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Region



FINAL Vegetation Specialist Report

Forest Plan Revision Final Environmental Impact Statement

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Vegetation Specialist Report

Introduction

The environment is the basic determinant of the nature and productivity of eco-systems. Physical environmental factors, which include climate, topography and soil, determine the potential of ecosystems to support certain types and levels of use (Hamito, 2009). Within the limits set by this potential, the influence of fire and biological environmental factors (i.e. insects, herbivory, microorganisms) results in different types of vegetation and levels of productivity. According to Branson (1985), vegetation changes are of importance for many reasons, improvement in vegetation can only be considered good, but deterioration can have many undesirable effects, such as decrease herbage production, increased runoff and erosion, and a decline in scenic quality, as well as a loss of biological diversity. Critical processes at the ecosystem level influence plant productivity, soil fertility, water quality, atmospheric chemistry, and many other local and global environmental conditions that ultimately affect human welfare. These ecosystem processes are controlled by both the biological diversity and identity of the plant, animal, and microbial species living within a community (Naeem et al., 1999). Therefore, understanding of how the various environmental factors plus management activities affect vegetation is crucial to successful administration of the Apache-Sitgreaves National Forests (A-SNFs).

The purpose of this assessment is to profile the terrestrial ecosystems of the A-SNFs and the surrounding area with an emphasis on vegetation (see the 2008 Vegetation Specialist Report (A-SNFs, 2008a) for a more in-depth discussion of this topic). This report evaluates and discloses the potential environmental consequences on the vegetation resource that may result from the adoption of a revised land management plan. It examines, in detail, four different alternatives for revising the 1987 A-SNFs land management plan (1987 forest plan).

Relevant Laws, Regulations, and Policy that Apply

The authority for restoring National Forest System lands derives from many laws enacted by Congress that define the purpose of national forests and grasslands. Forest Service Manual 2020 - Ecological Restoration and Resilience, summarizes the principal statutes that govern management and restoration, and provides an overview of each statute (see the Apache-Sitgreaves National Forests Proposed Land Management Plan for a more in-depth listing).

The Laws include:

- *Organic Administration Act* of 1897 (16 U.S.C. 475, 551)
- *Weeks Act* of 1911, as amended (16 U.S.C. 515, 552)
- *Knutsen-Vandenberg Act* of 1930 (16 U.S.C. at 576b)
- *Anderson-Mansfield Reforestation and Revegetation Joint Resolution Act* of 1949 (16 U.S.C. 581j and 581j(note))
- *Granger-Thye Act* of 1950 (16 U.S.C. at 580g-h)
- *Surfaces Resources Act* of 1955 (30 U.S.C. 611-614)
- *Sikes Act* (Fish and Wildlife Conservation) of September 15, 1960 (16 U.S.C. at 670g)
- *Multiple-Use Sustained Yield Act* of 1960 (16 U.S.C. 528-531)
- *Wilderness Act* of 1964 (16 U.S.C. §§ 1131 et seq.)
- *Wild and Scenic Rivers Act* of 1968 (82 Stat. 906, as amended, 16 U.S.C. 1271 (note), 1271-1287)
- *National Environmental Policy Act* of 1969 (16 U.S.C. 4321 et seq.)

- *Clean Air Act* of 1970 as amended 1977 and 1990 (42 U.S.C. 7401, 7418, 7470, 7472, 7474, 7475, 7491, 7506, 7602)
- *Endangered Species Act* of 1973 (P.L. 93-205, 87 Stat. 884; 16 U.S.C. 1531-1544, as amended)
- *Forest and Rangeland Renewable Resources Planning Act* of 1974, as amended through Public Law 106-580, Dec. 31, 2000
- *National Forest Management Act* of 1976 (16 U.S.C. 1600-1614, 472a)
- *Clean Water Act* of 1977 (33 U.S.C. 1251, 1254, 1323, 1324, 1329, 1342, 1344; 91 Stat. 1566)
- *North American Wetland Conservation Act* of 1989 (16 U.S.C. 4401 (note), 4401-4413, 16 U.S.C. 669b (note))
- *Healthy Forests Restoration Act* of 2003 (16 U.S.C. at 1611-6591)
- *The Omnibus Appropriations Act* for Fiscal Year 2003 [Stewardship End Result Contracting Projects (Public Law 108-7, 16 U.S.C. 2104 (note))]
- *Tribal Forest Protection Act* of 2004 (P.L. 108-278, 118 Stat. 868; 25 U.S.C. 3115a)

Principal Executive Orders relevant to ecological restoration are listed below:

- Executive Order 11514: Protection and enhancement of environmental quality (35 FR 4247, March 7, 1970)
- Executive Order 11644: Use of off-road vehicles on the public lands (37 FR 2877, February 9, 1972)
- Executive Order 11988: Floodplain management (42 FR 26951, May 25, 1977)
- Executive Order 11990: Protection of wetlands (42 FR 26961, May 25, 1977)
- Executive Order 13112: Invasive species (64 FR 6183, February 8, 1999)

Forest Service Manual 2020 itself also establishes further policy aimed to re-establish and retain ecological resilience of National Forest System lands.

Methodology and Analysis Process

This report describes and analyzes the 14 PNVTs of the A-SNFs. It describes the forests role in the larger landscape of the ecoregion and the contribution to sustainability¹ of these vegetation types. The report quantifies how far departed the PNVTs' structure, composition, and cover are from desired condition (DC) and historic range of variability (HRV) using the measure of Departure Index² (DI) and what that departure and trend will be after implementing the vegetation treatment objectives identified in each alternative. It discusses the threats and risks that have caused departures from DCs and may hinder progress towards DC. This report examines the state of quaking aspen (*Populus tremuloides* Michx.), or

¹ Sustainability is the use of the environment and resources to meet the needs of the present without compromising the ability of future generations to meet their needs (Chapin et al., 2009a).

² Departure Index (DI) is a rating based on departure from characteristic or desired vegetation and fuel conditions considered to be those that occurred within the historic range of variability (HRV). Uncharacteristic conditions are those that did not occur within the HRV, such as invasive species (e.g., plants, insects, and diseases), changes in forest structure, size class and canopy cover due to vegetation treatments, repeated annual livestock grazing, and uncharacteristic fire behavior due changed fuel characteristics. Determination of the amount of departure is based on comparison of a composite measure of forest structure, size class, and canopy cover. DI classes are: No departure (0-20%); composition and structure of vegetation and fuels are similar to HRV and/or DCs, and risk of loss of key ecosystem components (e.g., native species, forest structure, soil) is minimal. Low departure (21-40%); composition and structure of vegetation and fuels are somewhat altered from HRV and/or DCs, and risk of loss of key ecosystem components is low. Moderate departure (41-60%); composition and structure of vegetation and fuels are moderately altered from HRV and/or DCs, and risk of loss of key ecosystem components is moderate. High departure (61-80%); composition and structure of vegetation and fuels are highly altered from HRV and/or DCs, and risk of loss of key ecosystem components is great. Severe departure (81-100%); composition and structure of vegetation and fuels are extremely altered from HRV and/or DCs, and risk of loss of key ecosystem components is pronounced.

aspen, by estimating the current and potential amount (acres) of aspen and whether it has open or closed canopy (which indicates the age and state of the aspen stands). The report also describes the overstory and understory herbaceous vegetation cover relationship using the amount (acres) of closed canopy cover. See the 2008 Vegetation Specialist Report (A-SNFs, 2008a) for a more in-depth discussion of these topics.

Potential Natural Vegetation Types (PNVTs)

The Vegetation Specialist Report (A-SNFs, 2008a) is organized around Potential Natural Vegetation Types (PNVTs). The Region 3 Ecological Sustainability Report (USFS, 2008a) provides guidance on evaluating ecological sustainability by using PNVTs as the framework for vegetation analysis.

The distribution of PNVTs on Region 3 National Forest System lands and across land ownership throughout Arizona and New Mexico was analyzed by the Nature Conservancy (Vander Lee et al., 2006). PNVTs are coarse-scale groupings of ecosystem types that share similar geography, soils, vegetation, and historic ecosystem disturbances such as fire, drought, and grazing by native species. PNVTs represent the vegetation type and characteristics that would occur when natural disturbance regimes and biological processes prevail (Vander Lee et al., 2006). Tables 1 and 2 display the major PNVTs (Vander Lee et al., 2006) found within the A-SNFs. The A-SNFs' Terrestrial Ecosystem Survey (TES) data (Laing et al., 1987) was used for PNVT delineation and development. The TES reflect 1:24,000-scale ecological unit mapping depicting climate, soil, and vegetation pattern, along with the description of multiple biophysical attributes including life zone, climate step (subclass of life zone), vegetation class, and disclimax categorization (Triepke et al., 2014), and was then used to summarize vegetation for this analysis because of their relevance to the characterizations of historic range of natural variability (HRV³) and vegetation state and transition models⁴ being developed for PNVTs in preparation for the forest planning process (see appendix A tables 1 and 2 for the TES (Laing et al., 1987) map units that comprise each PNVT). See appendix A maps 1 and 2 for the spatial relationship between the 14 PNVTs found on the forests.

The PNVTs (table 1) used for this analysis were summarized from the Terrestrial Ecosystem Survey of the Apache-Sitgreaves National Forests (Laing et al., 1987) and cross-walked with the Southwestern Regional Gap Analysis Project (Lowry et al., 2005) land cover vegetation data.

³ According to Wiens et al. (2012), the concept of HRV and assessments of HRV have been developed and applied most often in the forested ecosystems of the western U.S., where the impacts of Euro-American settlement occurred relatively recently, and where long-lived trees are available for relatively precise reconstruction of past forest structure and disturbance regimes. Some of the drawbacks and limitations of using historic range of variability (HRV) (Romme et al., 2012; Wiens et al., 2012): 1. The role of humans in reference ecosystems is not well known, 2. The amount and quality of data available for HRV summaries and assessments may be incomplete or not well known, and 3. Can HRV be relevant when facing a future of climate change, invasive species, and accelerated human land-use impacts? Some examples of how the HRV concept can be utilized effectively in resource management, planning and policymaking (Romme et al., 2012): 1. HRV helps in identifying ecological conditions that will restore ecological resilience in the face of changing climate and fire regimes, 2. HRV helps in evaluating the ecological feasibility of management goals that society may find desirable, 3. HRV helps in designing management plans that maintain ecological integrity while producing economic commodities, and 4. HRV helps in educating the public and facilitating collaborative discourse and decision making about resource-management goals and methods.

⁴ Modeling projected trends in state and transitions were derived through the use of the Vegetation Dynamics Development Tool (VDDT) (ESSA Technologies, 2006). VDDT software is a non-spatial model that allows the user to model vegetation change over time as a series of vegetation states that differ in structure, composition, and cover and to specify the amount of time it takes to move from one vegetation state to another in the absence of disturbance. Various disturbance agents affecting the movement of vegetation between states (or transitions) are incorporated (e.g., mechanical vegetation treatments, surface fires, mixed-severity fires, stand-replacing fires, grazing, insect outbreaks, and drought events, etc.). By varying the types and rates of disturbance across the landscape, the effects of different disturbance regimes, such as historic and current fire regimes, or different management treatments, such as wildland fire to meet resource objectives, fire suppression, prescribed burning, grazing practices, and mechanical fuel treatments, on vegetation can be investigated (Schussman and Smith, 2006a). Input data used in modeling came directly from forest management activities and fire data over the last 25 years.

Table 1. The 14 potential natural vegetation types (PNVTs) of the A-SNFs

Potential Natural Vegetation Types (PNVTs) ^{1, 2}				
forests	woodlands	grasslands	chaparral	riparian areas/ riparian forests
ponderosa pine (PPF)	Madrean pine-oak (MPOW)	Great Basin (GBG)	interior (IC)	wetland/cienega (WCRA)
wet mixed conifer (WMCF)	piñon-juniper (PJW)	semi-desert (SDG)		cottonwood-willow (CWRF)
dry mixed conifer (DMCF)		montane/subalpine (MSG)		mixed broadleaf deciduous (MBDRF)
spruce-fir (SFF)				montane willow (MWRF)

¹ PNVTs were defined by terrestrial ecosystem units, based on the terrestrial ecosystem survey of the A-SNFs (Laing et al., 1987) (see appendix A tables 1 and 2)

² Within each major vegetation type, the PNVTs are arranged by size: largest to smallest

In order to manage the ecosystems of today, it is important to know as much as possible about past forest conditions, especially the “reference conditions” that existed before forest structure and function were altered by Euro-American settlers (Friederici, 2004). Such conditions were not unchanging, but were sustained across what has been called a “natural range of variability” (Falk, 1990; Landres, et al., 1999). They shaped the “evolutionary environment” of southwestern ecosystems and were a fairly stable environment in which vegetation and animals evolved and adapted together. Restoring conditions similar to those of the evolutionary environment is not a matter of trying to return to the past; rather, it is the only way to assure the long-term health of these forests into the future (Friederici, 2004). Health is described as the degree to which the integrity of the soils, vegetation, water and air as well as the ecological processes of the forests’ ecosystems are balanced and sustained (Pyke et al., 2002).

According to the Schussman and Smith (2006a), HRV is a description of the change over time and space in the ecological condition of PNVTs and the ecological processes that shape those types. Dillon et al. (2005), characterized HRV as “the spatial and temporal variation in composition, structure and function experienced in an ecosystem from about 1600 to 1850, when the influences of Euro-Americans were minimal, within the land area being evaluated.” HRV is a tool for assessing ecological integrity, and does not necessarily constitute a management target or desired conditions. HRV can help identify key structural, functional, compositional, and connectivity characteristics, for which plan components may be important for either maintenance or restoration of such ecological conditions. A comparison between a PNVT’s existing vegetation and HRV was used to show the departure from reference conditions. HRV descriptions focus on characteristics important for managing PNVTs found on National Forests in Arizona and New Mexico, including: vegetation composition and structure and how this attribute varies across the region within a PNVT; patch or stand characteristics such as size and spatial distribution; patch dynamics such as succession; the dominant disturbance processes and frequency of disturbance that shape ecological conditions within a PNVT over time; anthropogenic disturbances or exclusion of natural disturbance regimes; and the effects of climatic fluctuations (Schussman and Smith, 2006a). Descriptions of HRV also focus on quantifying the rate of change in PNVT characteristics and the influence of humans on changes in these characteristics (Schussman and Smith, 2006a).

Ecological integrity is achieved when ecosystem structure, function, processes, and services are preserved over space and time (Grumbine, 1994; Finch and Dahms, 2004). The closer ecological composition, structure, and process are to their historic conditions, the more properly each vegetation type is functioning and the more secure dependent species (plants and animals) are within the associated habitats. This is particularly important with potential changes in the climate. The intent is to re-establish the natural patterns and processes within these vegetation communities that allowed for natural resiliency. This is especially important when faced with potential changes in climate, uncharacteristic wildfire, and the presence of invasive plant species (the A-SNFs has 81 known noxious and invasive weed species (White, 2008, 2011 and 2013) see the Invasive Species Specialist Report for more information).

Desired conditions (DC), together with other plan components, constitute a framework for sustainability and articulate management intent over the life of the forest plan. DCs are the specific conditions of the vegetation resources on a landscape scale which meets the management objective as outlined in the forest plan. A comparison between a PNVTs' existing vegetation conditions were used to show the departure from DC and HRV (table 2). DC descriptions focus on characteristics important for managing PNVTs found on the A-SNFs, including: vegetation composition and structure and how these attributes vary within a PNVT. This assessment focuses on the current vegetation conditions found within the administrative boundaries of the A-SNFs relative to their HRV and the forests identified DCs.

Because vegetation DC for each PNVT have been identified at or near HRV, the assumption is still the same; the closer the composition, structure, and processes of the individual PNVT is to its HRV the more properly the PNVT is functioning, and the dependent species (plants and animals) are more secure within their habitat.

Table 2. Departure rating of the PNVTs, based on woody overstory, in relation to their defined desired condition (DC) and historic range of variability (HRV)

Potential Natural Vegetation Types (PNVT) and Percent Departure ¹ from Forest Plan Desired Conditions (DC) and Historic Range of Variability (HRV)									
within DC/HRV (0-20%)		low departure (21-40%)		moderate departure (41-60%)		high departure (61-80%)		severe departure (81-100%)	
PNVT	departure rating	PNVT	departure rating	PNVT	departure rating	PNVT	departure rating	PNVT	departure rating
PNVT Departure from Desired Condition (DC)²									
IC	8	MWRF	21	MSG	54	MPOW	61		
CWRF	20	PJW	26	WMCF	54	GBG	67		
		MBDRF	33	SFF	59	DMCF	67		
		WCRA	36			PPF	77		
						SDG	79		
PNVT Departure from Historic Range of Variability (HRV)²									
IC	8	MWRF	21	MSG	54	WMCF	61	PPF	94
CWRF	20	PJW	26			SFF	62		
		MBDRF	33			GBG	67		
		WCRA	36			MPOW	72		
						DMCF	77		
						SDG	79		

¹ Departure from DC and HRV are based solely on overstory (woody vegetation) attributes of size class, cover class and species composition. Understory (herbaceous vegetation) is not factored into the departure calculation, so any departure rating accounts for only a portion of the total plant community structure, composition, and function

² Within each departure class, the PNVTs are arranged by level of departure: least to greatest

In most cases, reference condition and DCs have been identified as the same target objective. However, as can be seen in the above table, departure from reference conditions and DCs are not equal for five of the 14 PNVTs; ponderosa pine, wet mixed conifer, dry mixed conifer, and spruce-fir forests, and Madrean pine-oak woodland. Southwestern Regional Office direction for DCs have been altered from reference condition for the ponderosa pine and dry mixed conifer forests to reflect contemporary landscape vegetation structural states important to northern goshawks and Mexican spotted owls. DCs have also been changed from reference condition within the Madrean pine-oak woodland to reflect contemporary landscape vegetation structural states important to Mexican spotted owls. DCs have also been altered from reference condition for the wet mixed conifer and spruce-fir forests to reflect areas absent the succession of aspen cover types, where even-aged conifer succession predominates. As an expression of socioeconomic sustainability, a minor percentage of areas without aspen cover types would be managed on shorter rotations than the historic stand replacement intervals (120 years versus 200+ years). This results in DCs that have a somewhat higher proportion of early-successional vegetation structural states than reference conditions, a proportion of mid-successional vegetation structural states that is somewhat

lower than reference conditions, and a proportion of late-successional vegetation structural states that is somewhat lower than reference conditions (Jack Triepke, Southwestern R3 Regional Ecologist, professional communication).

