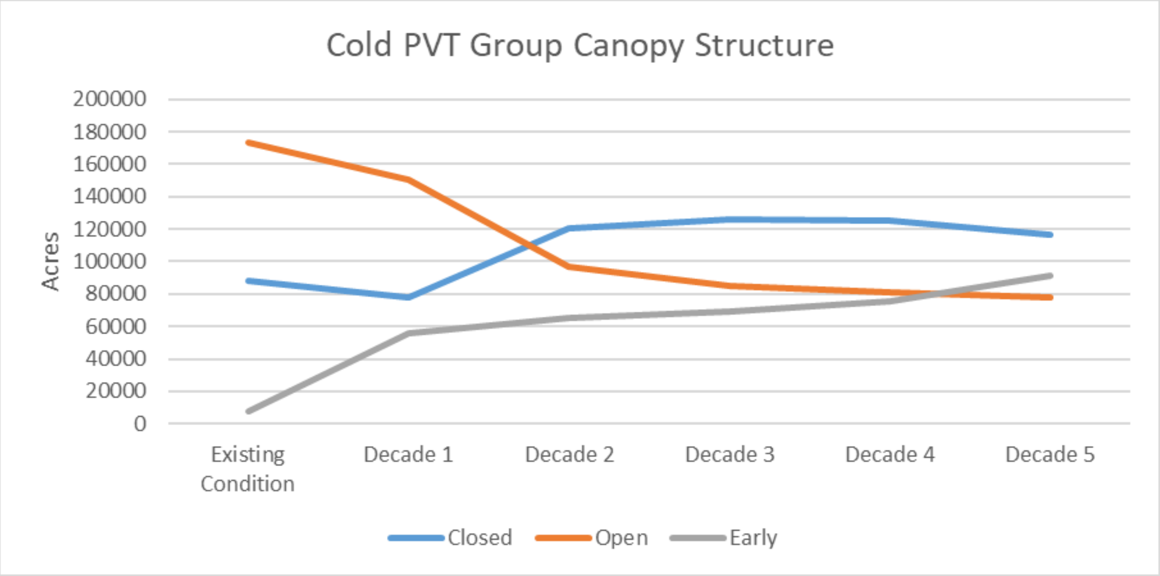

Figure 58. Projected canopy structure for the cold potential vegetation type (PVT) group

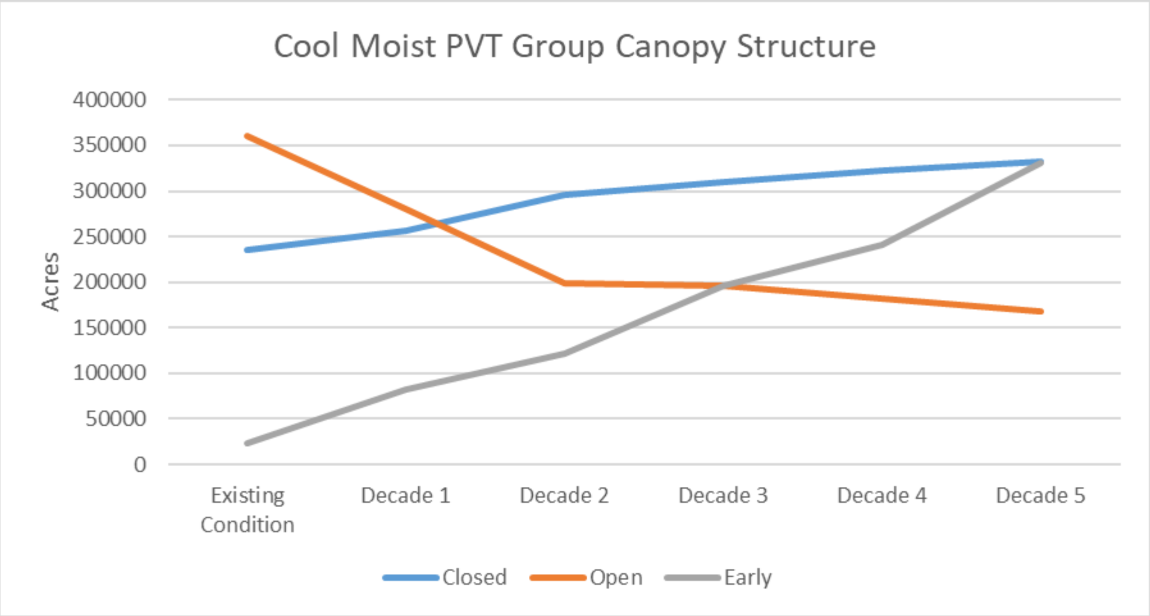

Figure 59. Projected canopy structure for the cool moist potential vegetation type (PVT) group

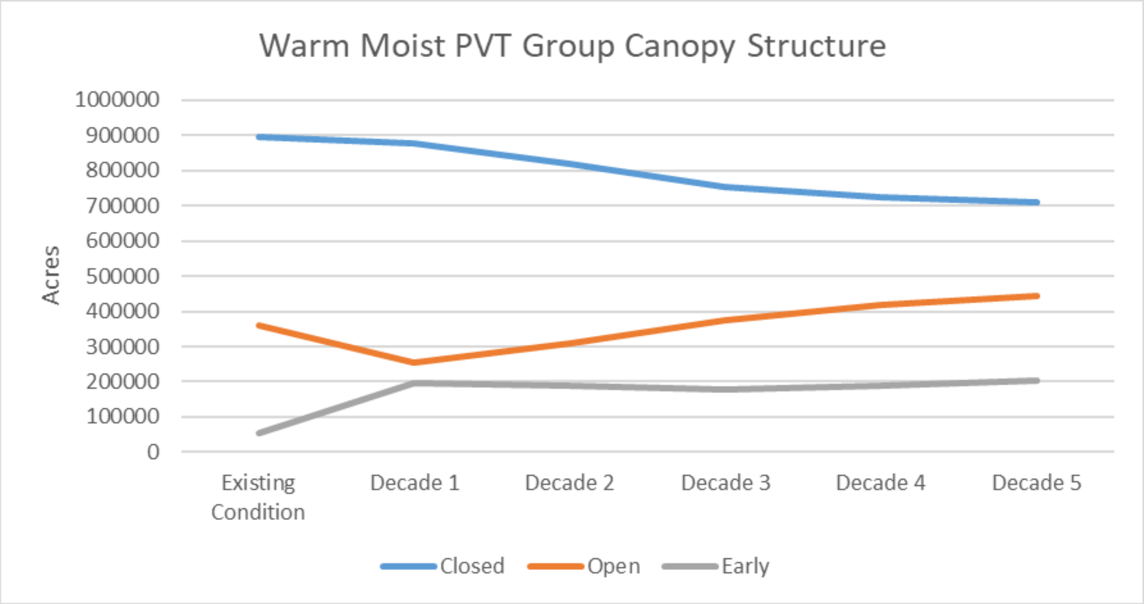

Figure 60. Projected canopy structure for the warm moist potential vegetation type (PVT) group