PNVT Write-ups

Each individual PNVT write-up is organized under the following topics (see the 2008 Vegetation Specialist Report (A-SNFs, 2008a) for a more in-depth discussion of this topic):

Setting: PNVT descriptions were adapted from Vander Lee et al. (2006) with some modifications to fit specific situations occurring on the A-SNFs. Within each PNVT there will be local variations in associated vegetation that are due to a combination of several factors; such as, topography, elevation, aspect, soil type, soil moisture and soil temperature, associated vegetation, and ambient air temperatures, as well as biotic influences. The A-SNFs' Terrestrial Ecosystem Survey (ASTES) data (Laing et al., 1987) was used for PNVT delineation.

Context/Niche: Information regarding context and niche were derived from data provided by the Southwestern Regional Office (RO), Albuquerque, New Mexico in 2007.

Vegetation States' Structure, Composition and Cover: Projecting changes in overstory, or woody vegetation structure and composition over time is an important part of landscape-level analyses. Vegetation can change for a variety of reasons. Information regarding vegetative states' structure, composition and cover were derived from data provided by the RO in 2007, the A-SNFs draft (2007) midscale vegetation analysis (updated in 2012 to reflect the effects of the 2011 Wallow Fire), and The Nature Conservancy (Schussman and Smith, 2006b; Vander Lee et al., 2006).

Trends and Projected Future Conditions: Describes the projected future status of the PNVT assuming management consistent with Alternative A and the 3 action alternatives, and displays the extent of the PNVT within the planning area relative to the ecoregion section and subsections. This step involves projecting the conditions of the PNVT into the future (10, 15, 20, 30, 40, and 50 years). Comparing the projected future status of the characteristics to the HRV is designed to display the direction in which characteristics of the PNVT are headed and is essential in determining the status of ecosystem sustainability. Focus is on describing whether the alternatives are sufficient to maintain and/or move the PNVT towards DC and HRV. Information used to project trends and future conditions were derived from current A-SNFs management and fire activities.

Vegetation Analyses

Analyses were conducted on vegetation using PNVTs, existing mid-scale vegetation types found on the A-SNFs⁵ and soil types from Terrestrial Ecological Unit Inventory data for the A-SNFs⁶. A comparison

⁵ Mid-scale vegetation types were determined using satellite data and are mapped at the scale of 1:100,000. The mid-scale vegetation inventory for all A-SNFs' vegetation types analyzed in this report was conducted in 2005 and 2006. As a result of the 2011 Wallow fire, the A-SNFs' midscale mapping product was updated to reflect changed conditions. This product represents a rapid assessment done to help identify changed vegetation condition within the perimeter of the Wallow Fire. The assessment utilized mid-scale existing vegetation data products for vegetation dominance type, tree size, and overstory canopy cover map units as well as RAVG (Rapid Assessment of Vegetation Condition after Wildfire) data produced by the Remote Sensing Applications Center (RSAC) representing overstory canopy cover mortality classes. The datasets were combined using a standard rule-set, developed by the U.S. Forest Service Southwestern Regional Office, to determine where mid-scale map units had changed according to fire severity. This outcome is intended as a rapid assessment of changed condition and does not represent an update of the official mid-scale map products.

between PNVT, defined forest plan DCs, and existing vegetation was used to show the departure from DCs, and to estimate trends and future conditions. Projecting changes in vegetation structure and composition over time is an important part of landscape-level analyses. Vegetation can change for a variety of reasons such as human activity, fires, insects, pathogens, mammals, weather, or growth and competition. The interaction of these factors can be quite complex and it can be difficult to project the combined effects over long periods of time (ESSA Technologies, 2007). Modeling projected trends in state and transitions (see appendix B for more information on state and transition modeling) were derived through the use of the Vegetation Dynamics Development Tool (VDDT), Version 6.0.25 (ESSA Technologies, 2006). VDDT software is a non-spatial model that allows the user to model vegetation change over time as a series of vegetation states that differ in structure, composition, and cover and to specify the amount of time it takes to move (or transitions) from one vegetation state to another in the absence of disturbance⁷. Various disturbance agents affecting the movement (or transitions) of vegetation between states are incorporated (e.g., surface fires, stand-replacing fires, grazing, insect outbreaks, and drought events, vegetation treatments, etc.). By varying the types and rates of disturbance across the landscape, the effects of different disturbance regimes, such as historic and current fire regimes, or different management treatments, such as planned and unplanned fire ignitions, fire suppression, grazing practices, and mechanical fuel treatments, on vegetation can be investigated (Schussman and Smith, 2006b; TNC, 2006). Input data used in modeling came directly from forest management activities and fire data over the last 25 years.

According to Weisz et al. (2010), projecting transitions in vegetation states (composition and structure) over time facilitates evaluating the ecological sustainability of ecosystems. State destinations and transition probabilities for vegetation treatments were derived from Forest Vegetation Simulator (FVS), modeling, Version 6.31. FVS is a distance-independent; individual-tree forest growth model widely used in the United States and is used to compare alternatives. State destinations for natural fires and fire treatments were derived from FVS, modeling, Version 2.02 and Fire and Fuel Extension (FFE) (Weisz et al., 2012; Weisz and Vandendriesche, 2014).

Some of the drawbacks and limitations of VDDT modeling are:

- Many of the VDDT inputs used were derived from other modeling outputs, e.g., FVS timber harvest treatment state transition destinations and the probability of those outcomes
- Many of the VDDT inputs used were derived from incomplete data sources such as the Forest Service Activity Tracking (FACTS⁸) database
- VDDT is a non-spatial model intended mainly for broad scale analysis

⁶ The Terrestrial Ecological Unit Inventory referenced in this document is specific to the A-SNFs and is a classification of ecological types. It maps terrestrial ecological units based on soil types and existing vegetation (Laing et al., 1987).

⁷ State and transition models are simple box-and arrow diagrams in which boxes represent observed or theoretical ecosystem states and arrows represent the observed or theoretical transitions among these states. These models are commonly used to conceptualize either formal mathematical models or the complex behavior of dynamic systems. They are essentially a means of mapping system behavior in the absence of adequate predictive models (Westoby et al., 1989).

⁸ FACTS is an activity tracking system for all levels of the Forest Service. It supports timber sales in conjunction with TIM Contracts and Permits; tracks and monitors NEPA decisions; tracks Knutson-Vandenberg trust fund plans at the timber sale level, reporting at the National level; and, it generates National, Regional, Forest, and/or District Reports. FACTS is a nationally supported application that tracks land based activities through the NEPA, Layout, and Accomplished stages of a project. The features in GIS represent the activity unit on which these activities occur and are depicted in GIS as polygons, lines or points. FACTS version 2.0 uses a total of three feature classes for each feature type - polygon, line, point. Within each feature class, there exists three "sub-types" to identify the stage an activity is in - NEPA, Layout, Accomplished. The appropriate stage of an activity unit is determined by the status of the project.

- VDDT projects changes in vegetative conditions in response to succession, disturbances, and management treatments, however, the VDDT model divides vegetation conditions within each PNVT into a small number of discrete states, and it is acknowledged that there is more variability within each state and within nature than has been modeled for forest plan revision.
- A small number of states were selected because the VDDT model is driven by the data available; the amount of available data was limited
- VDDT modeled the distribution of landscape states over time, and does not model the more detailed physical (soil, temperature, precipitation, aspect, elevation, productivity) chemical and biological dynamics of what is happening at each scale of spatial resolution
- VDDT is a long-range, broad scale, strategic model, and does not describe what is happening at a site specific level of detail to individual trees, groups of trees, etc.
- VDDT does not model detailed mechanisms of landscape change, but by calibrating the VDDT models with FVS model outputs (Weisz et al., 2011; Weisz and Vandendriesche, 2012; Weisz et al., 2012; Weisz and Vandendriesche, 2014), VDDT modeling takes advantage of some of the detailed mechanisms (mortality, regeneration, background dwarf mistletoe presence, natural growth, succession, etc.) that FVS considers
- VDDT models overstory structure, composition, and cover as defined by mid-scale vegetation mapping in great detail, but does not model the herbaceous understory vegetation (for example, the species composition of grasses and forbs)
- VDDT models the probability and timing of events (such as fire behavior, management activities, insect and disease occurrences, etc.) based on empirical observations, but our current information on historical behavior and evidence cannot accurately predict future behavior due to climate change and other phenomena which may not have occurred within the realm of the statistical evidence which is available to us today

It is assumed the disturbances (e.g., management activities) selected for the VDDT model represent the majority of disturbances the A-SNFs experience. There could be many variations to these disturbances; however these were not modeled in detail for this analysis. According to Lauenroth and Laycock (1989), and others, succession may follow multiple pathways and reach different end-points depending on the effects of disturbance on the life history characteristics of the vegetation; causing predictability to be limited by the importance of chance or infrequent events. Given the complexities of heterogeneity, unforeseen event, and multiple interacting drivers, predicting future ecological changes is an immense challenge (Jackson et al., 2009; Romme et al., 2011).

The following PNVTs were modeled using VDDT software: ponderosa pine, wet mixed conifer, dry mixed conifer, and spruce-fir forests; Madrean pine-oak, and piñon-juniper woodlands; Great Basin and semi-desert grasslands. State and transition modeling was not conducted for interior chaparral, and montane/subalpine grasslands, and the four riparian PNVTs. Separate, regionally consistent VDDTs models were not developed for montane/subalpine grasslands, and the four riparian PNVTs.

Assumptions

In the analysis for this resource, the following assumptions have been made:

- Acreage within each PNVT is static because it is based on a combination of several factors; such as, topography, elevation, aspect, soil type, soil moisture and soil temperature, associated vegetation, and ambient air temperatures, as well as biotic influences. However, the acreage within each PNVT structural state may vary over time because of natural succession, management treatments, and other disturbance factors.

- The planning timeframe is 15 years; other timeframes were analyzed depending on the resource (usually a discussion of anticipated trends into the future). As mentioned earlier, the timeframes analyzed in VDDT modeling were 10, 15 (planning period), 20, 30, 40, and 50 (modeling period) years.
- The kinds of resource-management activities allowed under the prescriptions are reasonably foreseeable future actions to achieve the goals and objectives. However, the specific location, design, and extent of such activities are generally not known at the time. The decisions are made on a site-specific (project-by-project) basis. Therefore, the discussions should refer to the potential for the effect to occur and are usually only estimates. The effects analyses are to be useful for comparing and evaluating alternatives on a forest-wide basis. It is not intended to be applied directly to specific locations on the Forests.
- The closer ecological composition, structure, and process are to their historic conditions, the more properly each vegetation type is functioning and the more secure dependent species (plants and animals) are within the associated habitats. This is especially important with potential changes in the climate.

Revision Topics Addressed in this Analysis

Revision Topic 1: Maintenance and Improvement of Ecosystem Health

Issue: Vegetation Conditions

- PNVT percent departed from desired conditions and historic range of variability using the Departure Index
- Percent departed from DCs for acres of old/large trees, number of snags per acre and tons of coarse woody debris
- Acres of aspen-dominant and co-dominated forest types and current vegetation state size, composition and cover of aspen
- Vegetation overstory/understory relationships compared using acres of closed (> 30%) forest and woodland woody canopy cover and < 10 percent woody canopy cover within grasslands

Summary of Alternatives

A summary of alternatives, including key differences among alternatives, is outlined in the Draft Environmental Impact Statement.

Description of Affected Environment

Existing Condition

This assessment primarily focuses on the vegetation conditions found within the administrative boundaries of the A-SNFs. An attempt has been made to identify the importance or “contribution to sustainability” of vegetation managed by the A-SNFs by comparing the quantity and spatial extent of vegetation within and outside of the forests’ administrative boundary. The following discussion places the A-SNFs in the broader context of the surrounding landscape and uses a hierarchical framework of ecological map units including Ecoregion Provinces, Sections, and Subsections as described below.

A scale larger than the Forest is desirable to understand the environmental context, opportunities and limitations of National Forest System lands to contribute to ecological sustainability. Ecoregions are ecosystems of regional extent. Using the National Hierarchical Framework of Ecological Units⁹ (ECOMAP, 1993; Cleland et al., 1997) an analysis of the landscapes surrounding the A-SNFs was completed using the ecological section and subsection units. This broad-scale analysis was done to set the context for the contributions the A-SNFs make to ecological sustainability. As described by Bailey (1980, 1983, 1985 and 1998) ecoregions distinguish areas that share common climatic and vegetation characteristics (Cleland et al., 1997). Ecoregions are subdivided into provinces, which are controlled primarily by continental weather patterns such as length of dry season and duration of cold temperatures. Provinces are also characterized by similar soils. Sections are a subdivision of provinces, described by broad areas of similar subregional climate, geomorphic process, geology, geologic origin, topography, and drainage networks. Such areas are often inferred by relating geologic maps to potential natural vegetation "series" groupings such as those mapped by Kuchler (1964). Ecological subsections are a further division of sections, and described by areas with similar surface geology, geomorphic process, soil groups, subregional climate, and potential natural vegetation communities (McNab and Avers 1994). Because subsections are smaller in size they are more useful in planning at a smaller scale.

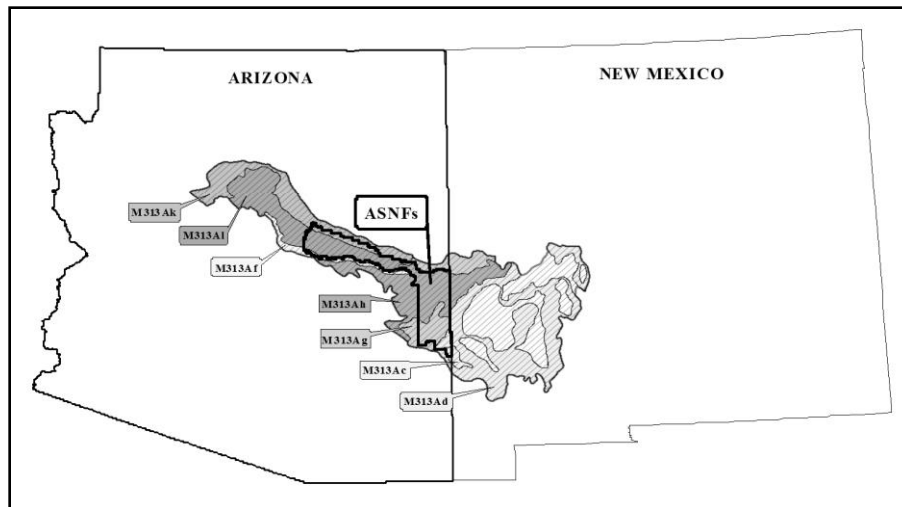
The A-SNFs is located within the Arizona-New Mexico Mountains Semi-Desert-Open Woodland-Coniferous Forest-Alpine Meadow ecoregion province (M313) (McNab and Avers, 1994; McNab et al., 2005 and 2007); and is located entirely within the province's White Mountains-San Francisco Peaks-Mogollon Rim ecoregion section (M313A). In addition, the A-SNFs is located within a portion of seven subsections in the White Mountains-San Francisco Peaks-Mogollon Rim ecoregion section (map 1).

Table 3 presents the relationship, in acres, of the A-SNFs to the overall ecoregion section and its seven subsections (columns one and two). Overall, the section and the seven subsections total nearly 13.5 million acres. The A-SNFs occupies 15 percent of these total acres. Column three displays the section and subsection percent contribution to the A-SNFs' acreage, while column four displays the A-SNFs' percent contribution to the section and seven subsections' acreages.

The remaining 85 percent of the lands within the ecoregion section are owned or managed by a diversity of entities; including the Coconino, Gila, Kaibab and Tonto National Forests, the states of Arizona and New Mexico, Bureau of Land Management, National Park Service, White Mountain Apache and San Carlos Apache Nations, and numerous private organizations and citizens.

Table 4 displays the major PNVTs (Vander Lee et al., 2006) found within the A-SNFs and ecoregion section and what percent of each PNVT within the ecoregion section is contributed by the forests. In addition, the proportional representativeness within the forests and ecoregion section is presented (map 1).

⁹ In 1993, as part of the Forest Service's National Hierarchical Framework of Ecological Units (ECOMAP, 1993), ecoregions were adopted for use in ecosystem management. The hierarchical interrelationships, or nesting, are as follows: 1) The United States is divided into three Domains (based on general climatic characteristics). The intermountain west (including Arizona and New Mexico) falls within the Dry Domain. The essential feature of the Dry Domain is that annual losses of water through evaporation at the earth's surface exceed annual water gains from precipitation; 2) Domains are further subdivided into Divisions, northeastern and eastern Arizona fall within the Tropical/Subtropical Steppe Division. Tropical steppes border the tropical deserts on both the north and south, and in places on the east as well. Locally because of altitude, plateaus and high plains within what would otherwise be desert have a semiarid steppe climate. The Tropical/Subtropical Steppe Division is further subdivided into a Mountain segment exhibiting altitudinal zonation and the climatic regime of the adjacent lowlands and is distinguished according to the character of altitudinal zonation; 3) Divisions are further subdivided into Provinces and central and eastern Arizona falls within the Arizona-New Mexico Mountains Semi desert--Open Woodland--Coniferous Forest--Alpine Meadow Province of the Mountain segmentation. This area consists mostly of steep foothills and mountains, but includes some deeply dissected high plateaus; 4) Provinces are further subdivided into Sections and the A-SNFs falls entirely within the White Mountains-San Francisco Peaks-Mogollon Rim Section which extends from the south rim of the Grand Canyon to central New Mexico; and 5) Sections are further subdivided into Subsections. The A-SNFs falls within a portion of seven Subsections.



Map 1. A-SNFs in context to the land areas of the White Mountains-San Francisco Peaks-Mogollon Rim M313A ecoregion section (cross-hatched area) and the seven ecoregion subsections in which it occurs, and the ecoregion section in context within Arizona and New Mexico

Table 3. Land area, in acres, of the A-SNFs in relation to the land areas of the ecoregion section and seven ecoregion subsections in which it occurs

Ecoregion Section and Subsection Code	Ecoregion Section and Subsection Name	Total Area of the Ecoregion Section and Subsection (acres)	Total A-SNFs Area within the Section and Subsection (acres)	Ecoregion Section and Subsection Contribution to A-SNFs Acreage (percent)	A-SNFs Contribution to Ecoregion Section and Subsection Acreage (percent)
Ecoregion Section					
M313A	White Mountains-San Francisco Peaks-Mogollon Rim	13,474,691	2,015,352	100	15.0
Ecoregion Subsections					
M313Ac	Burro Mountains Oak-Juniper Woodland	128,507	23,290	1.2	18.1
M313Ad	Mogollon Mountains Woodland	3,591,109	89,792	4.5	2.5
M313Af	White Mountains Scarp Woodland-Coniferous Forest	321,920	25,451	1.3	7.9
M313Ag	White Mountains Woodland	1,057,569	382,771	19.0	36.2
M313Ah	White Mountains Coniferous Forest	2,124,359	697,158	34.6	32.8
M313Ak	Coconino Plateau Woodland	1,610,862	180,849	9.0	11.2
M313Al	Coconino Plateau Coniferous Forest	1,974,415	616,042	30.6	31.2
Other ¹	Located entirely within New Mexico	2,665,951	0	0.0	0.0

¹ Other = Mangas High Plains Grassland Subsection M313Ab; Mogollon Mountains Coniferous Forest Subsection M313Ae; and San Francisco Peaks Coniferous Forest Subsection M313Am

The A-SNFs contains very diverse floristic assemblages that occupy certain areas along an elevational gradient. At low elevations (3,500-6,100 feet), the A-SNFs support semi-desert grassland and Madrean evergreen woodland biotic communities. Low to middle elevations (6,100-8,800 feet) support interior chaparral, Great Basin coniferous woodland, and plains and Great Basin grassland biotic communities. Rocky Mountain (petran) and Madrean montane coniferous forests, subalpine coniferous forests, alpine and subalpine grassland, and montane grassland biotic communities dominate middle to high elevations (8,800-11,300 feet) and are found primarily in the northern two-thirds of the A-SNFs. However, Rocky Mountain and Madrean montane coniferous forests are the largest and most widespread biotic community on the A-SNFs. The A-SNFs provides a wide range of habitats, both geographical and environmental, to which plants have been able to adapt. According to White (2014), the A-SNFs provides habitat for nearly 2,450 vascular plants. Including lichens, mosses, and fungi the A-SNFs contains more than 4,000 different plant species.

Table 4. Land area, in acres, of the A-SNFs' major PNVTs in relation to the overall land area of the forests and their context, or "niche", and proportional representativeness within the greater ecoregion section

Potential Natural Vegetation Types (PNVT)	White Mountains-San Francisco Peaks-Mogollon Rim Ecoregion Section M313A							A-SNFs’ Proportional Representativeness Relative to the Ecoregion Section (ratios are based on comparison of percent displayed in columns 2b and 3b)	A-SNFs’ Proportional Contribution Relative to the Ecoregion Section (ratios are based on comparison of percent displayed in columns 4b and 4c)
	total PNVT area contained within the A-SNFs (column 2)		total PNVT area contained within ecoregion section (column 3)		A-SNFs’ contribution to the PNVT total area within ecoregion section (column 4)				
	acres (a)	percent (b)	acres (a)	percent ¹ (b)	acres (a)	percent			
						on forests (b)	in ecoregion (c)		
Forests									
Ponderosa pine	602,206	29.9	4,573,316	33.9	602,206	13.2	86.8	0.9:1	1:6.6
Wet mixed conifer	177,995	8.8	388,258	3.4	177,995	45.8	54.2	2.6:1	1:1.2
Dry mixed conifer	147,885	7.3	487,098	2.8	147,885	30.4	61.7	2.6:1	1:2.0
Spruce-Fir	17,667	0.9	38,748	0.3	17,667	45.6	54.4	3.0:1	1:1.2
Woodlands									
Madrean pine-oak	394,927	19.6	615,111	4.6	394,928	64.2	35.8	4.3:1	1:0.6
Piñon-juniper	222,166	11.0	2,919,950	21.7	222,155	7.6	92.4	0.5:1	1:12.1
Grasslands									
Great Basin	185,523	9.2	1,789,899	13.3	185,523	10.4	89.6	0.7:1	1:8.6
Semi-desert	106,952	5.3	761,965	5.7	106,952	14.0	86.0	0.9:1	1:6.1
Montane/subalpine	51,559	2.6	174,810	1.3	51,559	29.5	70.5	2.0:1	1:2.4
Chaparral									
Interior	55,981	2.8	233,468	1.7	55,981	24.0	76.0	1.6:1	1:3.2
Riparian Areas									
Wetland/cienega	17,900	0.9	27,925	0.1	17,900	64.1	35.9	9.0:1	1:0.6
Riparian Forests									
Cottonwood-willow	15,876	0.8	19,621	0.2	15,876	80.9	19.1	4.0:1	1:0.2
Mixed broadleaf deciduous	9,657	0.5	28,239	0.1	9,657	34.2	65.8	5.0:1	1:1.9
Montane willow	4,808	0.2	21,930	0.0005	4,808	21.9	78.1	400.0:1	1:3.6

¹ Summation of this column does not equal 100% because there are other PNVTs within the ecoregion section that do not occur on the A-SNFs, such as, alpine and tundra, desert communities, Gambel oak shrubland, Madrean encinal woodland, and sagebrush shrubland; which are not displayed

The majority of PNVTs (ten) have a greater proportional representation on the A-SNFs than in the ecoregion section; this includes all of the riparian PNVTs. The A-SNFs' top five biggest contributing PNVTs to the ecoregion section are: Montane Willow Riparian Forest, Wetland/Cienega Riparian Areas, Mixed Broadleaf Deciduous Riparian Forest, Madrean Pine-Oak Woodland, and Cottonwood-Willow Riparian Forest, from greatest to least, respectively.

Spatial and Temporal Niche Analysis

As mentioned earlier, spatial niche analysis occurs within the context of the ecoregion section(s) and comes down to: when the bulk of the PNVT within the ecoregion section is located on-forest, sustainability analysis falls to a temporal niche analysis (focus is on conditions on-forest). When the bulk of the PNVT within the ecological section is located off-forest, the sustainability analysis falls to a spatial and temporal niche analysis (focus on conditions off-forest). For other PNVTs, ecological sustainability analysis will reflect the sum conditions of the PNVT both on- and off-forest (see the 2008 Vegetation Specialist Report (A-SNFs, 2008a) for a more in-depth discussion of this topic). See figure 1 for a graphic used to determine if the management of lands within the A-SNFs is influential to the sustainability within the ecoregion section.

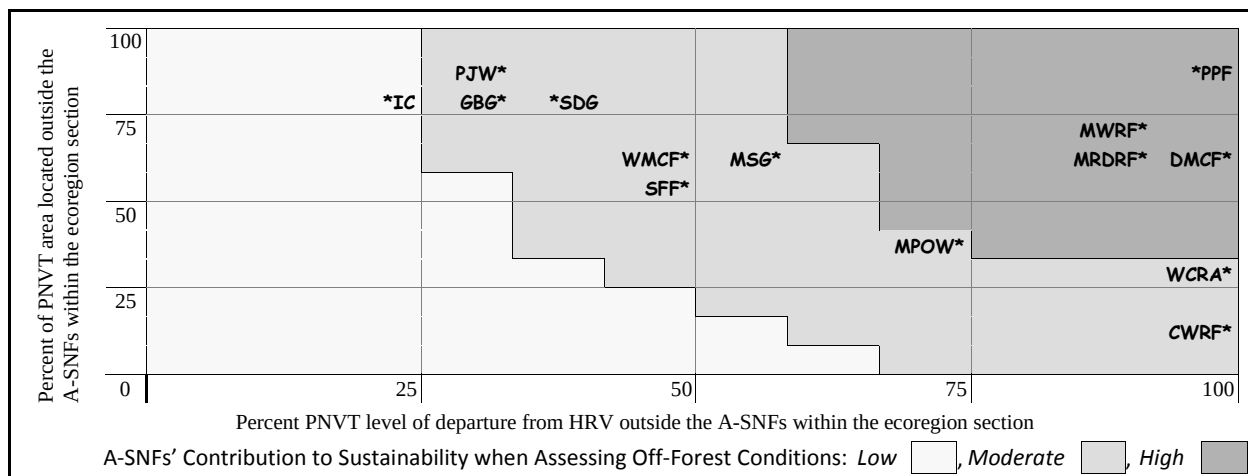


Figure 1. Spatial niche analysis, potential A-SNFs contribution to sustainability of PNVTs off-forests within the White Mountains-San Francisco Peaks-Mogollon Rim Ecoregion Section

Spatial Niche Analysis: As can be seen from table 3, the importance of the PNVTs within the A-SNFs to the sustainability of ecosystems represented by these vegetation communities varies with amount and distribution within and outside of the A-SNFs' boundaries. On one hand, the ponderosa pine Forest PNVT comprises nearly 30 percent of the A-SNFs, and represents only about 13 percent of the overall ecoregion section acreage. A similar situation exists with the piñon-juniper woodland, and Great Basin and semi-desert grassland PNVTs in that these PNVTs represent a relatively small percentage of the forests and an even smaller percent of what the ecoregion section contains overall; 11 percent and eight percent, nine percent and 10 percent, and five percent and 14 percent, respectively. Because these PNVTs are such a relatively small percentage of what the ecoregion section contains, overall, the ability of the A-SNFs to make a significant contribution to the ecological sustainability of these vegetation communities within the ecoregion section specifically and the Southwest in general is limited, but may be very important.

Conversely, all of the riparian forests and wetland/cienega riparian area PNVTs, individually, each make up less than two and one-half percent of the A-SNFs, however, they represent a significant portion of the total acreage of these vegetation types within the ecoregion section. A similar situation exists with the Madrean pine-oak woodland, spruce-fir, wet mixed conifer, and dry mixed conifer forest PNVTs in that these PNVTs contribute a relatively large percentage of the ecoregion sections acreage; overall, for these vegetation communities. The management of these communities within the A-SNFs is very influential and makes a significant contribution to the ecological sustainability of these PNVTs within the ecoregion section.

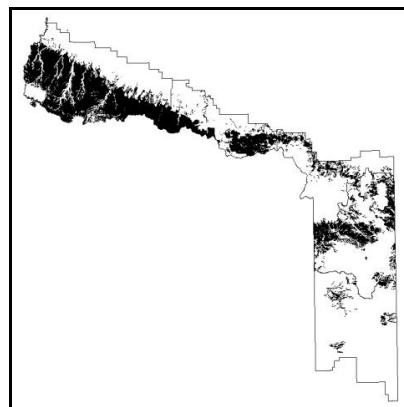
Potential Natural Vegetation Types (PNVTs)

A summary of information regarding each of the PNVTs found on the A-SNFs follows. Detailed PNVT assessments can be found in the 2008 Vegetation Specialist Report (A-SNFs, 2008a).

Forested PNVTs

Ponderosa pine forest (map 2, and appendix A maps 1 and 2): The ponderosa pine forest is widespread and at roughly 602,206 acres of NFS lands, or approximately 30 percent of the forests (table 4), represents the largest PNVT on the A-SNFs.

This PNVT generally occurs at elevations ranging from 6,000 to 9,000 feet on soils derived from igneous, metamorphic, and sedimentary parent material with good aeration and drainage. Ponderosa pine forest is typically bounded at the upper elevation by mixed conifer forest, and at the lower elevation by grassland, piñon-juniper forest, or chaparral, although extensive intergrading of species may occur at ecotone boundaries along gradients of slope, elevation, aspect, and moisture (Moir, 1993). Generally, annual precipitation ranges from 17.3 to 27.6 inches, with 45 to 55 percent coming between October 1st and March 31st (table 5).



Map 2. General location of the ponderosa pine forest PNVT

Table 5. Ponderosa pine forest PNVT temperature and moisture data (Laing et al., 1987)

Table 1.1. Understory pine forest: T-VVP temperature and moisture data (Zhang et al., 1997)									
Average Annual Air Temperature ¹ (° F)		Average Annual Precipitation (inches)				Average Snowfall ² (inches)		Number of Frost-free Days per Year	
low	high	low	high	percent occurring between Oct 1 st and Mar 31 st	annual	accumulation	major accumulation period		
41	45	17.3	27.6	45 - 55	39 - 47	6 - 14	Nov 1 st - Apr 30 th	100 - 130	

¹ Winters are cold

² Snowfall moisture is included in average annual precipitation data

The dominant species in this PNVT is ponderosa pine (*Pinus ponderosa* P. & C. Lawson var. *scopulorum* Engelm.)¹⁰. Other trees, such as Gambel oak (*Quercus gambelii* Nutt.), Rocky Mountain Douglas-fir (*Pseudotsuga menziesii* (Mirbel) Franco var. *glauca* (Beissn.) Franco), piñon pine (*Pinus edulis* Engelm.), and junipers (*Juniperus* spp. L.) may be present. There is typically a shrubby understory; for example, currants/gooseberries (*Ribes* spp. L.), and buckbrush (*Ceanothus* spp. L.), mixed with a variety of grasses and forbs, such as Arizona fescue (*Festuca arizonica* Vasey), mountain muhly (*Muhlenbergia montana* (Nutt.) A.S. Hitchc.), pine dropseed (*Blepharoneuron tricholepis* (Torr.) Nash), blue grama (*Bouteloua gracilis* (Willd. ex Kunth) Lag. ex Griffiths), fleabanes (*Erigeron* spp. L.), pussytoes (*Antennaria* spp. Gaertn.), and others, although this type sometimes occurs as savannah with extensive grasslands interspersed between widely spaced clumps or individual trees.

This PNVT is adapted to drought during the growing season, and has evolved several mechanisms to tolerate frequent, low intensity surface fires.

The A-SNFs' niche for this PNVT is approximately 13 percent of the White Mountains-San Francisco Peaks-Mogollon Rim ecoregion section (table 4). Within the Coconino Plateau Coniferous Forest and the White Mountains Woodland subsections, the A-SNFs contribute 30 and 25 percent of this PNVT, respectively. The A-SNFs' contribution to the sustainability of the ponderosa pine forest PNVT is high (figure 1). Nearly 87 percent (table 4) of this PNVT is located off-forest and has a severe departure rating

¹⁰ Plant names follow USDA Natural Resources Conservation Service's (USDA NRCS, 2013a) USDA PLANTS Database conventions and nomenclature. The PLANTS Database provides standardized information about the vascular plants, mosses, liverworts, hornworts, and lichens of the United States and its territories. The PLANTS Database is available at: <http://plants.usda.gov/java/>

from HRV.

Ponderosa pine forest PNVT burn severity¹¹ acres produced by the 2011 Wallow Fire can be seen in table 6. Overall, the fire did not cause a significant impact to the ponderosa pine forest PNVT. Somewhat more than 21 percent of this PNVT was within the perimeter of the Wallow Fire. Of the acres within the fire perimeter, less than 20 percent were burned, and of that; less than six percent (34,543 acres) were classified as undergoing a moderate to high severity burn (see Appendix C table 1 for a comparison of pre and post-2011 Wallow Fire ponderosa pine forest PNVT overstory vegetation structural states).

Table 6. 2011 Wallow Fire burn severity within the ponderosa pine forest PNVT for pre and post-2011 Wallow Fire structural states (see Appendix C table 1)

Item	Burn Severity by Soil Burn Severity Class					Outside Fire Perimeter	Total PNVT
	within fire perimeter						
	high	moderate	low	unburned	total		
Acres	11,809	22,734	79,821	14,488	128,852		
Percent	9.2	17.6	61.9	11.2	100		
	Total Ponderosa Pine Forest PNVT						
Acres	11,809	22,734	79,821	14,488	128,852	473,355	602,206
Percent	2.0	3.8	13.3	2.4	21.4	78.6	100

Current conditions within the ponderosa pine forest are highly departed from DCs and severely departed from HRV (table 2). With a Departure Index¹² (DI) of 77 and 94 percent, respectively, this PNVT is the most departed on the forests in relation to HRV and the 2nd most departed in respect to DC. With respect to the DI from DCs there is a considerable (56%) over-representation of all size and age trees, single or multi-storied with closed canopy cover (vegetation structural states G, H, I, L, and M) (see Appendix D figure 1 and Appendix D tables 1 through 10), as well as the existence of an atypical, early developmental state created by uncharacteristic wildfire represented by vegetation structural state N (11%). Historically, this forest type was characterized by open canopies which are now reflected in an under-representation (58%) of medium to very large size, single or multi-storied trees with open canopy cover (vegetation structural states D, E, J, and K). Historically these forests were dominated by very shade intolerant and shade intolerant shrub and tree species with open canopy characteristics. In addition, a more open canopy should promote an increase in shrubs and herbaceous understory diversity and abundance.

¹¹ Vegetation Burn Severity: The effect of a fire on vegetative ecosystem properties, often defined by the degree of scorch, consumption, and mortality of vegetation and the projected or ultimate vegetative recovery (Lentile et al., 2006; Morgan et al., 2001). The vegetation burn severity of a fire depends on the fire intensity and the degree to which ecosystem properties are (or are not) fire resistant. For example, a fire of exactly the same fireline intensity might kill thin-barked trees but have little effect on thick-barked trees, or it may root-kill rather than canopy-kill trees, which would result in greater mortality than initially observed (Parsons et al., 2010). Burn severity indicators are classified and defined as follows (Parsons et al., 2010): 1) Low Soil Burn Severity - Surface organic layers are not completely consumed and are still recognizable. Structural aggregate stability is not changed from its unburned condition, and roots are generally unchanged because the heat pulse below the soil surface was not great enough to consume or char any underlying organics. The ground surface, including any exposed mineral soil, may appear brown or black (lightly charred), and the canopy and herbaceous understory vegetation will likely appear "green." 2) Moderate Soil Burn Severity - Up to 80 percent of the pre-fire ground cover (litter and ground fuels) may be consumed but generally not all of it. Fine roots (~3/32 inch diameter) may be scorched but are rarely completely consumed over much of the area. The color of the ash on the surface is generally blackened with possible gray patches. There may be potential for recruitment of effective ground cover from scorched needles or leaves remaining in the canopy that will soon fall to the ground. The prevailing color of the site is often "brown" due to canopy needle and other vegetation scorch. Soil structure is generally unchanged. 3) High Soil Burn Severity - All or nearly all of the pre-fire ground cover and surface organic matter (litter, duff, and fine roots) is generally consumed and charring may be visible on larger roots. The prevailing color of the site is often "black" due to extensive charring. Bare soil or ash is exposed and susceptible to erosion, and aggregate structure may be less stable. White or gray ash (up to several centimeters in depth) indicates that considerable ground cover or fuels were consumed. Sometimes very large tree roots (> 3 inch diameter) are entirely burned extending from a charred stump hole. Soil is often gray, orange, or reddish at the ground surface where large fuels were concentrated and consumed.