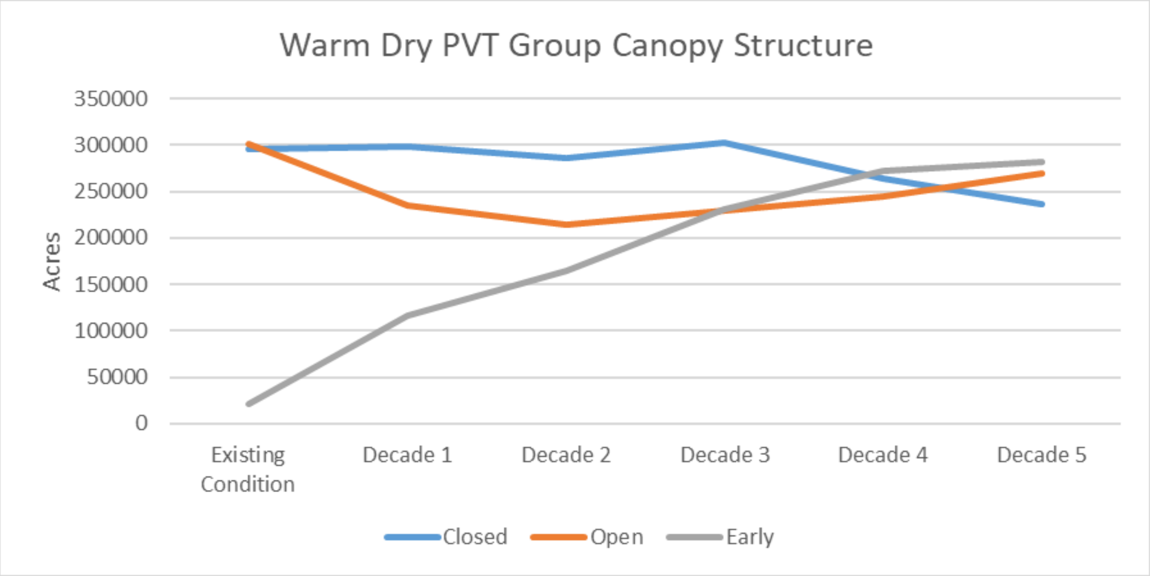

Figure 61. Projected canopy structure for the warm dry potential vegetation type (PVT) group