¹² One of the simplest means of analyzing vegetative data is to look at the degree of association between sample sets and the level of similarity or dissimilarity (i.e., departure) between them (comparing current conditions to DC and HRV). Departure Indices (DI) were developed to measure the degree to which the defined DC and HRV sets of conditions, such as, amount and arrangement of vegetation successional structure, composition and cover classes, compare with the amount and arrangement of these same variables as they exist today. See appendix A table 4 for a more complete description of DIs and an explanation and example on how the DI was calculated for each PNVT.

Because the ponderosa pine forest makes up the largest PNVN on the A-SNFs it sequesters the greatest amount of carbon of any other PNVN.

Disturbances

Fire: According to Smith (2006b), the effects of fire suppression and livestock grazing on understory and herbaceous vegetation has been reviewed by Korb and Springer (2003), and effects of tree thinning and prescribed burning by Abella (2004). Generally, as the overstory density has increased, both total cover and species richness have decreased (Korb and Springer, 2003). Also, thinning and burning generally increase ground flora (understory and herbaceous) biomass, but composition and populations processes (such as recruitment) have been little studied in ponderosa pine forests (Abella, 2004). Ponderosa pine forests in the Southwest generally experienced a high frequency, low intensity surface fire regime, although on a small scale, individual trees occasionally may have incinerated via fuel ladders carrying surface fire into the crowns over small areas (Weaver, 1951 and 1952; Cooper, 1960; Dieterich, 1980; Covington and Moore, 1994; Swetnam and Baisan, 1996; Vankat, 2006). In PPF PNVN systems supporting a predominantly grass understory, fire regime group I historically burned frequently with low intensity fire. In PPF PNVN systems supporting a more robust shrub component, the fire regime group III historically burned with mixed severity (Barrett et al., 2010; Wahlberg et al., 2014). Beyond fire studies, little is known about historic disturbance factors that shaped ponderosa pine forests in historic times, because settlement and disturbance disruption occurred simultaneously. Based on its current DI rating, this PNVN has a fire regime condition class¹³ (FRCC) of III. Historic fire return interval (the average number of years between fires) is estimated to have been between 2.1 and 17.1 years (Vander Lee et al., 2006).

It is well understood that fire suppression has led to degradation of fire-dependent ecosystem (Beckage et al., 2005) by reducing its resilience (Larson et al., 2013). In addition, fire plays a major role in shaping our environment and maintaining biodiversity. When fire regimes are altered, they can contribute to climate-changing greenhouse gases into the environment, provide a pathway for harmful invasive species, alter the hydrology of a site, and present a direct risk to biodiversity and human habitation (Shlisky et al., 2007). Appropriately applied fire can play a critical role in restoration and maintenance of this frequent fire PNVN; however, fires that occur at a frequency or season outside the natural fire regime can also have negative effects on community structure and species composition (Platt et al., 1988 and 2002; Glitzenstein et al., 1995; Breckage et al., 2005). The restoration and management of fire dependent ecosystems

¹³ FRCC reflects the degree of departure of the PNVN's current fire regime from its reference condition (HRV) fire regime (Hann & Bunnell, 2001; Hann et al., 2005). Condition classes rank the changes in the fire regime and the resulting proportions of vegetation states, and are represented by one of three classes (Schmidt et al., 2002): FRCC I - Within reference conditions (0-33% departure). Fire regimes within or near historical range (e.g. fire frequencies have departed from historical range by no more than one return interval). There is a low risk of losing key ecosystem components. Vegetation attributes (composition and structure) are intact and functioning within historical range. These areas can be maintained within the historical fire regime by such treatments as fire use; FRCC II - moderately departed from reference conditions (34-66% departure). Fire regimes have been moderately altered from their historical range (e.g. fire frequencies have either increased or decreased from range by more than one interval). Moderate changes in fire size, frequency intensity, severity or landscape pattern has resulted. There is a moderate risk of losing key ecosystem components. Vegetation attributes (composition and structure) have been moderately altered from the historical range. These areas may need moderate levels of restoration treatments, such as fire use, hand or mechanical treatments to be restored to historical regime; and FRCC III - severely departed from reference conditions (67-100% departure). Fire regimes have been significantly altered from their historical range (e.g. fire frequencies have departed from historical range by multiple return intervals). Dramatic changes in fire size, frequency, intensity, severity or landscape pattern has resulted. Vegetation attributes (composition and structure) have been significantly altered from the historical range. These areas may need high levels of restoration treatments, such as hand or mechanical before fire is used to restore to historical fire regimes. The higher the condition class number the more altered the ecosystem is from reference condition.

requires ecologically appropriate fire management that, ideally, should be based on natural fire regimes (Cissel et al., 1999; Breckage et al., 2005). This should be true for all of the PNVTs on the A-SNs as well.

Non-native Invasive Plants: Non-native invasive plants infest roughly 8,950 to 13,450 acres; primarily mullein (*Verbascum thapsus* L.), weeping lovegrass (*Eragrostis curvula* (Schr.) Nees), and bull thistle (*Cirsium vulgare* (Savi) Ten.). See the Invasive Species Specialist Report for more information concerning invasive plants. According to Jordan et al. (2008), noxious and invasive weeds are of special concern because there is ample evidence that non-native invasive plants can modify the physical and/or chemical attributes of soil, including inputs and cycling of N and other elements (Ehrenfeld, 2003; Haubensak et al., 2004; Hawkes et al., 2005; Sperry et al., 2006; Norton et al., 2007), pH (Kourtev et al., 2003), and soil organic matter and aggregation (Saggar et al., 1999). There is also evidence of direct modification of various components of the biotic composition of invaded soil, e.g., affecting the soil food web (Duda et al., 2003), total soil microbial communities (Kourtev et al., 2002a and 2002b; Kourtev et al., 2003), and mutualistic fungi (Allen et al., 2003; Hawkes et al., 2006; Mummey and Rillig, 2006; Mack and Rudgers, 2008).

Non-native plant invasions are widely recognized as significant threats to biodiversity conservation worldwide (Brooks et al., 2004; Brooks, 2008). One way invasions can affect native ecosystems is by changing fuel properties (Ramakrishnan and Vitousek, 1989), which can in turn affect fire behavior and, ultimately, alter fire regime characteristics such as frequency, intensity, extent, type, and seasonality of fire (Levine et al., 2003; Brooks et al., 2004; Brooks, 2008). If the regime changes subsequently promote the dominance of the invaders, then an invasive plant-fire regime cycle can be established (Ramakrishnan and Vitousek, 1989). This change in fire regime is one of the most significant ways that plant invasions can affect ecosystems (Brooks, 2008). There are other cases, in Hawaii (Mueller-Dombois, 1973), California, and Australia (Vivrette and Muller, 1977) where non-native invasive species have altered ecosystem processes during secondary succession, by creating boggy conditions (e.g., Hawaii) and changing soil properties; and altering soil chemistry (e.g., California, Australia).

Roads: According to the forests' geographic information system (GIS) database, approximately 3,200 miles of roads and motorized trails have been constructed within this PNVT; this equates to 3.5 linear miles of road per square mile. Roads and trails are one of the primary access points for noxious and invasive weed transport and their right-of-way are areas of establishment.

Insects and Disease: For thousands of years, southwestern forest trees have been host to several species of insects, pathogenic fungi, and parasitic plants (Dahms and Geils, 1997; Lynch et al., 2010). Unfortunately, the earliest reports of bark beetles on ponderosa pine date from the early 1900s, after settlement (Dahms and Geils, 1997), so there are no accounts of historic insect outbreak periodicity. However, between 2000 and 2004, insects and disease have impacted (weakened and/or caused mortality) approximately 28 percent of this PNVT.

Herbivory: According to Smith (2006b), the disruption of historic fire regimes by introduced grazing animals has been well documented in southwestern ecosystems, and ponderosa pine forests were utilized as summer range for large numbers of sheep and cattle (Allen, 1989; Covington and Moore, 1994; Swetnam et al., 1999). There is evidence that heavy grazing can degrade arid rangelands (Todd and Hoffman, 1999), so it is important not to make the assumption that livestock have no impact on arid and semi-arid rangeland locations around the world (Fernandez-Gimenez and Allen-Diaz, 1999; Illius and O'Connor 1999; Reid and Fernandez-Gimenez, no-date), as well as in the American southwest. Herbivory by cattle also reduces competition by grasses with conifer seedlings, allowing them to expand or encroach into grasslands (Dahms and Geils, 1997). Herbivory has had detrimental effects on the composition, structure and function of forested ecosystems, and has led to a decrease in native species richness (Fleischner et al., 1994). And according to Beschta et al. (2012), historical and contemporary livestock

production, the most widespread and long-running commercial use of public lands, can alter vegetation, soils, hydrology, and wildlife species composition and abundances in ways that exacerbate the effects of climate change on these resources. Excess abundance of native ungulates (e.g., deer (*Odocoileus hemionus* and *O. virginianus*), or elk (*Cervus elaphus*)) and feral horses and burros (*Equus* spp.) also add to these impacts.

The most current A-SNFs data, 2007-2008 (USFS, 2008b), indicates that within the capable¹⁴ grazing lands (94% of the total PNVT's area) associated with the ponderosa pine forest (table 7); approximately 85 percent of the herbaceous understory is in low to moderately-low ecological status¹⁵ or very-poor to poor range condition¹⁶, while only 15 percent is in moderately-high ecological status or fair range condition. Movement in the direction of low to moderately-low ecological status has resulted in lower levels of herbaceous vegetation ground cover and lower levels of vigor and growth, as well as species compositional changes, and possible changes in site potential. Total herbage production is considered to be correlated with the condition of the range (Osborn, 1956; Goebel and Cook, 1960). The majority of the herbaceous understory vegetation within the ponderosa pine forest capable grazing lands is highly to severely departed from DCs. According to Osborn (1952), for maximum moisture infiltration, two conditions are essential: 1) an adequate surface [vegetation] cover to cushion the impact of the falling raindrops and 2) favorable soil conditions associated with a relatively advanced stage of ecological succession for the site, typical of one of the higher range condition classes.

Threats: The most important and far reaching threats under agency authority for this PNVT include managing the legacy of past livestock grazing, which removed fine fuels needed for carrying frequent, low intensity surface fires; forest management practices (vegetation treatments), which have changed forest age class distribution, overstory and understory composition, density, and cover values, and greatly reduced understory productivity; and fire suppression, which effectively ended the frequent fire regime typical of this forest type. There are also areas (roughly 6%) where the soils are in unsatisfactory condition¹⁷. According to Printz et al. (2014), soil health is the capacity of a soil to maintain its function

¹⁴ The grazing capability evaluation is a qualitative expression of the inherent ability of an ecosystem to support grazing use by various kinds and classes of livestock while maintaining sustainability of the resource and providing for multiple uses and ecosystem services. Grazing capability of a land area is dependent upon the interrelationship of the soils, topography, vegetation, forage production, and animal behavior (USFS, 2013). Because areas classified as having no grazing capability are not allocated for livestock grazing they are not usually evaluated for range condition and ecological status, therefore this information is generally not collected from these areas and is unavailable, or incomplete. In addition, other resource program areas do not generally collect this same type of data as well, so again, this type of information is not available outside of capable grazing areas.

¹⁵ Ecological status is the degree of similarity or dissimilarity (i.e., departure) between the existing vegetation (all components and their characteristics) and existing soil conditions compared to the potential natural plant community and the desired soil condition on a site. The present state of a TES map unit stated in terms of specific values or potentials with respect to species composition, ground cover, and soil characteristics. Ecological status is often evaluated on the basis of similarity indices between current conditions and the potential natural plant community (USFS, 2013). Ecological status ratings are: high, moderately-high, moderate-low, and low (FSH 2209.21. R3).

¹⁶ According to McGinty and White (2000) range condition is the key to sustaining ranching productivity by sustaining the forage base. Range condition is the present state of vegetation of a range site in relation to the climax (potential natural) plant community for that site (Stoddart et al., 1975). It is an expression of the relative degree to which the kinds, proportions, and amounts of plants in a plant community resemble that of the climax plant community for the site (USFS, 2013). The adjective descriptions of range condition are: excellent, good, fair, poor and very-poor (FSH 2209.21. R3). According to Dyksterhuis (1948 and 1959); Pieper and Beck (1990); and Holecchek et al. (1989 and 1998), range condition is measured in degrees of departure from climax; excellent range condition would represent climax, and very poor range condition would represent the greatest departure from climax. The relationship between ecological status and range condition are: excellent and good range condition represents high ecological status, signifying no or low departure from desired conditions; fair range condition represents moderately-high ecological status, signifying moderate departure from desired conditions; poor range condition represents moderately-low ecological status, signifying high departure from desired conditions; and very-poor range conditions represent low ecological status, signifying severe departure from desired conditions (see Appendix D - Addendum tables 1 and 2).

¹⁷ Soil condition (refined) is a qualitative rating developed within the Southwestern Region of the Forest Service that provides an overall picture of soil condition vital in sustaining ecosystems. It is based on three soil functions; the ability of soil to resist erosion, to infiltrate water, and to recycle nutrients. From Forest Service Handbook (FSH 2509.18 R-3 Supplement), soil condition class Unsatisfactory is defined as - Indicators signify that loss of soil function has occurred. Degradation of vital soil functions result in the inability of soil to maintain resource values, sustain outputs, and recover from impacts. Soils rated in the unsatisfactory category are candidates for improved management practices or

and flow of ecosystem services given a specific set of physical, chemical, and environmental boundaries (Doran and Parken, 1994; USDA NRCS, 2013b). When a soil's health deteriorates, its capacity to support and regulate ecosystems is diminished, affecting energy flows, nutrient cycling, and productivity. Overall, based on VDDT modeling, under current management, there is a change in the DI from current to DC and HRV, which would indicate movement toward DC, and HRV, and a more properly functioning system. This trend appears to be consistent over all modeling periods out to 50 years. See Appendix E for a more complete discussion of the threats affecting the ponderosa pine forest and the risks they pose to this PNVT.

Table 7. Most current (USFS, 2008b) understory vegetation ecological status, range condition, and departure from desired conditions (DC) on capability grazing lands within the ponderosa pine forest PNVT on the A-SNFs

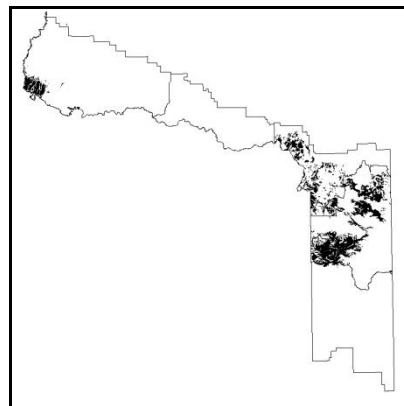
No Capability Grazing Lands (DC departure status unknown)†	Vegetation Ecological Status ¹⁵ and Range Condition ^{16, 18} Ratings of Capable Grazing Lands within the Ponderosa Pine Forest PNVT on the A-SNFs‡														Total Acres	
	high ecological status						moderately-high ecological status		moderately-low ecological status		low ecological status		no data (DC departure status unknown)			total acres
	excellent range condition		good range condition		fair range condition		poor range condition		very-poor range condition							
	acres	%	acres	%	acres	%	acres	%	acres	%	acres	%				
	34,902	5.8	80	0.0	6,776	1.2	76,353	13.5	394,874	69.6	85,409	15.1	3,812	0.7		
DC departure	no		low		moderate		high		severe							

† See footnote 14 on page 18

‡ See footnotes 15 and 16 on page 18

Wet mixed conifer forest (map 3, and appendix A maps 1 and 2): The wet mixed conifer forest is found primarily on the Alpine, Black Mesa, and Springerville RDs and at roughly 177,995 acres of NFS lands, or approximately 9 percent of the forests (table 4), represents the fifth largest PNVT on the A-SNFs. This PNVT is also known as *Cool/Moist Mixed Conifer* (Margolis et al., 2013) and *Mixed Conifer with Aspen*.

Wet mixed conifer forests range in elevation from approximately 9,000 to 11,500 feet along a variety of gradients including gentle to very steep mountain slopes. Generally, annual precipitation ranges from 22.8 to 31.9 inches, with 50 percent coming between October 1st and March 31st (table 8).



Map 3. General location of the wet mixed conifer forest PNVT

Engelmann spruce (*Picea engelmannii* Parry ex Engelm.), blue spruce (*P. pungens* Engelm.), and subalpine fir (*Abies lasiocarpa* (Hook.) Nutt.), or corkbark fir (*A.*

restoration designed to recover soil functions.

¹⁸ Range condition as evaluated and ranked by the Forest Service, is a subjective expression of the status or health of the vegetation and soil relative to the combined potential to produce a sound and stable biotic community. According to Parker (1954), the criteria most frequently used in describing condition of the range include floral composition, plant density, and comparative vigor of forage species, total forage production, litter accumulation, and soil stability (Goebel and Cook, 1960). Many of the earliest investigators regarded change of vigor as one of the important indicators of change in range condition since it is frequently the first response to a change in management (Weaver and Darland, 1947; Humphrey, 1949; Pechanec, 1949; Parker, 1954; Johnson, 1956; Short and Woolfolk, 1956; Goebel and Cook, 1960; Blaisdell et al., 1982; Reece et al., 1991; Heitschmidt et al., 1998; Tunnell, 2004; among others). Soundness and stability are evaluated relative to a standard that encompasses the composition, density, and vigor of the vegetation, and physical characteristics of the soil (FSH 2209.21.40 R3, page 3 of 46). Although the *Allotment Analysis Handbook* (FSH 2209.21 R3) was officially removed from the directive system, this definition is used because the above information was derived (collected, calculated, and evaluated) using the procedures outlined in the FSH 2209.21 R3 over a number of years.

lasiocarpa (Hook.) Nutt. var. *arizonica* (Merriam) Lemmon) dominate this PNVT either mixed or alone. Rocky Mountain Douglas-fir along with mixed conifer and quaking aspen stands may also be present in this system for long periods without regeneration. Herbaceous species may include but are not limited to red baneberry (*Actaea rubra* (Ait.) Willd.), starry false Solomon's seal (*Maianthemum stellatum* (L.) Link), sprucefir fleabane (*Erigeron eximius* Greene), thimbleberry (*Rubus parviflorus* Nutt.), and subalpine lupine (*Lupinus arcticus* S. Wats. ssp. *subalpinus* (Piper & B.L. Robins.) D. Dunn).

Table 8. Wet mixed conifer forest PNVT temperature and moisture data (Laing et al., 1987)

Average Annual Air Temperature ¹ (° F)		Average Annual Precipitation (inches)			Average Snowfall ² (inches)			Number of Frost-free Days per Year
low	high	low	high	percent occurring between Oct 1 st and Mar 31 st	annual	accumulation	major accumulation period	
36	43	22.8	31.9	50	55 - 67	20 - 39	Oct 1 st - Apr 30 th	70 - 90

¹ Winters are cold

² Snowfall moisture is included in average annual precipitation data

The A-SNFs' niche for this PNVT is approximately 46 percent of the White Mountains-San Francisco Peaks-Mogollon Rim ecoregion section (table 4). Within the White Mountains Woodland and White Mountains Scarp Woodland-Coniferous Forest subsections, the A-SNFs contribute 93 and 74 percent of this PNVT, respectively. The A-SNFs' contribution to the sustainability of the wet mixed conifer forest PNVT is moderate (figure 1). With nearly 54 percent (table 4) of this PNVT located off-forest and having a high departure rating from HRV.

Wet mixed conifer forest PNVT burn severity acres produced by the 2011 Wallow Fire can be seen in table 9. Overall, the fire did cause a significant impact to the wet mixed conifer forest PNVT. Somewhat more than 75 percent of this PNVT was within the perimeter of the Wallow Fire. Of the acres within the fire perimeter, roughly 82 percent were burned, and of that; 50 percent (67,244 acres) were classified as experiencing a moderate to high severity burn. According to Margolis et al. (2011), stand-replacing fire patches as large as 500 to 1,250 acres burning in the upper elevations (> 8,500 feet) of the wet mixed conifer forest may be within the historical range of variability of this PNVT (see Appendix C table 2 for a comparison of pre and post-2011 Wallow Fire wet mixed conifer forest PNVT overstory vegetation structural states).

Table 9. 2011 Wallow Fire burn severity within the wet mixed conifer forest PNVT (see Appendix C table 2)

Item	Burn Severity by Soil Burn Severity Class					Outside Fire Perimeter	Total PNVT
	within fire perimeter						
	high	moderate	low	unburned	total		
Acres	47,409	19,835	43,494	23,702	134,440		
Percent	35.3	14.8	32.4	17.6	100		
	Total Wet Mixed Conifer Forest PNVT						
Acres	47,409	19,835	43,494	23,702	134,440	43,555	177,995
Percent	26.6	11.1	24.4	13.3	75.5	24.5	100

Current conditions within the wet mixed conifer forest are moderately departed from DC and highly departed with respect to HRV (table 2). With a DI of 54 and 61 percent, respectively, this PNVT is the 6th most departed on the forests from DC¹⁹ and 7th most departed from HRV, respectively. With respect to the DI there is an over-representation (37%) of vegetation structural states that are lacking or have limited aspen regeneration (vegetation structural states K, L, M, N, O, P, Q, R, and S) due primarily to the

¹⁹ Wet mixed conifer forest PNVT has the equivalent woody overstory departure from DC as the montane/subalpine grasslands PNVT (montane/subalpine grasslands PNVT should not have a significant woody overstory; < 10 percent).

presence of elk (see Appendix D figure 2 and Appendix D tables 11 through 20) and a sizeable under-representation (38%) of large to very large size, single- or multi-storied trees with closed canopy cover (vegetation structural states E and F). Historically these forests were dominated by very shade tolerant, shade tolerant, and mixed shade tolerant shrub and tree species with closed canopy characteristics.

Disturbances

Fire: Historic fire regimes of the WMCF PNVNT is characterized by historic fire regime group IIb (Barrett et al., 2010; Wahlberg et al., 2014), with an average fire return interval of 50-100 years from both stand replacing and mixed severity fire. Small scale, stand replacing fire events play an important role in aspen regeneration, and upwards of 150 to 400 years for high intensity, stand replacing crown fires (Fulé et al., 2003, Swetnam et al., 2005, Vankat, 2006; Vander Lee et al., 2006). Based on its current DI rating, this PNVNT has a FRCC of II.

Non-native Invasive Plants: Non-native invasive plants infest roughly 490 to 750 acres; primarily mullein and bull thistle. According to Jordan et al. (2008), noxious and invasive weeds are of special concern because there is ample evidence that non-native invasive plants can modify the physical and/or chemical attributes of soil, including inputs and cycling of N and other elements (Ehrenfeld 2003; Haubensak et al., 2004; Hawkes et al., 2005; Sperry et al., 2006; Norton et al., 2007), pH (Kourtev et al., 2003), and soil organic matter and aggregation (Saggar et al., 1999). There is also evidence of direct modification of various components of the biotic composition of invaded soil, e.g., affecting the soil food web (Duda et al., 2003), total soil microbial communities (Kourtev et al., 2002a and 2002b; Kourtev et al., 2003), and mutualistic fungi (Allen et al., 2003; Hawkes et al., 2006; Mummey and Rillig, 2006; Mack and Rudgers, 2008).

Non-native plant invasions are widely recognized as significant threats to biodiversity conservation worldwide (Brooks et al., 2004; Brooks 2008). One way invasions can affect native ecosystems is by changing fuel properties, which can in turn affect fire behavior and, ultimately, alter fire regime characteristics such as frequency, intensity, extent, type, and seasonality of fire (Levine et al., 2003; Brooks et al., 2004; Brooks, 2008). If the regime changes subsequently promote the dominance of the invaders, then an invasive plant-fire regime cycle can be established. This change in fire regime is one of the most significant ways that plant invasions can affect ecosystems (Brooks, 2008).

Roads: According to the forests' GIS database, approximately 840 miles of roads and motorized trails have been constructed within this PNVNT; this equates to roughly 3.0 linear miles of road per square mile. Roads and trails are one of the primary access points for noxious and invasive weed transport and their right-of-way are areas of establishment.

Insects and Disease: Historically, spruce beetles (*Dendroctonus rufipennis*) have had the greatest impact on wet mixed conifer forests of the central and southern Rocky Mountains, and in the Southwest (Alexander, 1987). Historic photographs and tree-ring analysis indicate that there have been six major outbreaks since the middle 1800s, and between 1850 and 1880 a very large-scale outbreak affected forests from northern New Mexico to northern Colorado (Baker and Veblen, 1990). These outbreaks are considered part of the natural variability of spruce-fir with wet mixed conifer forests, and spruce beetles likely persist in small windthrow areas (Veblen et al., 1991) and in live trees (Veblen et al., 1994).

Herbivory: The disruption of historic fire regimes by introduced grazing animals has been well documented in southwestern ecosystems, and high elevation wet mixed conifer forests were well utilized as summer range for large numbers of sheep and cattle (Carlson, 1969; Allen, 1989; Covington and Moore, 1994; Bahre, 1998; Swetnam et al., 1999). Herbivory has had detrimental effects on the composition, structure and function of forested ecosystems, and has led to a decrease in native species

richness (Fleischner et al., 1994). It has also been suggested (Smith, 2006c) that the extinction of large carnivores such as the Mexican wolf (*Canis lupus baileyi*) and grizzly bear (*Ursus arctos horribilis*) has affected at least one component of the mixed conifer forest, quaking aspen, which experiences increased mortality due to high levels of herbivory by native and introduced ungulates (elk), and livestock. Herbivory has had detrimental effects on the composition, structure and function of forested ecosystems, and has led to a decrease in native species richness (Fleischner et al., 1994). Predator control has allowed herbivores to increase in numbers, and to exert longer duration and higher intensity grazing and browsing effects on select vegetation types, especially aspen (Shepperd and Fairweather, 1994; Romme et al., 1995; Kay, 1997; Ripple et al., 2001; Fairweather et al., 2014).

The most current A-SNFs data, 2007-2008 (USFS, 2008b), indicates that within the capable grazing lands (45% of the total PNVT's area) associated with the wet mixed conifer forest (table 10); approximately 74 percent of the herbaceous understory is in low to moderately-low ecological status or very-poor to poor range condition, while only 21 percent is in moderately-high ecological status or fair range condition. Movement in the direction of low to moderately-low ecological status has resulted in lower levels of herbaceous vegetation ground cover and lower levels of vigor and growth, as well as species compositional changes, and possible changes in site potential. Total herbage production is considered to be correlated with the condition of the range (Osborn, 1956; Goebel and Cook, 1960). The majority of the herbaceous understory vegetation within the wet mixed conifer forest capable grazing lands is highly to severely departed from DCs. According to Osborn (1952), for maximum moisture infiltration, two conditions are essential: 1) an adequate surface [vegetation] cover to cushion the impact of the falling raindrops and 2) favorable soil conditions associated with a relatively advanced stage of ecological succession for the site, typical of one of the higher range condition classes.

Table 10. Most current (USFS, 2008b) understory vegetation ecological status, range condition, and departure from desired conditions (DC) on capability grazing lands within the wet mixed conifer forest PNVT on the A-SNFs

No Capability Grazing Lands (DC departure status unknown)†		Vegetation Ecological Status ¹⁵ and Range Condition ^{16, 18} Ratings of Capable Grazing Lands within the Wet Mixed Conifer Forest PNVT on the A-SNFs‡														Total Acres
		high ecological status		moderately-high ecological status		moderately-low ecological status		low ecological status		no data (DC departure status unknown)		total acres				
		excellent range condition	good range condition	fair range condition	poor range condition	very-poor range condition										
acres	%	acres	%	acres	%	acres	%	acres	%	acres	%	acres	%			
97,266	54.6	89	0.1	2,827	3.5	17,119	21.2	48,496	60.1	11,533	14.3	665	0.8	80,729	177,995	
DC departure		no		low		moderate		high		severe						

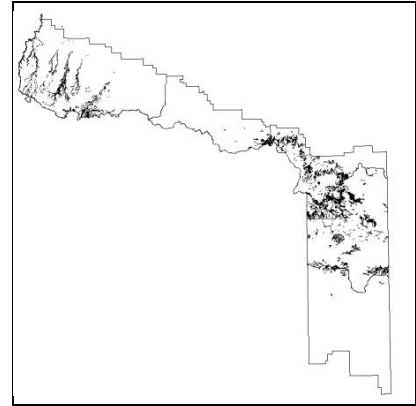
† See footnote 14 on page 18

‡ See footnotes 15, 16 and 18 on page 18

Threats: The most important and far reaching threat under agency authority for this PNVT is the potential for human-caused fires, and forest management practices (vegetation treatments), which have changed forest age class distribution, overstory and understory composition, density, and cover value. Overall, based on VDDT modeling, under current management, there is a change in the DI from current to DC and HRV, which would indicate continued reduction in departure with movement toward DC, and HRV, and a more properly functioning system. These trends appear to stabilize after 50 years. See Appendix E for a more complete discussion of the threats affecting the wet mixed conifer forest and the risks they pose to this PNVT.

Dry mixed conifer forest (map 4, and appendix A maps 1 and 2): The dry mixed conifer forest is widespread and at roughly 147,885 acres of NFS lands, or approximately 7 percent of the forests (table 4), represents the sixth largest PNVT on the A-SNFs. This PNVT is also known as *Warm/Dry Mixed Conifer* (Margolis et al., 2013) and *Mixed Conifer with Frequent Fire* (Reynolds et al., 2013).

This PNVT contains a mix of dominant and co-dominant species in both dry and moister environments in the Rocky Mountain (petran), Madrean montane and subalpine coniferous forest biotic communities at elevations between 7,500 and 10,000 feet. Dominant and co-dominant vegetation varies in relation to elevation and moisture availability. Generally, annual precipitation ranges from 15.7 to 31.9 inches, with 45-55 percent coming between October 1st and March 31st (table 11).



Map 4. General location of the dry mixed conifer forest PNVT

This PNVT is situated between the lower-drier ponderosa pine, and pine-oak forests, and higher-moister wet mix conifer and spruce-fir forests. In the lower and drier elevation portions within this PNVT, to a greater or lesser degree, Gambel oak, ponderosa pine, piñon and alligator juniper (*Juniperus deppeana* Steud.) may co-dominate.

Other vegetation that may be present but does not co-dominate in these higher and mesic areas includes both Engelmann and blue spruce. The herbaceous understory vegetation is comprised of a wide variety of shrubs, grasses, sedges, rushes, and forbs; the composition depends on soil type, aspect, elevation, disturbance history and other factors.

The A-SNFs' niche for this PNVT is approximately 30 percent of the White Mountains-San Francisco Peaks-Mogollon Rim ecoregion section (table 4). Within the White Mountains Woodland and Coconino Plateau Coniferous Forest subsections, the A-SNFs contribute 67 and 59 percent of this PNVT, respectively. The A-SNFs' contribution to the sustainability of the dry mixed conifer forest PNVT is high (figure 1). With nearly 62 percent (table 4) of this PNVT located off-forest and having a high departure rating from HRV.

Table 11. Dry mixed conifer forest PNVT temperature and moisture data (Laing et al., 1987)

Average Annual Air Temperature ¹ (° F)		Average Annual Precipitation (inches)				Average Snowfall ² (inches)		Number of Frost-free Days per Year
low	high	low	high	percent occurring between Oct 1 st and Mar 31 st	annual	accumulation	major accumulation period	
37	50	15.7	31.9	45 - 55	39 - 59	14 - 35	Oct 1 st - Apr 30 th	70 - 130

¹ Winters are cold

² Snowfall moisture is included in average annual precipitation data

Dry mixed conifer forest PNVT burn severity acres produced by the 2011 Wallow Fire can be seen in table 12. Overall, the fire did cause a significant impact to the dry mixed conifer forest PNVT. Somewhat more than 52 percent of this PNVT was within the perimeter of the Wallow Fire. Of the acres within the fire perimeter, roughly 81 percent were burned, and of that; 41 percent (31,665 acres) were classified as undergoing a moderate to high severity burn (see Appendix C table 3 for a comparison of pre and post-2011 Wallow Fire dry mixed conifer forest PNVT overstory vegetation structural states).

Table 12. 2011 Wallow Fire burn severity within the dry mixed conifer forest PNVT (see Appendix C table 3)

Item	Burn Severity by Soil Burn Severity Class					Outside Fire Perimeter	Total PNVT
	within fire perimeter						
	high	moderate	low	unburned	total		
Acres	19,412	12,253	31,462	14,813	77,940		
Percent	24.9	15.7	40.4	19.0	100		
	Total Dry Mixed Conifer Forest PNVT						
Acres	19,412	12,253	31,462	14,813	77,940	69,946	147,885
Percent	13.1	8.3	21.3	10.0	52.7	47.3	100

Current conditions within the dry mixed conifer forest are highly departed from DC and HRV (table 2). With a DI of 67 and 77 percent, respectively, this PNVT is the 3rd most departed on the forests from both DC and HRV. With respect to the DI there is an over-representation (56%) of all size and age trees, single or multi-storied with closed canopy cover (vegetation structural states G, H, I, L, and M) (see Appendix D figure 3 and Appendix D tables 21 through 30), as well as the existence of an atypical, early developmental state created by uncharacteristic wildfire represented by vegetation structural state N (25%). Historically, this forest type was characterized by open canopies which are now reflected in an under-representation (52%) of medium to very large size, single or multi-storied trees with open canopy cover (vegetation structural states D, E, J, and K). Historically these forests were dominated by very shade intolerant and shade intolerant shrub and tree species with open canopy characteristics. In addition, a more open canopy should promote an increase in shrubs and herbaceous understory diversity and abundance.

Disturbances

Fire: According to Smith (2006c), the disruption of historic fire regimes by introduced grazing animals has been well documented in southwestern ecosystems, and high elevation mixed conifer forests were well utilized as summer range for large numbers of sheep and cattle (Carlson, 1969; Allen, 1989; Covington and Moore, 1994; Swetnam et al., 1999). The DMCF PNVT is characterized by historical fire regime group I, with an average fire return interval of 9-22 years from primarily non-lethal surface fire, though less frequent mixed severity fires also occurred (Wahlberg et al., 2014). This is also supported by Vander Lee et al. (2006). Little is known about pre-settlement processes in mixed conifer forests, except regarding fire, drought, insects, and their interaction. Prior to Euro-American settlement times, the fire regime of mixed conifer forests was a mixture of infrequent, small patch size, high intensity crown fires interspersed with more frequent, widespread and low intensity surface fires (Touchan et al., 1996). Based on its current DI rating, this PNVT has a FRCC of III.

Non-native Invasive Plants: Non-native invasive plants infest roughly 2,650 to 4,000 acres; primarily mullein and bull thistle. See the Invasive Species Specialist Report for more information concerning invasive plants. According to Jordan et al. (2008), noxious and invasive weeds are of special concern because there is ample evidence that non-native invasive plants can modify the physical and/or chemical attributes of soil, including inputs and cycling of N and other elements (Ehrenfeld, 2003; Haubensak et al., 2004; Hawkes et al., 2005; Sperry et al., 2006; Norton et al., 2007), pH (Kourtev et al., 2003), and soil organic matter and aggregation (Saggar et al., 1999). There is also evidence of direct modification of various components of the biotic composition of invaded soil, e.g., affecting the soil food web (Duda et al., 2003), total soil microbial communities (Kourtev et al., 2002a and 2002b; Kourtev et al., 2003), and mutualistic fungi (Allen et al., 2003; Hawkes et al., 2006; Mummey and Rillig, 2006; Mack and Rudgers, 2008).