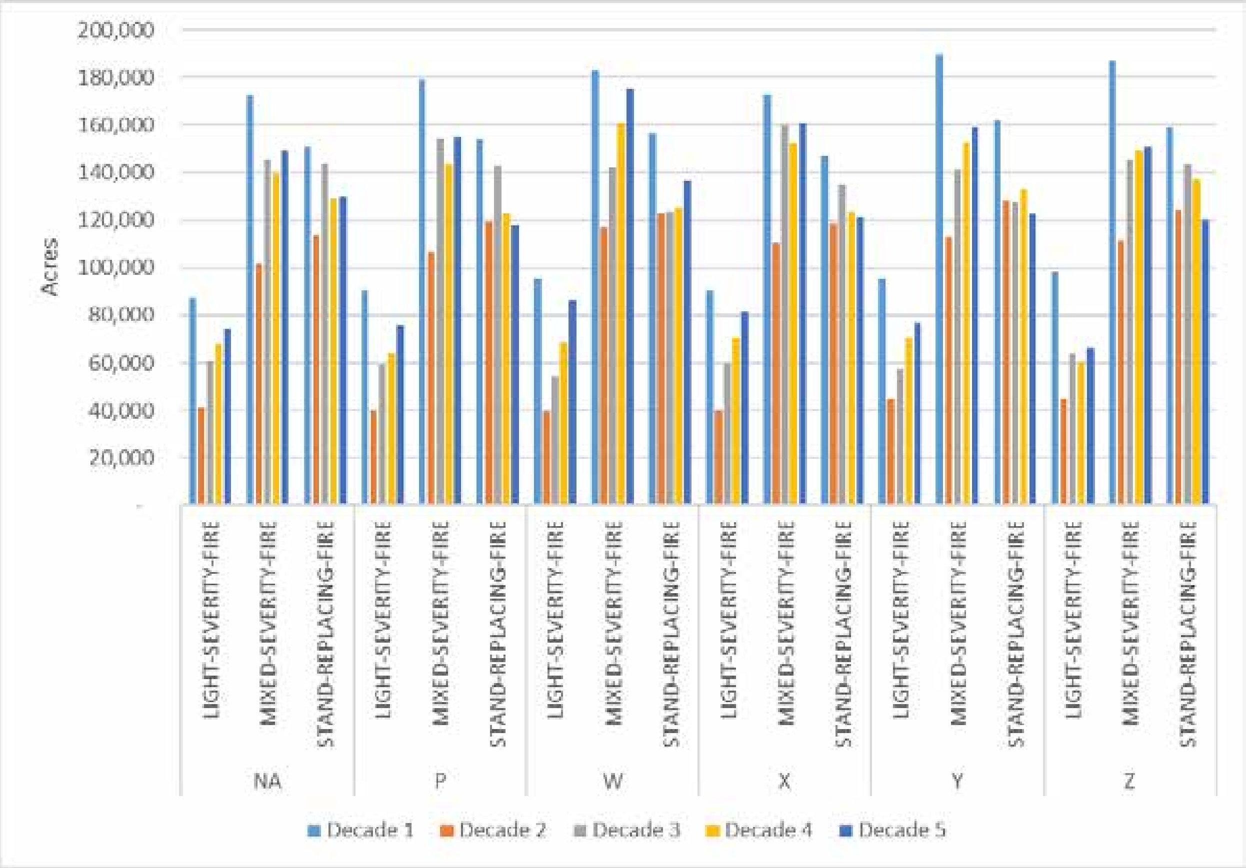

Figure 62. Projected forestwide wildfire acres by severity class

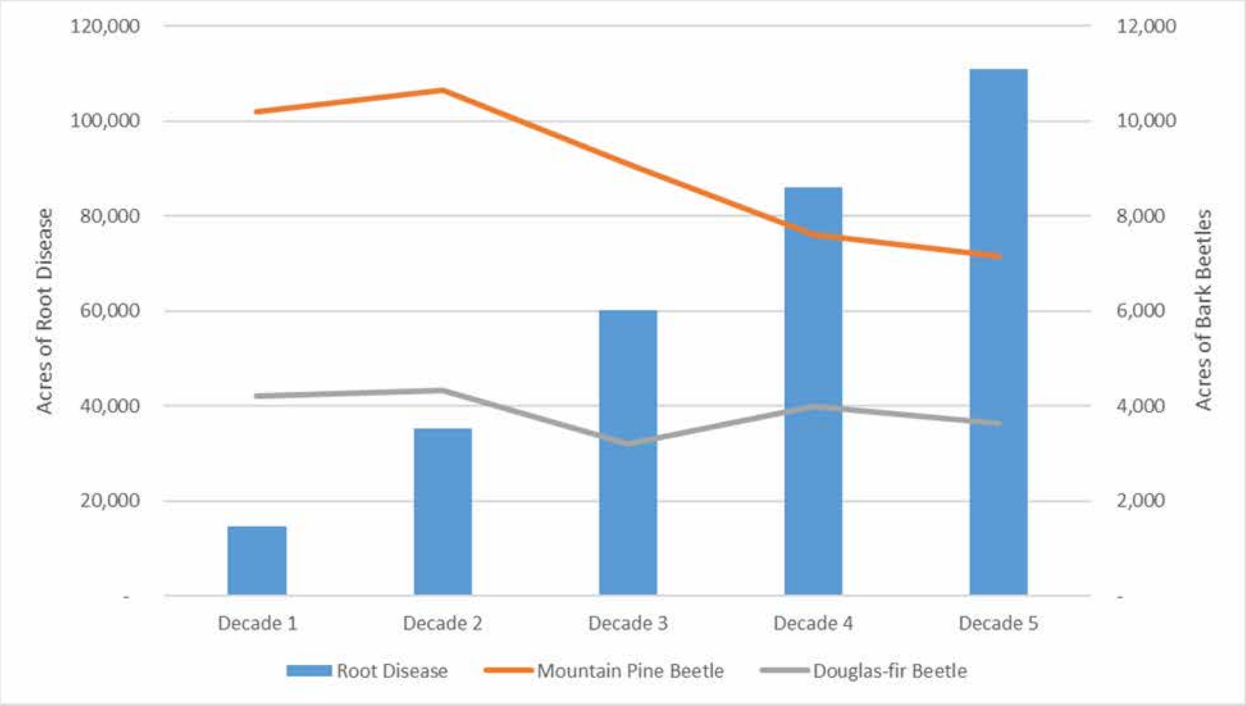

Figure 63. Projected acres affected by selected insects and root disease

Riparian vegetation analysis section (SIMPPLLE)

The following figures illustrate Preferred Alternative model projection of dominance types, size class distribution and canopy structure for riparian areas. These areas are distinct from upland habitats in terms of site productivity and disturbance regimes. Natural disturbance events dominate the successional pathways of riparian vegetation.