Non-native plant invasions are widely recognized as significant threats to biodiversity conservation worldwide (Brooks et al., 2004; Brooks, 2008). One way invasions can affect native ecosystems is by

changing fuel properties, which can in turn affect fire behavior and, ultimately, alter fire regime characteristics such as frequency, intensity, extent, type, and seasonality of fire (Levine et al., 2003; Brooks et al., 2004; Brooks, 2008). If the regime changes subsequently promote the dominance of the invaders, then an invasive plant-fire regime cycle can be established. This change in fire regime is one of the most significant ways that plant invasions can affect ecosystems (Brooks, 2008).

Roads: According to the forests' GIS database, approximately 520 miles of roads and motorized trails have been constructed within this PNVT; this equates to roughly 2.3 linear miles of road per square mile. Roads and trails are one of the primary access points for noxious and invasive weed transport and their right-of-way are areas of establishment.

Insects and Disease: According to Smith (2006c); Swetnam and Lynch (1989) found that there have been eight or nine outbreaks of western spruce budworm (*Choristoneura occidentalis*) since 1700, with average return intervals of 30 to 40 years. Western spruce budworm populations periodically increase to outbreak proportions, and cause extensive defoliation, tree mortality and altered succession in several mixed conifer species. Lynch and Swetnam (1992) studied several old-growth mixed conifer sites in New Mexico and found evidence of multiple outbreaks of western spruce budworm, but found that outbreaks were not focused on old-growth stands. Several other species of insects as well as fungi currently make use of mixed conifer tree species. Between 2000 and 2004, insects and disease have impacted approximately 47 percent of this PNVT.

Herbivory: It has been suggested (Smith, 2006c) that the extinction of large carnivores such as the Mexican wolf and grizzly bear has affected at least one component of the mixed conifer forest, quaking aspen, which experiences increased mortality due to high levels of herbivory by native and introduced ungulates (elk), and livestock. Herbivory has had detrimental effects on the composition, structure and function of forested ecosystems, and has led to a decrease in native species richness (Fleischner et al., 1994). Predator control has allowed herbivores to increase in numbers, and to exert longer duration and higher intensity grazing and browsing effects on select vegetation types, especially aspen (Shepperd and Fairweather, 1994; Romme et al., 1995; Kay, 1997; Ripple et al., 2001; Fairweather et al., 2014).

The most current A-SNFs data, 2007-2008 (USFS, 2008b), indicates that within the capable grazing lands (71% of the total PNVT's area) associated with the dry mixed conifer forest (table 13); approximately 78 percent of the herbaceous understory is in low to moderately-low ecological status or very-poor to poor range condition, while only 19 percent is in moderately-high ecological status or fair range condition. Movement in the direction of low to moderately-low ecological status has resulted in lower levels of herbaceous vegetation ground cover and lower levels of vigor and growth, as well as species compositional shifts, and possible changes in site potential. Total herbage production is considered to be correlated with the condition of the range (Osborn, 1956; Goebel and Cook, 1960). The majority of the understory within the dry mixed conifer forest capable grazing lands is highly to severely departed from DCs. According to Osborn (1952), for maximum moisture infiltration, two conditions are essential: 1) an adequate surface [vegetation] cover to cushion the impact of the falling raindrops and 2) favorable soil conditions associated with a relatively advanced stage of ecological succession for the site, typical of one of the higher range condition classes.

Table 13. Most current (USFS, 2008b) understory vegetation ecological status, range condition, and departure from desired conditions (DC) on capability grazing lands within the dry mixed conifer forest PNV on the A-SNFs

No Capability Grazing Lands (DC departure status unknown)†	Vegetation Ecological Status ¹⁵ and Range Condition ^{16, 18} Ratings of Capable Grazing Lands within the Dry Mixed Conifer Forest PNV on the A-SNFs‡													Total Acres		
	high ecological status				moderately-high ecological status		moderately-low ecological status		low ecological status		no data (DC departure status unknown)		total acres			
	excellent range condition		good range condition		fair range condition		poor range condition		very-poor range condition							
	acres	%	acres	%	acres	%	acres	%	acres	%	acres	%				
	43,469	29.4	60	0.1	2,001	1.9	19,838	19.0	47,819	45.8	33,851	32.4			847	0.8
DC departure	no		low		moderate		high		severe							

† See footnote 14 on page 18

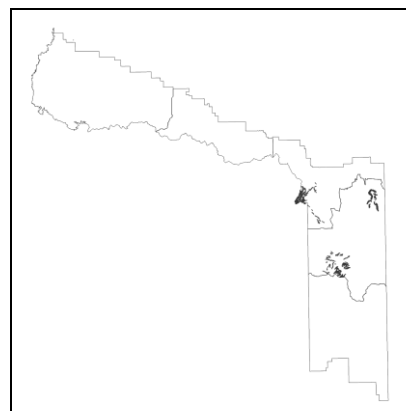
‡ See footnotes 15, 16 and 18 on page 18

Threats: The most important and far reaching threats under agency authority for this PNV include managing the legacy of past livestock grazing, which removed fine fuels needed for carrying frequent, low intensity surface fires; forest management practices (vegetation treatments), which have changed forest age class distribution, composition, density, and cover values, and greatly reduced understory productivity; and fire suppression, which effectively ended the frequent fire regime typical of this forest type. There are also areas (roughly 24%) where the soils are in unsatisfactory condition. According to Printz et al. (2014), soil health is the capacity of a soil to maintain its function and flow of ecosystem services given a specific set of physical, chemical, and environmental boundaries (Doran and Parken, 1994; USDA NRCS, 2013b). When a soil's health deteriorates, its capacity to support and regulate ecosystems is diminished, affecting energy flows, nutrient cycling, and productivity. Overall, based on VDDT modeling, under current management, there is a change in the DI from current to DC and HRV, which would indicate movement toward DC, and HRV, and a more properly functioning system. This trend appears to be consistent over all modeling periods out to 50 years. See Appendix E for a more complete discussion of the threats affecting the dry mixed conifer forest and the risks they pose to this PNV.

Spruce-fir forest (map 5 and appendix A map 2): The spruce-fir forest is found on the Alpine and Springerville RDs and at roughly 17,667 acres of NFS lands, or approximately 1 percent of the forests (table 4), is the smallest of the forest types, and represents the eleventh largest PNV on the A-SNFs.

Also known as subalpine conifer forests, spruce-fir with wet mixed conifer forests range in elevation from approximately 9,000 to 11,300 feet along a variety of gradients including gentle to very steep mountain slopes. Generally, annual precipitation ranges from 26.8 to 36.2 inches, with 50 percent coming between October 1st and March 31st (table 14).

Engelmann spruce, blue spruce, and subalpine fir or corkbark fir dominate this PNV either mixed or alone. Rocky Mountain Douglas-fir along with mixed conifer and quaking aspen stands may also be present in this system for long periods without regeneration. Understory herbaceous species may include but are not limited to red baneberry, starry false Solomon's seal, sprucefir fleabane (*Erigeron eximius* Greene), blackberry, and subalpine lupine.



Map 5. General location of the spruce-fir forest PNV

Table 14. Spruce-fir forest PNVT temperature and moisture data (Laing et al., 1987)

Average Annual Air Temperature ¹ (° F)		Average Annual Precipitation (inches)			Average Snowfall ² (inches)			Number of Frost-free Days per Year
low	high	low	high	percent occurring between Oct 1 st and Mar 31 st	annual	accumulation	major accumulation period	
32	37	26.8	36.2	50	67 - 71	39 - 47	Oct 1 st - Apr 30 th	60 - 70

¹ Winters are cold² Snowfall moisture is included in average annual precipitation data

The A-SNFs' niche for this PNVT is approximately 46 percent of the White Mountains-San Francisco Peaks-Mogollon Rim ecoregion section (table 4). Within the White Mountains Woodland and White Mountains Scarp Woodland-Coniferous Forest subsections, the A-SNFs contribute 93 and 74 percent of this PNVT, respectively. The A-SNFs' contribution to the sustainability of the spruce-fir forest PNVT is moderate (figure 1). With nearly 54 percent (table 4) of this PNVT located off-forest and having a moderate departure rating from HRV.

Spruce-fir forest PNVT burn severity acres produced by the 2011 Wallow Fire can be seen in table 15. Overall, the fire did cause a significant impact to the spruce-fir forest PNVT. Somewhat more than 71 percent of this PNVT was within the perimeter of the Wallow Fire. Of the acres within the fire perimeter, roughly 81 percent were burned, and of that, 50 percent (6,336 acres) were classified as experiencing a moderate to high severity burn. According to Margolis et al. (2011), stand-replacing fire patches as large as 500 to 1,250 acres burning in the upper elevations (> 8,500 feet) of the spruce-fir forest may be within the historical range of variability of this PNVT (see Appendix C table 4 for a comparison of pre and post-2011 Wallow Fire spruce-fir forest PNVT overstory vegetation structural states).

Table 15. 2011 Wallow Fire burn severity within the spruce-fir forest PNVT (see Appendix C table 4)

Item	Burn Severity by Soil Burn Severity Class					Outside Fire Perimeter	Total PNVT
	within fire perimeter						
	high	moderate	low	unburned	total		
Acres	3,874	2,462	3,897	2,423	12,656		
Percent	30.6	19.5	30.8	19.1	100		
	Total Spruce-Fir Forest PNVT						
Acres	3,874	2,462	3,897	2,423	12,656	5,010	17,667
Percent	21.9	13.9	22.1	13.7	71.6	28.4	100

Current conditions within the spruce-fir forest are moderately departed from DC and highly departed from HRV (table 2). With a DI of 59 and 62 percent, respectively, this PNVT is the 5th most departed on the forests from DC and the 6th most departed from HRV. With respect to the DI there is an over-representation (29%) of vegetation structural states that are lacking or have limited aspen regeneration (vegetation structural states K, L, M, N, O, P, Q, R, and S) due primarily to the presence of elk browsing (see Appendix D figure 4 and Appendix D tables 31 through 40). There is a sizable (43%) under-representation of large to very large size trees, single- or multi-stored with closed canopies (vegetation structural states E and F). Historically these forests were dominated by very shade tolerant, shade tolerant, and mixed shade tolerant shrub and tree species with closed canopy characteristics.

Disturbances

Fire: The SFF PNVT is characterized by historic fire regime group IIIc (100-200 years) (Barrett et al., 2010; Wahlberg et al., 2014) with an average fire return interval of 100 to 200 years from mixed severity fire (Fulé et al., 2003; Swetnam et al., 2005; Vankat, 2006) and fire regime group Va (200-400 years) (Barrett et al., 2010; Wahlberg et al., 2014), with an average fire return interval of 200 to 400 years from

stand replacing fire (Vander Lee et al., 2006). Based on its current DI rating, this PNVNT has a FRCC of II (0-35 years).

Non-native Invasive Plants: Non-native invasive plants infest roughly 490 to 750 acres; primarily mullein and bull thistle. According to Jordan et al. (2008), noxious and invasive weeds are of special concern because there is ample evidence that non-native invasive plants can modify the physical and/or chemical attributes of soil, including inputs and cycling of N and other elements (Ehrenfeld, 2003; Haubensak et al., 2004; Hawkes et al., 2005; Sperry et al., 2006; Norton et al., 2007), pH (Kourtev et al., 2003), and soil organic matter and aggregation (Saggar et al., 1999). There is also evidence of direct modification of various components of the biotic composition of invaded soil, e.g., affecting the soil food web (Duda et al., 2003), total soil microbial communities (Kourtev et al., 2002a and 2002b; Kourtev et al., 2003), and mutualistic fungi (Allen et al., 2003; Hawkes et al., 2006; Mummey and Rillig, 2006; Mack and Rudgers, 2008).

Non-native plant invasions are widely recognized as significant threats to biodiversity conservation worldwide (Brooks et al., 2004; Brooks, 2008). One way invasions can affect native ecosystems is by changing fuel properties, which can in turn affect fire behavior and, ultimately, alter fire regime characteristics such as frequency, intensity, extent, type, and seasonality of fire (Levine et al., 2003; Brooks et al., 2004; Brooks, 2008). If the regime changes subsequently promote the dominance of the invaders, then an invasive plant-fire regime cycle can be established. This change in fire regime is one of the most significant ways that plant invasions can affect ecosystems (Brooks, 2008).

Roads: According to the forests' GIS database, approximately 15 miles of roads and motorized trails have been constructed within this PNVNT; this equates to roughly 0.5 linear miles of road per square mile. Roads and trails are one of the primary access points for noxious and invasive weed transport and their right-of-way are areas of establishment.

Insects and Disease: Historically, spruce beetles (*Dendroctonus rufipennis*) have had the greatest impact on wet mixed conifer forests of the central and southern Rocky Mountains, and in the Southwest (Alexander, 1987). Historic photographs and tree-ring analysis indicate that there have been six major outbreaks since the middle 1800s, and between 1850 and 1880 a very large-scale outbreak affected forests from northern New Mexico to northern Colorado (Baker and Veblen, 1990). These outbreaks are considered part of the natural variability of spruce-fir with wet mixed conifer forests, and spruce beetles likely persist in small windthrow areas (Veblen et al., 1991) and in live trees (Veblen et al., 1994).

Herbivory: The disruption of historic fire regimes by introduced grazing animals has been well documented in southwestern ecosystems, and high elevation wet mixed conifer forests were well utilized as summer range for large numbers of sheep and cattle (Carlson, 1969; Allen, 1989; Covington and Moore, 1994; Bahre, 1998; Swetnam et al., 1999). Herbivory has had detrimental effects on the composition, structure and function of forested ecosystems, and has led to a decrease in native species richness (Fleischner et al., 1994).

As mentioned previously, it has been suggested (Smith, 2006c) that the extinction of large carnivores such as the Mexican wolf and grizzly bear has affected at least one component of the mixed conifer forest, quaking aspen, which experiences increased mortality due to high levels of herbivory by native and introduced ungulates (elk), and livestock. Herbivory has had detrimental effects on the composition, structure and function of forested ecosystems, and has led to a decrease in native species richness (Fleischner et al., 1994). Predator control has allowed herbivores to increase in numbers, and to exert longer duration and higher intensity grazing and browsing effects on select vegetation types, especially aspen (Shepperd and Fairweather, 1994; Romme et al., 1995; Kay, 1997; Ripple et al., 2001; Fairweather et al., 2014).

The most current A-SNFs data, 2007-2008 (USFS, 2008b), indicates that within the capable grazing lands (12% of the total PNVT's area) associated with the spruce-fir forest (table 16); approximately 55 percent of the herbaceous understory is in high ecological status or good range condition, while only 24 percent is in moderately-low ecological status or poor range condition. High ecological status has resulted in maintaining levels of herbaceous vegetation ground cover and levels of vigor and growth, as well as species composition, and site potential. Total herbage production is considered to be correlated with the condition of the range (Osborn, 1956; Goebel and Cook, 1960). The majority of the herbaceous understory vegetation within the spruce-fir forest capable grazing lands is low to moderately departed from DCs. According to Osborn (1952), for maximum moisture infiltration, two conditions are essential: 1) an adequate surface [vegetation] cover to cushion the impact of the falling raindrops and 2) favorable soil conditions associated with a relatively advanced stage of ecological succession for the site, typical of one of the higher range condition classes.

Threats: The most important and far reaching threat under agency authority for this PNVT is the potential for human-caused fires, and forest management practices (vegetation treatments), which have changed forest age class distribution, composition, density, and cover value. Overall, based on VDDT modeling, under current management, there is a change in the DI from current to DC and HRV, which would indicate continued reduction in departure with movement toward DC, and HRV, and a more properly functioning system. The trend towards DC appears to begin around 10 years and the trend toward HRV appears to stabilize after 50 years. See Appendix E for a more complete discussion of the threats affecting the spruce-fir forest and the risks they pose to this PNVT.

Table 16. Most current (USFS, 2008b) understory vegetation ecological status, range condition, and departure from desired conditions (DC) on capability grazing lands within the spruce-fir forest PNVT on the A-SNFs

No Capability Grazing Lands (DC departure status unknown)†	Vegetation Ecological Status ¹⁵ and Range Condition ^{16, 18} Ratings of Capable Grazing Lands within the Spruce-Fir Forest PNVt on the A-SNFs‡														Total Acres	
	high ecological status				moderately-high ecological status		moderately-low ecological status		low ecological status		no data (DC departure status unknown)		total acres			
	excellent range condition		good range condition		fair range condition		poor range condition		very-poor range condition							
	acres	%	acres	%	acres	%	acres	%	acres	%	acres	%				
	15,454	87.5	0	0.0	1,205	54.5	481	21.7	524	23.7	0	0.0	3	0.1		2,213
DC departure	no		low		moderate		high		severe							

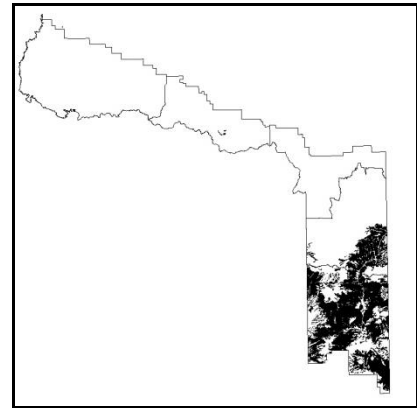
† See footnote 14 on page 18

‡ See footnotes 15, 16 and 18 on page 18

Woodland PNVTs

Madrean pine-oak woodland (map 6, and appendix A maps 1 and 2): The Madrean pine-oak woodland is found primarily below the Mollogon Rim on the Alpine and Clifton RDs closely associated with the semi-desert grasslands. At roughly 394,927 acres of NFS lands, or approximately 20 percent of the forests (table 4), Madrean pine-oak woodland represents the second largest PNVT on the A-SNFs (table 4). Madrean pine-oak woodland usually occupy foothills and mountains ranging from approximately 4,000 to 7,000 feet in elevation This PNVT is bounded by semi-desert grasslands at the lowest elevations and montane forests at the higher elevations.