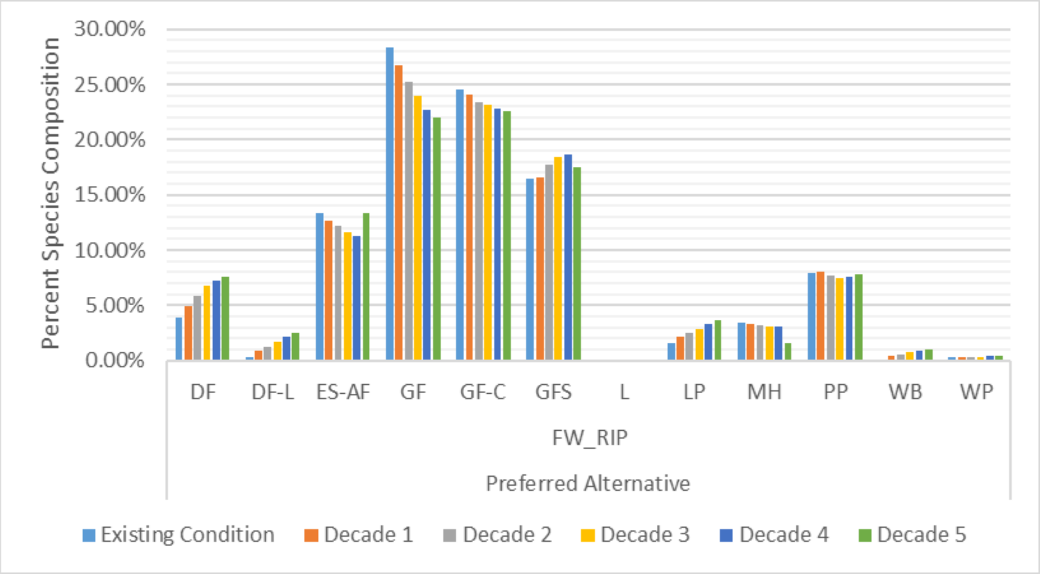

Figure 64. Projected forestwide riparian dominance types

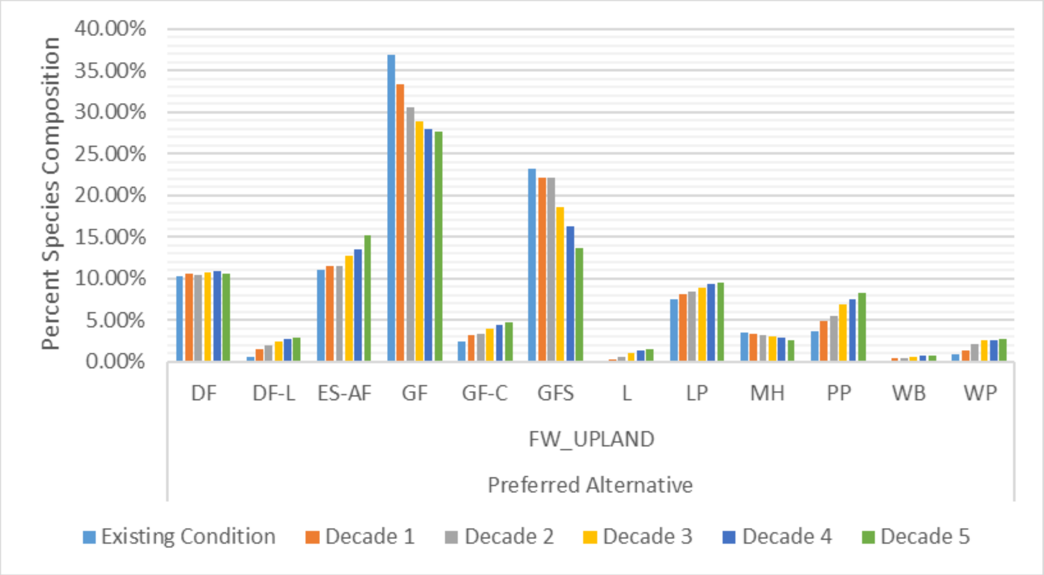

Figure 65. Projected forestwide upland dominance types (for comparison with riparian areas)

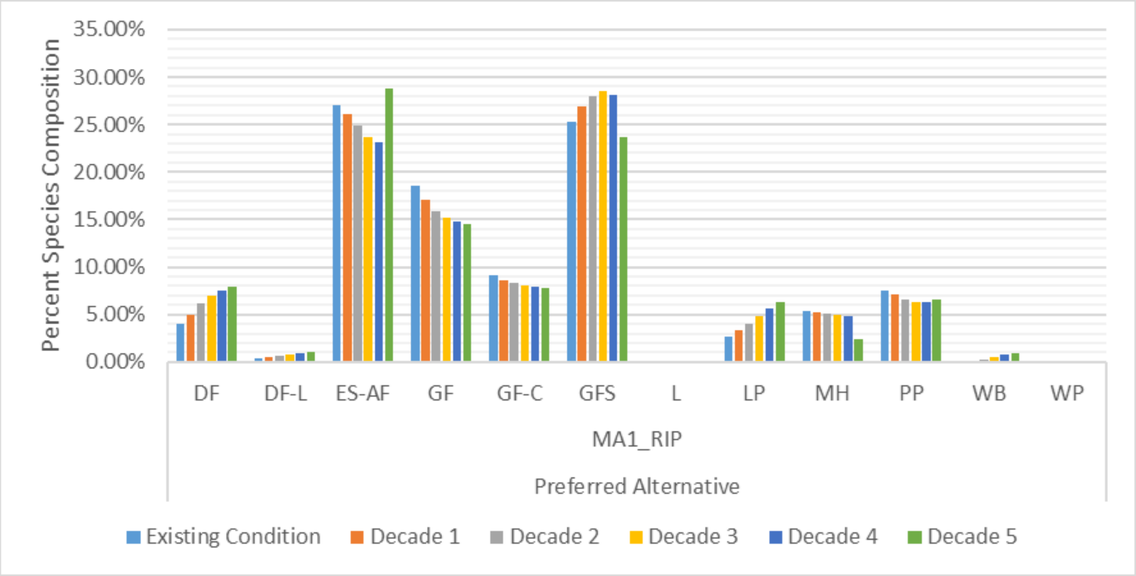

Figure 66. Projected riparian dominance types for Management Area 1.

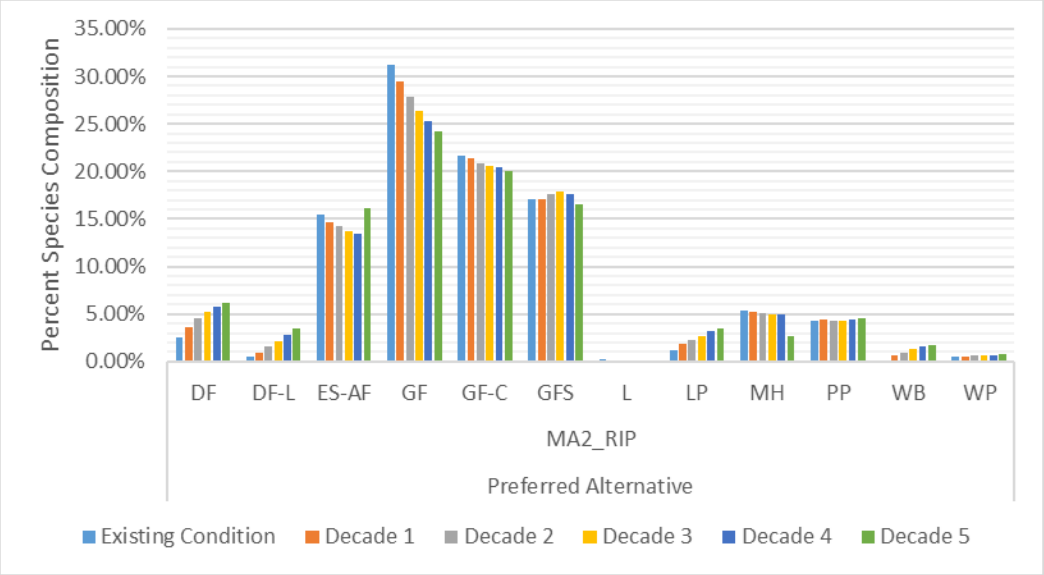

Figure 67. Projected riparian dominance types for Management Area 2.

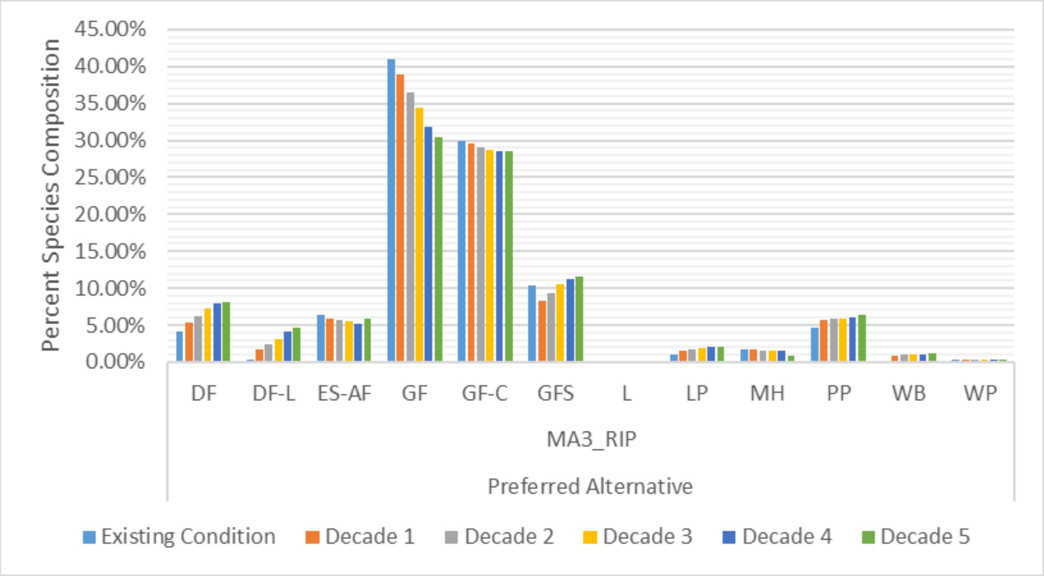

Figure 68. Projected riparian dominance types for Management Area 3.

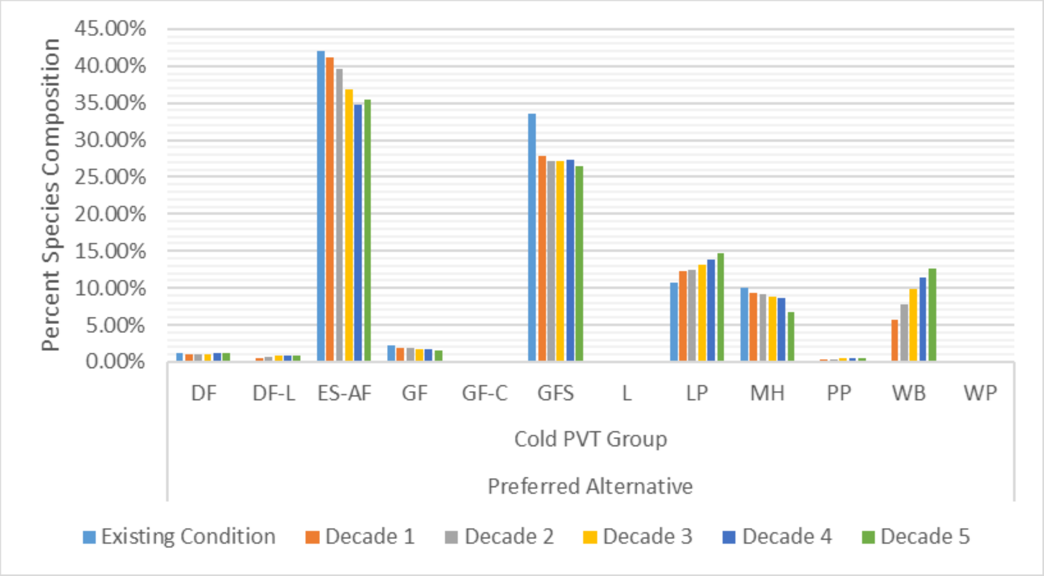

Figure 69. Projected riparian dominance types for the cold potential vegetation type (PVT) group

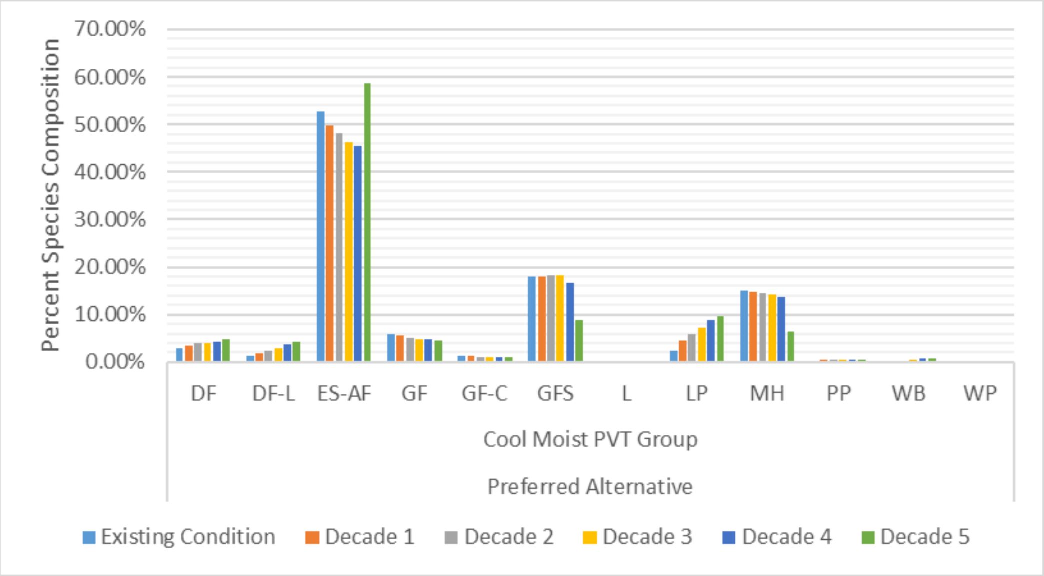

Figure 70. Projected riparian dominance types for the cool moist potential vegetation type (PVT) group.

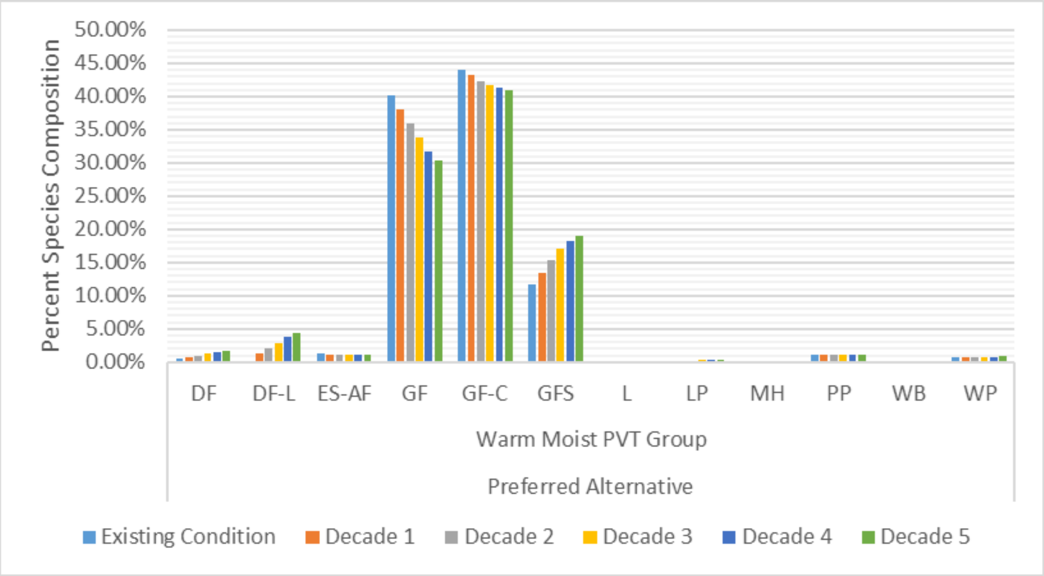

Figure 71. Projected riparian dominance types for the warm moist potential vegetation type (PVT) group.