Madrean pine-oak is dominated by open to closed canopy of evergreen oaks such as Arizona white oak (*Quercus arizonica* Sarg.), Emory oak (*Q. emoryi* Torr.), gray oak (*Q. grisea* Liebm.), and wavy leaf oak (*Q. turbinella* Greene), alligator juniper, and various other conifers. On the A-SNFs the most common conifer is the piñon. However, Rocky Mountain Douglas-fir, ponderosa pine, Chihuahuan pine (*Pinus leiophylla* Schiede & Deppe var. *chihuahuana* (Engelm.) Shaw), and border pine (*Pinus discolor* D.K. Bailey & Hawksw.) may also be present. In addition, annual and perennial grasses, forbs, half-shrubs and shrubs can be found beneath the woodland overstory.



Map 6. General location of the Madrean pine-oak woodland PNVT

Climate generally consists of mild winters and wet summers with mean annual precipitation ranging from about ten to 25 inches; half of the precipitation typically occurs in summer, with the remainder occurring during the winter and spring. Generally, annual precipitation ranges from 13.4 to 25.2 inches, with 40-45 percent coming between October 1st and March 31st (table 17).

Table 17. Madrean pine-oak woodland PNVT temperature and moisture data (Laing et al., 1987)

Average Annual Air Temperature ¹ (° F)		Average Annual Precipitation (inches)			Average Snowfall ² (inches)			Number of Frost-free Days per Year
low	high	low	high	percent occurring between Oct 1 st and Mar 31 st	annual	accumulation	major accumulation period	
48	61	13.4	25.2	40 - 45	4 - 24	0 - 5	Dec 1 st - Mar 15 th	130 - 180

¹ Winters can be mild or cold depending on elevation and aspect

² Snowfall moisture is included in average annual precipitation data

The A-SNFs' niche for this PNVT is approximately 64 percent of the White Mountains-San Francisco Peaks-Mogollon Rim ecoregion section (table 4). Within the White Mountains Woodland and the Burro Mountains Oak-Juniper Woodland subsections, the A-SNFs contribute 96 and 78 percent of this PNVT, respectively. The A-SNFs' contribution to the sustainability of the Madrean pine-oak woodland PNVT is high (figure 1). With nearly 36 percent (table 4) of this PNVT located off-forest and having a high departure rating from HRV.

Madrean pine-oak woodland PNVT burn severity acres produced by the 2011 Wallow Fire can be seen in table 18. Overall, the fire did not cause a substantial impact to the Madrean pine-oak woodland PNVT. Somewhat more than 13 percent of this PNVT was within the perimeter of the Wallow Fire. Of the acres within the fire perimeter, roughly 50 percent were burned, and of that; 11 percent (6,013 acres) were classified as undergoing a moderate to high severity burn (see Appendix C table 5 for a comparison of pre and post-2011 Wallow Fire Madrean pine-oak woodland PNVT overstory vegetation structural states).

Table 18. 2011 Wallow Fire burn severity within the Madrean pine-oak woodland PNVT (see Appendix C table 5)

Item	Burn Severity by Soil Burn Severity Class					Outside Fire Perimeter	Total PNVT
	within fire perimeter						
	high	moderate	low	unburned	total		
Acres	1,246	4,767	20,396	26,679	53,088		
Percent	2.3	9	38.4	50.3	100		
	Total Madrean Pine-Oak Woodland PNVT						
Acres	1,246	4,767	20,396	26,679	53,088	341,839	394,927
Percent	0.3	1.2	5.2	6.8	13.4	86.6	100

Current conditions within the Madrean pine-oak woodland are highly departed from both DC and HRV (table 2). With a DI of 61 and 72 percent, respectively, this PNVT is the 4th most departed on the forests from both DC and HRV. With respect to the DI there is a considerable (59%) over-representation of small to very large size trees with closed canopy cover (vegetation structural states F and G) (see Appendix D figure 5 and Appendix D table 41 through 50). Historically, this woodland type was characterized by open canopies which are now reflected in a noteworthy (60%) under-representation of seedling, saplings, small, and medium to very large size, single or multi-storied trees with open canopy cover (vegetation structural states B, C, and D). Historically these woodlands were dominated by very shade intolerant and shade intolerant shrub and tree species with open canopy characteristics. In addition, a more open canopy should promote an increase in herbaceous understory diversity and abundance.

Disturbances

Fire: Madrean pine-oak woodland has been shown (Schussman and Gori, 2006) to trend away from woodland with an open pine dominated overstory and oak understory to dense woodland with oaks and other sprouting tree species dominating the overstory (Barton et al., 2001; Barton, 2002; Fulé and Covington, 1998). This change in density and species composition is the result of switching from centuries of predominantly low intensity frequent surface fires to decades without fire followed by stand replacing fires (Fulé and Covington, 1998; Barton, 2002). Frequent low intensity surface fires allow fire resistant pines to dominate a site and maintain an open stand structure. Additionally, short fire-free periods, between 20 and 30 years in length, are necessary to allow for periodic pine regeneration (Barton et al., 2001). The MPOW PNVT is characterized by historic fire regime group III (I), with an average fire return interval of 35-200+ years from mixed severity fire (Barrett et al., 2010; Wahlberg et al., 2014).

The recent shift in fire regimes has been more conducive to the reduction of pine species and regeneration of oak and other sprouting species. According to Schussman and Gori (2006), it is well documented through fire scar data that prior to about 1880, low intensity surface fires frequently burned through the Madrean pine-oak woodland between early spring and summer, primarily as a result of lightning ignitions (Swetnam et al., 1992; Kaib et al., 1996; Swetnam and Baisan, 1996; Fulé et al., 2005).

The continuity of fire scars between lower and higher elevations suggests that fire sizes were large enough to span the entire elevational distribution of the pine-oak woodlands and that fire ignitions coming from semi-desert grasslands and/or montane conifer systems were not uncommon (Swetnam et al., 1992; Kaib et al., 1996; Fulé and Covington, 1997, 1998; Fulé et al., 2005). Passive fire suppression through livestock grazing in the late 1800s through today, as well as active suppression, has resulted in drastically reduced fire return intervals and increased fire severity in Madrean pine-oak woodland (Barton, 1999, Swetnam and Baisan, 1996). Based on its current DI rating, this PNVT has a FRCC of III. Historic fire return interval is estimated to have been between 3 and 8 years (Vander Lee et al., 2006).

Non-native Invasive Plants: Non-native invasive plants infest roughly 8,950 to 13,450 acres; primarily mullein and weeping lovegrass and Lehmann lovegrass (*Eragrostis lehmanniana* Nees). According to LANDFIRE (2007), Lehmann lovegrass was purposely introduced into North America in the 1930s, and has spread to the lower and drier edge of Madrean pine-oak woodland. By continuing to spread and therefore, add fine fuel, it may contribute to significantly increased fire frequency in this system. Lehmann lovegrass may have an advantage over native grasses following fire. According to Jordan et al. (2008), noxious and invasive weeds are of special concern because there is ample evidence that non-native invasive plants can modify the physical and/or chemical attributes of soil, including inputs and cycling of N and other elements (Ehrenfeld, 2003; Haubensak et al., 2004; Hawkes et al., 2005; Sperry et

al., 2006; Norton et al., 2007), pH (Kourtev et al., 2003), and soil organic matter and aggregation (Saggar et al., 1999). There is also evidence of direct modification of various components of the biotic composition of invaded soil, e.g., affecting the soil food web (Duda et al., 2003), total soil microbial communities (Kourtev et al., 2002a and 2002b; Kourtev et al., 2003), and mutualistic fungi (Allen et al., 2003; Hawkes et al., 2006; Mummey and Rillig, 2006; Mack and Rudgers, 2008).

Non-native plant invasions are widely recognized as significant threats to biodiversity conservation worldwide (Brooks et al., 2004; Brooks, 2008). One way invasions can affect native ecosystems is by changing fuel properties, which can in turn affect fire behavior and, ultimately, alter fire regime characteristics such as frequency, intensity, extent, type, and seasonality of fire (Levine et al., 2003; Brooks et al., 2004; Brooks, 2008). If the regime changes subsequently promote the dominance of the invaders, then an invasive plant-fire regime cycle can be established. This change in fire regime is one of the most significant ways that plant invasions can affect ecosystems (Brooks, 2008).

Roads: According to the forests' GIS database, approximately 145 miles of roads and motorized trails have been constructed within this PNV; this equates to roughly 0.2 linear miles of road per square mile. Roads and trails are one of the primary access points for noxious and invasive weed transport and their right-of-way are areas of establishment.

Insects and Disease: Between 2000 and 2004, insects and disease have impacted approximately 16 percent of this PNV. According to Jordan et al. (2008), noxious and invasive weeds are of special concern because there is ample evidence that non-native invasive plants can modify the physical and/or chemical attributes of soil, including inputs and cycling of N and other elements (Ehrenfeld, 2003; Haubensak et al., 2004; Hawkes et al., 2005; Sperry et al., 2006; Norton et al., 2007), pH (Kourtev et al., 2003), and soil organic matter and aggregation (Saggar et al., 1999). There is also evidence of direct modification of various components of the biotic composition of invaded soil, e.g., affecting the soil food web (Duda et al., 2003), total soil microbial communities (Kourtev et al., 2002a and 2002b; Kourtev et al., 2003), and mutualistic fungi (Allen et al., 2003; Hawkes et al., 2006; Mummey and Rillig, 2006; Mack and Rudgers, 2008).

Herbivory: While the level of resource competition between Coues deer (*Odocoileus virginianus couesi*) and livestock is unclear, it is clear that Coues deer did have an impact on browse species and would have been responsible for decreasing shrub cover, to some extent, in Madrean pine-oak woodland. In contrast, livestock grazing has decrease grass cover and so their impact on the Madrean pine-oak woodland would be different than that of white-tailed deer, the dominant native herbivore (Schussman and Gori, 2006). According to Fleischner et al. (1994), herbivory has had detrimental effects on the composition, structure and function of woodland ecosystems, and has led to a decrease in native species richness.

The most current A-SNFs data, 2007-2008 (USFS, 2008b), indicates that within the capable grazing lands (46% of the total PNV's area) associated with the Madrean pine-oak woodland (table 19); the herbaceous understory is split almost equally between moderately-high to high (48 percent) and low to moderately-low (46 percent) ecological status or fair to good and very-poor to poor range conditions. Movement in the direction of low to moderately-low ecological status has resulted in lower levels of herbaceous vegetation ground cover and lower levels of vigor and growth, as well as species compositional shifts, and possible changes in site potential. Total herbage production is considered to be correlated with the condition of the range (Osborn, 1956; Goebel and Cook, 1960). The majority of the herbaceous understory vegetation within the Madrean pine-oak woodland capable grazing lands is moderately to highly departed from DCs. According to Osborn (1952), for maximum moisture infiltration, two conditions are essential: 1) an adequate surface [vegetation] cover to cushion the impact of the falling raindrops and 2) favorable soil conditions associated with a relatively advanced stage of ecological succession for the site, typical of one of the higher range condition classes.

Table 19. Most current (USFS, 2008b) understory vegetation ecological status, range condition, and departure from desired conditions (DC) on capability grazing lands within the Madrean pine-oak woodland PNVT on the A-SNFs

No Capability Grazing Lands (DC departure status unknown)†	Vegetation Ecological Status ¹⁵ and Range Condition ^{16, 18} Ratings of Capable Grazing Lands within the Madrean Pine-Oak Woodland PNVT on the A-SNFs‡														total acres	Total Acres
	high ecological status				moderately-high ecological status		moderately-low ecological status		low ecological status		no data (DC departure status unknown)					
	excellent range condition		good range condition		fair range condition		poor range condition		very-poor range condition							
	acres	%	acres	%	acres	%	acres	%	acres	%	acres	%				
171,651	43.5	0	0.0	24,074	10.8	83,437	37.4	98,703	44.2	4,312	1.9	12,749	5.7	223,275	394,927	
DC departure	no		low		moderate		high		severe							

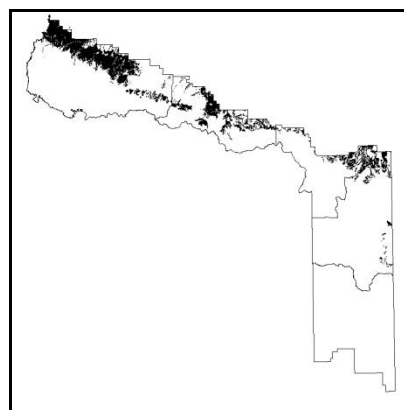
† See footnote 14 on page 18

‡ See footnotes 15, 16 and 18 on page 18

Threats: The most important and far reaching threats under agency authority for this PNVT include managing the legacy of past livestock grazing, which removed fine fuels needed for carrying frequent, low intensity surface fires; forest management practices, which have changed woodland age class distribution, composition, density, and cover values, and greatly reduced understory productivity; and fire suppression, which effectively ended the frequent fire regime typical of this woodland, and the introduction of invasive plants. There are also areas (roughly 38%) where the soils are in impaired and/or unsatisfactory condition, and another 58 percent are classified as inherently unstable. According to Printz et al. (2014), soil health is the capacity of a soil to maintain its function and flow of ecosystem services given a specific set of physical, chemical, and environmental boundaries (Doran and Parken, 1994; USDA NRCS, 2013b). When a soil's health deteriorates, its capacity to support and regulate ecosystems is diminished, affecting energy flows, nutrient cycling, and productivity. Overall, based on VDDT modeling, under current management, there is very little change in the DI from current to DC and HRV, which would indicate continued high departure with little or no movement toward DC, and HRV, and a more properly functioning system. This trend appears to stabilize after 60 years. See Appendix E for a more complete discussion of the threats affecting the Madrean pine-oak woodland and the risks they pose to this PNVT.

Piñon-juniper woodland (map 7, and appendix A maps 1 and 2): The piñon-juniper woodland occurs primarily along the forests' northern boundary closely associated with the Great Basin grasslands. At roughly 222,166 acres of NFS lands, or approximately 11 percent of the forests (table 4), the piñon-juniper woodland represents the third largest PNVT on the A-SNFs.

This PNVT is characterized by a series of vegetation states that move from herbaceous dominated to shrub-dominated to tree-dominated over time after a high severity stand replacing fire. The type, including its various vegetation states, occurs on deep, fine-textured soils in valley bottoms and on gentle plains with few barriers to fire spread; it is common in areas where most of the annual precipitation comes in the winter.



Map 7. General location of the piñon-juniper woodland PNVT

Generally, annual precipitation ranges from 11.0 to 22.0 inches, with 40-45 percent coming between October 1st and March 31st (table 20). It is mostly found on lower slopes of mountains and in upland rolling hills at approximately 4,500 to 7,500 feet in elevation. The most common conifer is piñon. The

juniper component is a mix of, to a greater or lesser degree, oneseed juniper *Juniperus monosperma* (Engelm.) Sarg.), Utah juniper (*J. osteosperma* (Torr.) Little), alligator juniper, and Rocky Mountain juniper. In addition, annual and perennial grasses and grass-like plants, forbs, half-shrubs and shrubs can be found beneath the woodland overstory.

Table 20. Piñon-juniper woodland PNVT temperature and moisture data (Laing et al., 1987)

Average Annual Air Temperature ¹ (° F)		Average Annual Precipitation (inches)			Average Snowfall ² (inches)			Number of Frost-free Days per Year
low	high	low	high	percent occurring between Oct 1 st and Mar 31 st	annual	accumulation	major accumulation period	
41	45	11.0	22.0	40 - 45	31 - 39	0 - 6	Dec 1 st - Mar 15 th	140 - 150

¹ Winters are cold

² Snowfall moisture is included in average annual precipitation data

The A-SNFs' niche for this PNVT is approximately eight percent of the White Mountains-San Francisco Peaks-Mogollon Rim ecoregion section (table 4). Within the Coconino Plateau Coniferous Forest and White Mountains Coniferous Forest subsections, the A-SNFs contribute 58 and 24 percent of this PNVT, respectively. The A-SNFs' contribution to the sustainability of the piñon-juniper woodland PNVT is moderate (figure 1). With nearly 92 percent (table 4) of this PNVT located off-forest and having a low departure rating from HRV.

Piñon-juniper woodland PNVT burn severity acres produced by the 2011 Wallow Fire can be seen in table 21. Overall, the fire did not cause a substantial impact to the Piñon-juniper woodland PNVT. Roughly eight percent of this PNVT was within the perimeter of the Wallow Fire. Of the acres within the fire perimeter, approximately 47 percent were burned, and of that; nearly 16 percent (2,808 acres) were classified as experiencing a moderate to high severity burn (see Appendix C table 6 for a comparison of pre and post-2011 Wallow Fire piñon-juniper woodland PNVT overstory vegetation structural states).

Table 21. 2011 Wallow Fire burn severity within the piñon-juniper woodland PNVT (see Appendix C table 6)

Item	Burn Severity by Soil Burn Severity Class					Outside Fire Perimeter	Total PNVT
	within fire perimeter						
	high	moderate	low	unburned	total		
Acres	583	2,225	5,587	9,389	17,784		
Percent	3.3	12.5	31.4	52.8	100		
	Total Piñon-Juniper Woodland PNVT						
Acres	583	2,225	5,587	9,389	17,784	204,382	222,166
Percent	0.3	1.0	2.5	4.2	8.0	92.0	100

Current conditions within the piñon-juniper woodland are at a low departure from both DC and HRV (table 2) with a DI of 26 percent, this PNVT is the 9th and 11th most departed from DC and HRV on the forests, respectively. With respect to the DI there is an over-representation (19%) of medium to very large size trees with open canopy cover (vegetation structural state D) (see Appendix D figure 6 and Appendix D tables 51 through 60), and an under-representation (25%) of early successional, seedlings, sapling and small size trees with open or closed canopy cover (vegetation structural states B, C, E and F). Historically these woodlands were dominated by very shade intolerant and shade intolerant shrub and tree species with open canopy characteristics. In addition, a more open canopy should promote an increase in herbaceous understory diversity and abundance.

Disturbances

Based on published literature, climate variation, insect outbreaks, fire and seed dispersal by birds and small mammals appear to be the most important natural disturbances that determined the historical

structure of Piñon-Juniper woodlands and the distribution and abundance of these stands or patches across the landscape (Gori and Bate, 2007).