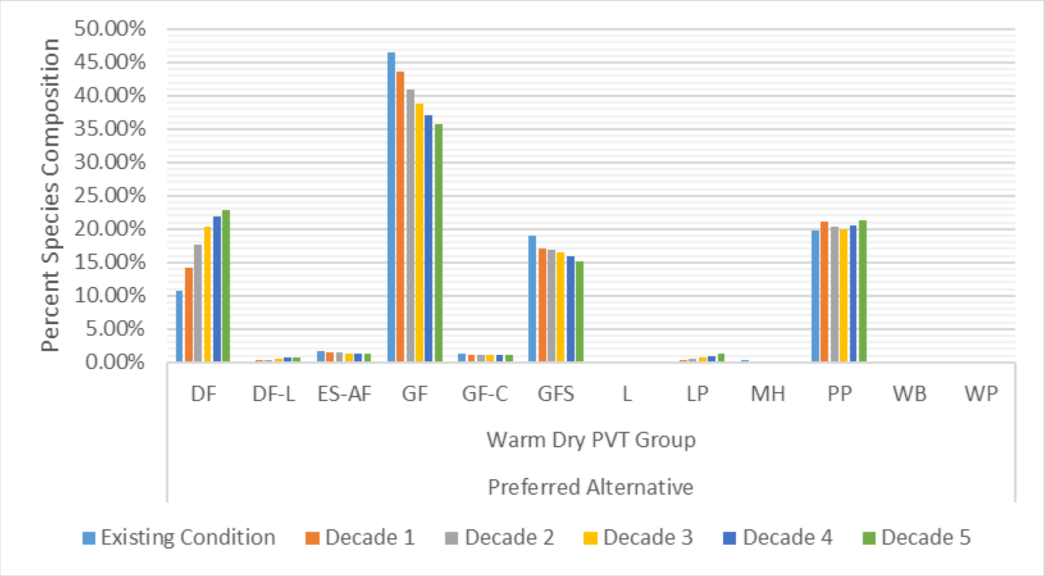

Figure 72. Projected riparian dominance types for the warm dry potential vegetation type (PVT) group.

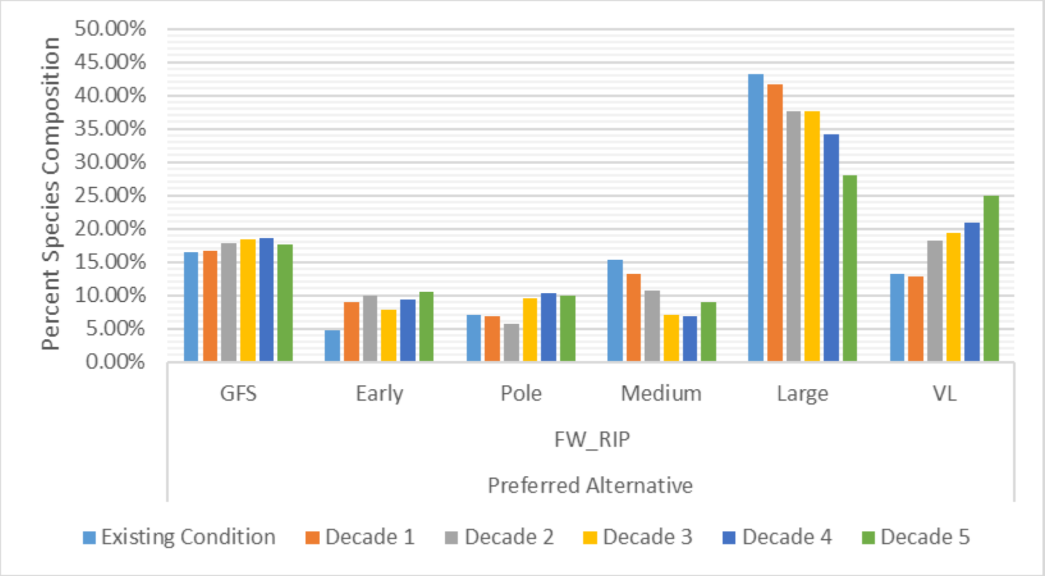

Figure 73. Projected forestwide riparian size class distribution

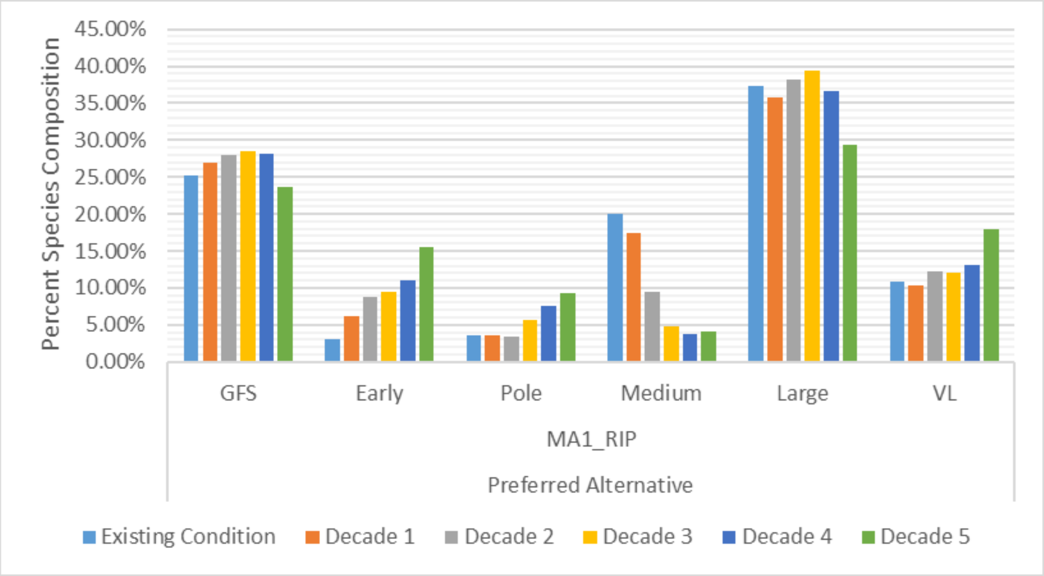

Figure 74. Projected riparian size class distribution for Management Area 1

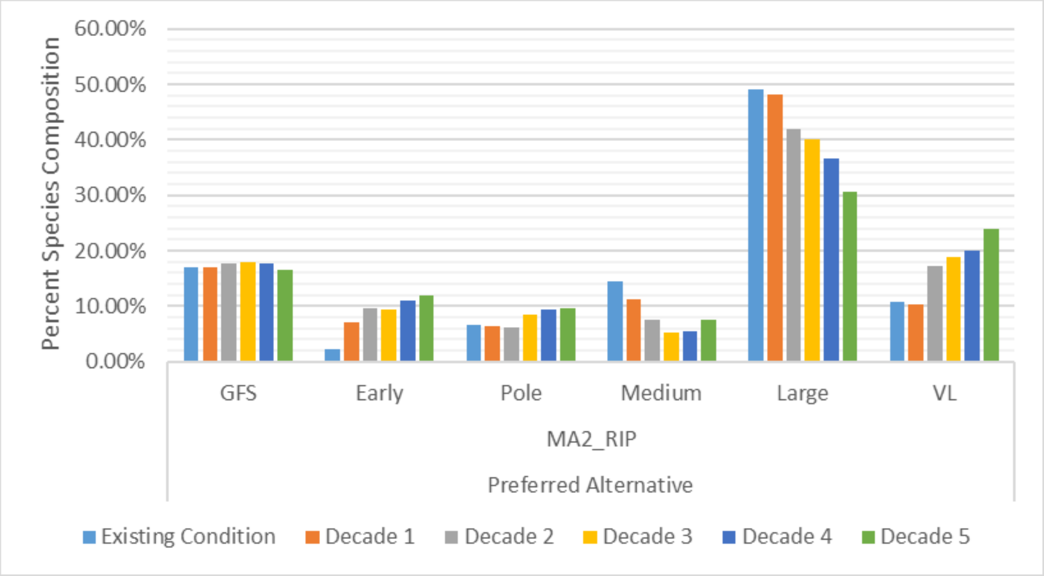

Figure 75. Projected riparian size class distribution for Management Area 2

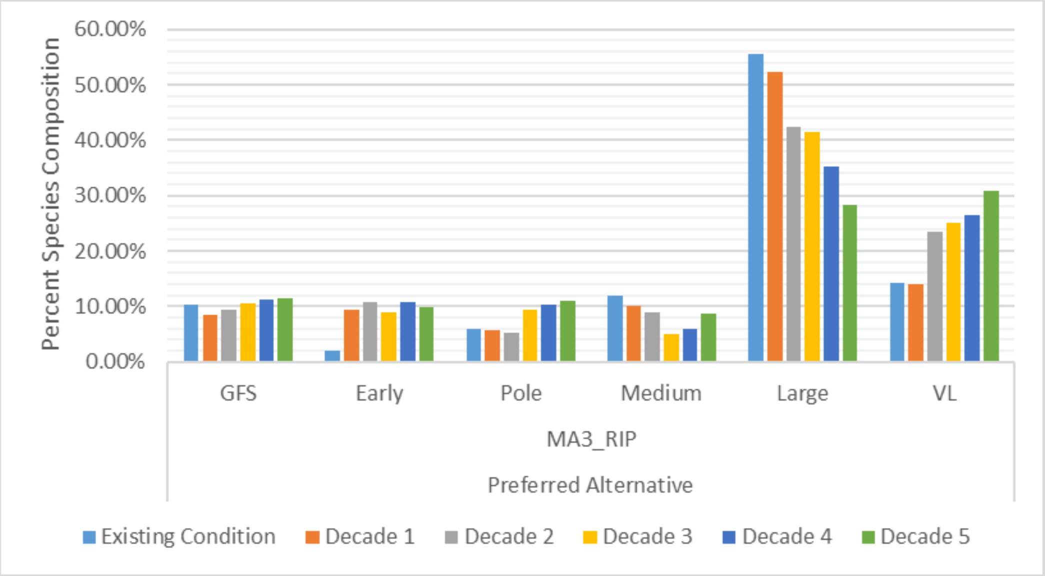

Figure 76. Projected riparian size class distribution for Management Area 3

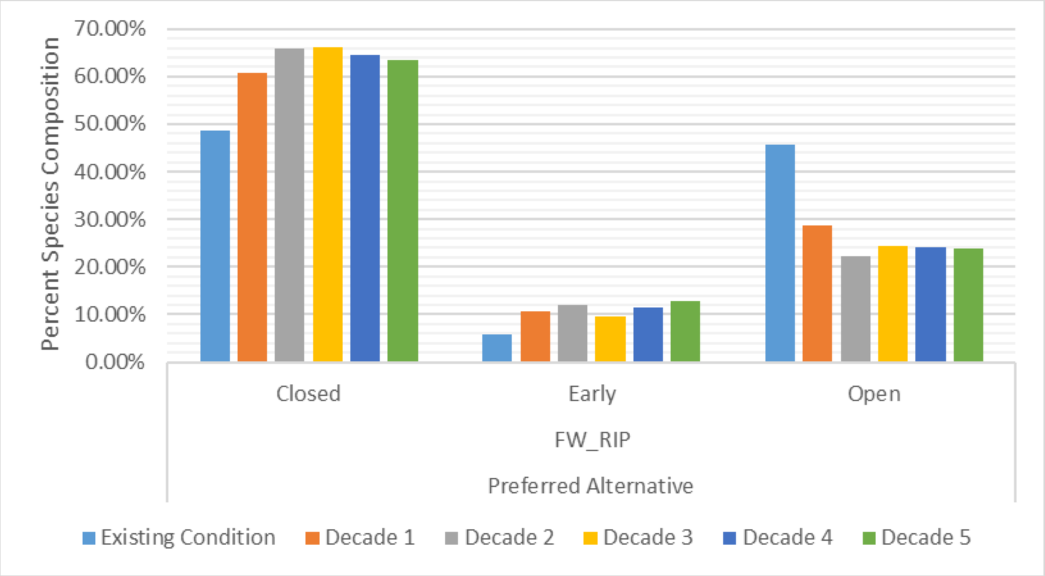

Figure 77. Projected forestwide riparian canopy structure

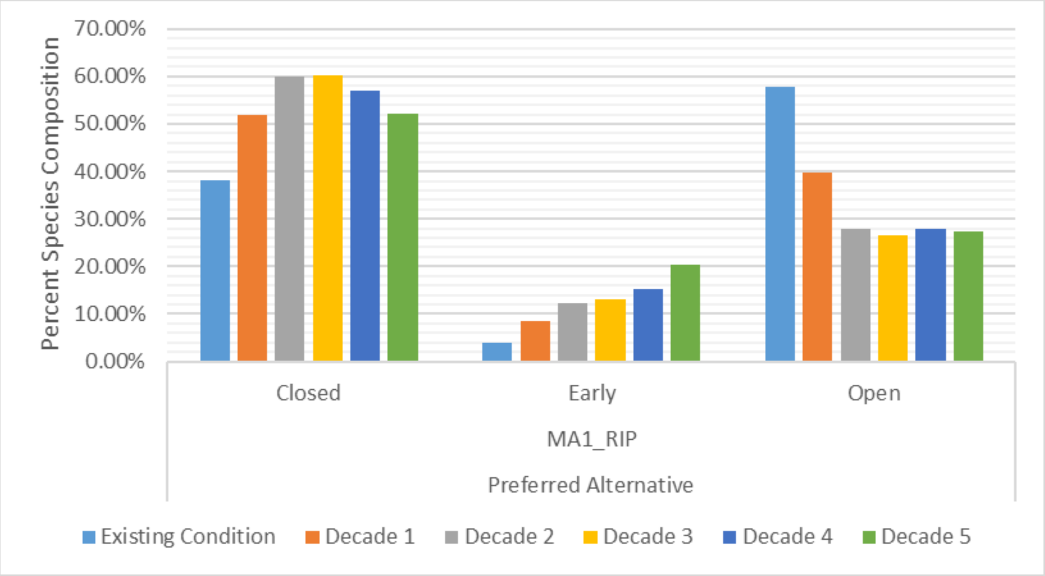

Figure 78. Projected riparian canopy structure for Management Area 1

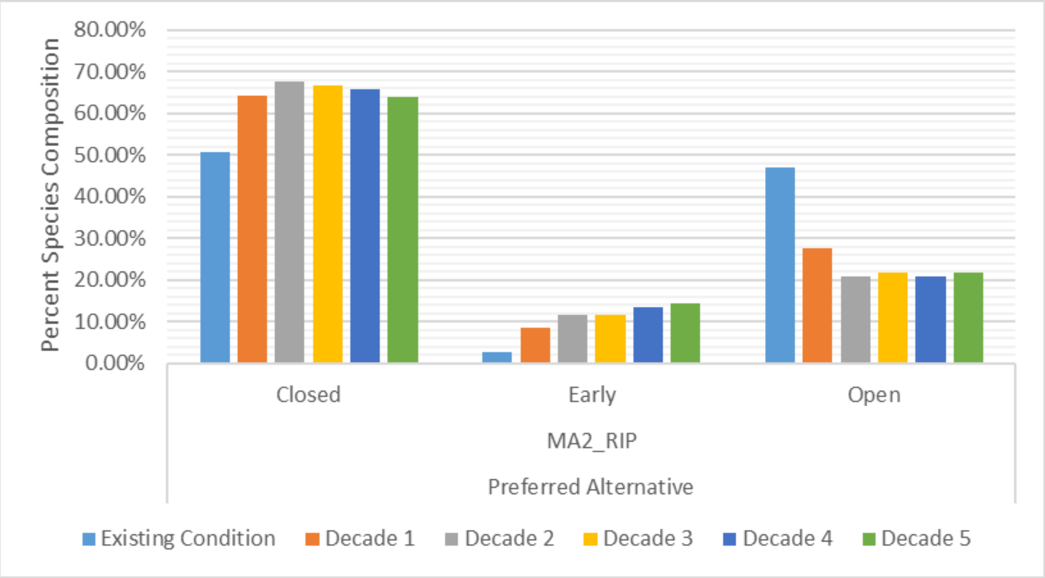

Figure 79. Projected riparian canopy structure for Management Area 2

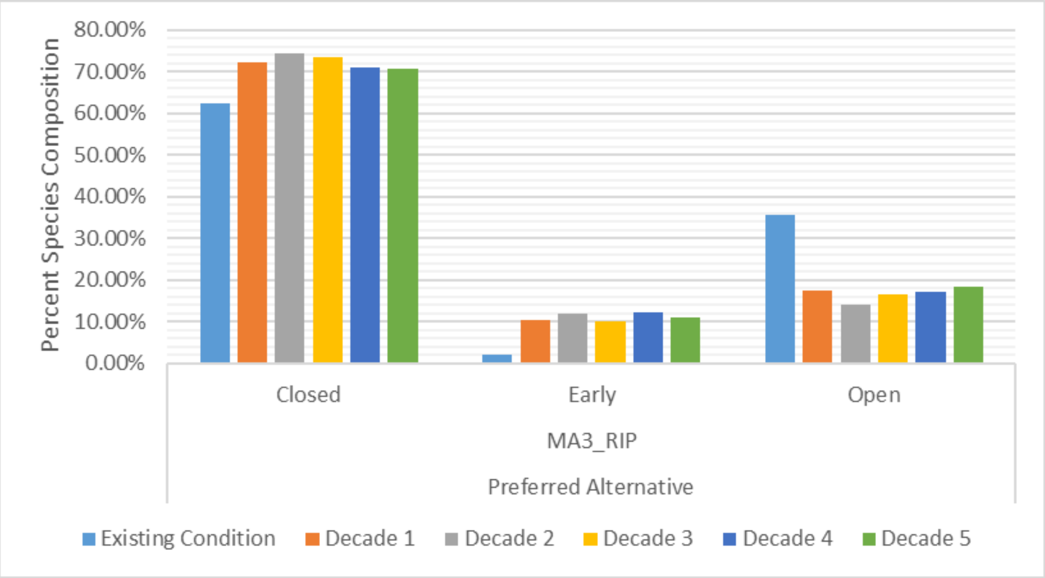

Figure 80. Projected riparian canopy structure for Management Area 3

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