Climate: According to Gori and Bate (2007), significant expansions and contractions in the distribution of piñon-juniper woodland also occurred over the last 4,000 years and have been documented by studies of packrat middens, dry caves, pollen cores, lake and wetland sediments and archaeological sites (Van Devender et al., 1984; Mehringer and Wigand, 1990; Gottfried et al., 1995). In general, during periods when the climate became wetter, piñon and juniper moved down mountain slopes into more xeric communities and grasses increased, and when the climate became drier and warmer, piñon-juniper declined but grasses persisted. After 500 BP (before present), increased winter precipitation led to a re-expansion of piñon-juniper woodland that sharply increased after 1700 and again in the early 1900s (Davis and Turner, 1986; Mehringer and Wigand, 1990; Ghil and Vautgard, 1991; Eisenhart, 2004).

Drought: According to the Gori and Bate (2007), the recent drought, which began in the mid-1990s, has also resulted in regional die-offs of piñon and, to a lesser extent, juniper during the extreme drought years of 1996 and 2002-2003 (Ogle et al., 2000; Breshears et al., 2005; Mueller et al., 2005a; Gitlin et al., 2006). Drought-induced changes in the composition and cover of piñon-juniper woodlands may have a number of important ecological effects including significant changes in carbon stores and dynamics (Breshears and Allen, 2002); increased solar radiation and ground temperatures (Martens et al., 2000); increased water runoff and erosion (Allen and Breshears, 1998; McAuliffe et al., 2006); changes in the genetic structure of piñon and other populations (Mitton and Duran, 2004); unfavorable recruitment conditions for piñon including a reduction in nurse plants, mycorrhizal fungal inoculum, and seed dispersal by birds (Christensen and Whitham, 1991; 1993; Swaty et al., 2004; Haskins and Gehring, 2005; Mueller et al., 2005a); and potentially large changes in the composition and function of associated biotic communities (Brown et al., 2001a; Ruel and Whitham, 2002; Whitham et al., 2003; Mueller et al., 2005b).

Fire: According to the Gori and Bate (2007), piñon-juniper grass savanna (and open woodland) is thought to have been maintained historically by frequent, low-severity surface fires. The more open, savanna-like PJW PNVNT is characterized by historic fire regime group I, with an average fire return interval of 0-35 years from low to moderate severity fire (Wahlberg et al., 2014). Piñon-juniper woodland developed after infrequent stand-replacing fire and was most likely maintained by patchy mixed-severity fires that occurred with moderate to low frequency (Arnold et al., 1964; Tausch and West, 1988; Despain and Mosley, 1990; Huffman et al., 2006a). The persistent PJW is generally characterized by historic fire regime group IV with fire return intervals of 35-200 years from stand-replacement. However, some types exhibit little to no natural fire (historic fire regime group V) (Barrett et al., 2010; Wahlberg et al., 2014). Persistent piñon-juniper woodland developed under an historic regime of infrequent high severity, stand replacing fire (Tress and Klopatek, 1987; Miller, 1999; Floyd et al., 2000 and 2004; Muldavin et al., 2003; Romme et al., 2003). Based on its current DI rating, this PNVNT has a FRCC of I. Historic fire return interval is estimated to have been between 6 and 400 years (Vander Lee et al., 2006).

Non-native Invasive Plants: Non-native invasive plants infest roughly 2,450 to 3,700 acres; primarily mullein and weeping lovegrass. According to Jordan et al. (2008), noxious and invasive weeds are of special concern because there is ample evidence that non-native invasive plants can modify the physical and/or chemical attributes of soil, including inputs and cycling of N and other elements (Ehrenfeld, 2003; Haubensak et al., 2004; Hawkes et al., 2005; Sperry et al., 2006; Norton et al., 2007), pH (Kourtev et al., 2003), and soil organic matter and aggregation (Saggar et al., 1999). There is also evidence of direct modification of various components of the biotic composition of invaded soil, e.g., affecting the soil food web (Duda et al., 2003), total soil microbial communities (Kourtev et al., 2002a and 2002b; Kourtev et al., 2003), and mutualistic fungi (Allen et al., 2003; Hawkes et al., 2006; Mummey and Rillig, 2006; Mack and Rudgers, 2008).

Non-native plant invasions are widely recognized as significant threats to biodiversity conservation worldwide (Brooks et al., 2004; Brooks, 2008). One way invasions can affect native ecosystems is by changing fuel properties, which can in turn affect fire behavior and, ultimately, alter fire regime characteristics such as frequency, intensity, extent, type, and seasonality of fire (Levine et al., 2003; Brooks et al., 2004; Brooks, 2008). If the regime changes subsequently promote the dominance of the invaders, then an invasive plant-fire regime cycle can be established. This change in fire regime is one of the most significant ways that plant invasions can affect ecosystems (Brooks, 2008).

Roads: According to the forests' GIS database, approximately 520 miles of roads and motorized trails have been constructed within this PNVT; this equates to roughly 1.5 linear miles of road per square mile. Roads and trails are one of the primary access points for noxious and invasive weed transport and their right-of-way are areas of establishment.

Insect and Disease: According to Gori and Bate (2007); Ronco (1990), Gottfried et al. (1995), Negrón (1995), Rogers (1995), Weber et al. (1999), and Shaw (2004) all provide lists of insects, pathogens, and plant parasites that attack piñon and juniper. Although the life cycles of these pests are known in some detail, little information exists on their impacts to piñon populations locally or regionally or on the environmental factors that control their populations, including outbreaks. Between 2000 and 2004, insects and disease have impacted approximately 38 percent of this PNVT.

Herbivory: The disruption of historical fire regimes that followed the introduction of livestock (and the drought of the 1890s) has been documented in historical accounts and fire-history reconstructions in piñon-juniper savanna and open woodland (upper and lower ecotones) and in shrub woodland at the ecotone with ponderosa pine forest (Leopold, 1924; Bahre, 1985 and 1991; Allen, 1989; Despain and Mosley, 1990; Kaib et al., 1996; Swetnam and Baisan, 1996; Baisan and Swetnam, 1997; Brown et al., 2001a; Muldavin et al., 2003; Huffman et al., 2006a). These reconstructions show the virtual cessation of surface and mixed-severity fires in piñon-juniper woodlands between 1890 and 1905. The decline in herbaceous cover due to livestock grazing in concert with the disruption of the fire regime has been cited in a number of studies as the primary causative factor for the observed increase in tree densities in many piñon-juniper systems over the last 120 years (Cottam and Stewart, 1940; Johnsen, 1962; Arnold et al., 1964; Dwyer and Pieper, 1967; Blackburn and Tueller, 1970; West et al., 1975; Burkhardt and Tisdale, 1976; Tausch et al., 1981; Gottfried, 1987; Gottfried et al., 1995; Huffman et al., 2006a and 2006b). The primary management objective for these activities was to increasing forage production for livestock grazing (Gori and Bate, 2007). According to Fleischner et al. (1994), herbivory has had detrimental effects on the composition, structure and function of woodland ecosystems, and has led to a decrease in native species richness.

The most current A-SNFs data, 2007-2008 (USFS, 2008b), indicates that within the capable grazing lands (96% of the total PNVT's area) associated with the piñon-juniper woodland (table 22); approximately 90 percent of the herbaceous understory is in low to moderately-low ecological status or very-poor to poor range condition, while only 8 percent is in moderately high ecological status or fair range condition. Movement in the direction of low to moderately-low ecological status has resulted in lower levels of herbaceous vegetation ground cover and lower levels of vigor and growth, as well as species compositional shifts, and possible changes in site potential. Total herbage production is considered to be correlated with the condition of the range (Osborn, 1956; Goebel and Cook, 1960). The majority of the herbaceous understory vegetation within the piñon-juniper woodland capable grazing lands is highly to severely departed from DCs. According to Osborn (1952), for maximum moisture infiltration, two conditions are essential: 1) an adequate surface [vegetation] cover to cushion the impact of the falling raindrops and 2) favorable soil conditions associated with a relatively advanced stage of ecological succession for the site, typical of one of the higher range condition classes.

Table 22. Most current (USFS, 2008b) understory vegetation ecological status, range condition, and departure from desired conditions (DC) on capability grazing lands within the piñon-juniper woodland PNVT on the A-SNFs

No Capability Grazing Lands (DC departure status unknown)†	Vegetation Ecological Status ¹⁵ and Range Condition ^{16, 18} Ratings of Capable Grazing Lands within the Piñon-Juniper Woodland PNVT on the A-SNFs‡															Total Acres
	high ecological status						moderately-high ecological status		moderately-low ecological status		low ecological status		no data (DC departure status unknown)		total acres	
	excellent range condition		good range condition		fair range condition		poor range condition		very-poor range condition							
	acres	%	acres	%	acres	%	acres	%	acres	%	acres	%				
	7,504	3.4	18	0.0	1,265	0.6	17,363	8.1	164,152	76.5	28,773	13.4	3,091	1.4	214,662	
DC departure	no		low		moderate		high		severe							

† See footnote 14 on page 18

‡ See footnotes 15, 16 and 18 on page 18

Other Disturbances: Other disturbances have included cabling or chaining; bulldozing; clearing or thinning with hand axes or motorized saws; and herbicide application. Current, estimates of the number of acres treated are lacking on the A-SNFs, however, state-wide, by 1961, roughly 1.2 million acres of piñon-juniper woodland had been cleared in Arizona (Cotner, 1963, Gori and Bate, 2007). These were very common management activities on the forests between 1950 and 1970 and to a limited extent, continue today.

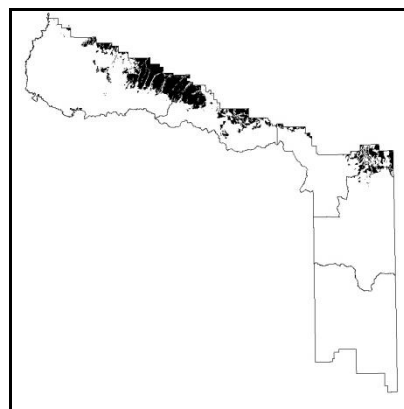
Threats: The most important and far reaching threats under agency authority for this PNVT include managing the legacy of past livestock grazing, which removed fine fuels needed for carrying frequent, low intensity surface fires; forest management practices, which have changed woodland age class distribution, composition, density, and cover values, and greatly reduced understory productivity; and fire suppression, which effectively ended the frequent fire regime typical of this woodland, and the introduction of invasive plants. There are also areas (roughly 73%) where the soils are in impaired condition, and another 10 percent are classified as inherently unstable. According to Printz et al. (2014), soil health is the capacity of a soil to maintain its function and flow of ecosystem services given a specific set of physical, chemical, and environmental boundaries (Doran and Parken, 1994; USDA NRCS, 2013b). When a soil's health deteriorates, its capacity to support and regulate ecosystems is diminished, affecting energy flows, nutrient cycling, and productivity. Overall, based on VDDT modeling, under current management, there is considerable change in the DI from current to DC and HRV, which would indicate a continued trend in departure movement away from DC, and HRV, and a more improperly functioning system. This trend appears to be constant from 15 to 50 years. See Appendix E for a more complete discussion of the threats affecting the piñon-juniper woodland and the risks they pose to this PNVT.

Grassland PNVTS

Great Basin grassland (map 8, and appendix A maps 1 and 2): The Great Basin grassland occurs primarily along the forests' northern boundary closely associated with the piñon-juniper woodland. At roughly 185,523 acres of NFS lands or, approximately 9 percent of the forests (table 4), the Great Basin grassland represents the fourth largest PNVT on the A-SNFs.

Rain, temperature and soils limit this PNVT to lower elevations with vegetation coverage consisting of mostly grasses and forbs with interspersed shrubs. These grasslands are higher in elevation and climatically cooler and moister than semi-desert grasslands and are adjacent to and intermingle with piñon-juniper savanna ecosystems. Generally, annual precipitation ranges from 11.8 to 18.1 inches, with 40 percent coming between October 1st and March 31st (table 23).

Grass species may include but are not limited to: Indian ricegrass (*Achnatherum hymenoides* (Roemer & J.A. Schultes) Barkworth), threeawns (*Aristida* spp. L.), blue grama, needle and thread (*Hesperostipa comata* (Trin. & Rupr.) Barkworth), New Mexico feathergrass (*Hesperostipa neomexicana* (Thurb. ex Coult.) Barkworth), green needlegrass (*Nassella viridula* (Trin.) Barkworth), muhlys (*Muhlenbergia* spp. Schreb.), James' galleta (*Pleuraphis jamesii* Torr.), big bluestem (*Andropogon gerardii* Vitman), little bluestem (*Schizachyrium scoparium* (Michx.) Nash), western wheatgrass (*Pascopyrum smithii* (Rydb.) A. Löve), and sand dropseed (*Sporobolus cryptandrus* A.S. Hitchc.).



Map 8. General location of the Great Basin grassland PNVT

Table 23. Great Basin grassland PNVT temperature and moisture data (Laing et al., 1987)

Average Annual Air Temperature ¹ (° F)		Average Annual Precipitation (inches)			Average Snowfall ² (inches)			Number of Frost-free Days per Year
low	high	low	high	percent occurring between Oct 1 st and Mar 31 st	annual	accumulation	major accumulation period	
46	52	11.8	18.1	40	0 - 31	0	-	150 - 160

¹ Winters are cold

² Snowfall moisture is included in average annual precipitation data

Shrub species may include but are not limited to: Saltbush (*Atriplex* spp. L.), jointfir (*Ephedra* spp. L.), rabbitbrush (*Chrysothamnus* Nutt.), snakeweed (*Gutierrezia* spp. Lag.), winterfat (*Krascheninnikovia lanata* (Pursh) A.D.J. Meeuse & Smit), juniper, and wax currant (*Ribes cereum* Dougl.). This PNVT may also include areas that are dominated by a variety of forbs.

The A-SNFs' niche for this PNVT is approximately ten percent of the White Mountains-San Francisco Peaks-Mogollon Rim ecoregion section (table 4). Within the Coconino Plateau Coniferous Forest and White Mountains Coniferous Forest subsections, the A-SNFs contribute 59 and 38 percent of this PNVT, respectively. The A-SNFs' contribution to the sustainability of the Great Basin grassland PNVT is moderate (figure 1). With nearly 90 percent (table 4) of this PNVT located off-forest and having a low departure rating from HRV.

Great Basin grassland PNVT burn severity acres produced by the 2011 Wallow Fire can be seen in table 24. Overall, the fire did not cause a substantial impact to the Great Basin grassland PNVT. Roughly six percent of this PNVT was within the perimeter of the Wallow Fire. Of the acres within the fire perimeter, approximately 57 percent were burned, and of that; slightly more than six percent (413 acres) were classified as undergoing a moderate to high severity burn (see Appendix C table 7 for a comparison of pre and post-2011 Wallow Fire Great Basin grassland PNVT overstory vegetation structural states).

Table 24. 2011 Wallow Fire burn severity within the Great Basin grassland PNVNT (see Appendix C table 7)

Item	Burn Severity by Soil Burn Severity Class					Outside Fire Perimeter	Total PNVNT
	within fire perimeter						
	high	moderate	low	unburned	total		
Acres	88	325	3,311	2,854	6,579		
Percent	1.3	4.9	50.3	43.4	100		
	Total Great Basin Grassland PNVNT						
Acres	88	325	3,311	2,854	6,579	178,944	185,523
Percent	0.0	0.2	1.8	1.5	3.5	96.5	100

Current conditions within the Great Basin grassland are highly departed from both DC and HRV (table 2) with a DI of 67 percent; this PNVNT is the 3rd and 5th most departed from DC and HRV, respectively, on the forests. With respect to the DI there is a considerable (66%) over-representation of encroaching shrubs and trees of all sizes with open and closed canopies (vegetation structural states C and D) (see Appendix D figure 7 and Appendix D tables 61 through 68) and a noteworthy (63%) under-representation of open, dense stands of perennial grasses and forbs with less than ten percent woody canopy cover (vegetation structural state B). There is also an uncharacteristic state where various noxious weeds and invasive plants makeup a significant portion of the herbaceous vegetation composition represented by vegetation structural state E (roughly 3,700 acres); a more open canopy should promote an increase in herbaceous diversity and abundance.

Disturbances

Fire: The GBG PNVNT is characterized by historic fire regime group II, with an average fire return interval of 0-35 years from stand replacing fire. Mixed severity fire has been reported in this PNVNT to have occurred with a mean return interval of 37 years primarily top-killing herbaceous species. Stand replacing fire occurred less frequently (mean fire return interval at 75 years) and consumed both shrub and herbaceous life forms (Wahlberg et al., 2014). Based on its current DI; this PNVNT has a FRCC of III. According to Vander Lee et al. (2006), historic fire return interval is estimated to have been between 10 and 30 years.

Non-native Invasive Plants: Non-native invasive plants infest roughly 2,970 to 4,425 acres; primarily mullein, weeping lovegrass, cheatgrass and bull thistle. According to Jordan et al. (2008), noxious and invasive weeds are of special concern because there is ample evidence that non-native invasive plants can modify the physical and/or chemical attributes of soil, including inputs and cycling of N and other elements (Ehrenfeld, 2003; Haubensak et al., 2004; Hawkes et al., 2005; Sperry et al., 2006; Norton et al., 2007), pH (Kourtev et al., 2003), and soil organic matter and aggregation (Saggar et al., 1999). There is also evidence of direct modification of various components of the biotic composition of invaded soil, e.g., affecting the soil food web (Duda et al., 2003), total soil microbial communities (Kourtev et al., 2002a and 2002b; Kourtev et al., 2003), and mutualistic fungi (Allen et al., 2003; Hawkes et al., 2006; Mummey and Rillig, 2006; Mack and Rudgers, 2008).

Non-native plant invasions are widely recognized as significant threats to biodiversity conservation worldwide (Brooks et al., 2004; Brooks, 2008). One way invasions can affect native ecosystems is by changing fuel properties, which can in turn affect fire behavior and, ultimately, alter fire regime characteristics such as frequency, intensity, extent, type, and seasonality of fire (Levine et al., 2003; Brooks et al., 2004; Brooks, 2008). If the regime changes subsequently promote the dominance of the invaders, then an invasive plant-fire regime cycle can be established. This change in fire regime is one of the most significant ways that plant invasions can affect ecosystems (Brooks, 2008).

Roads: According to the forests' GIS database, approximately 555 miles of roads and motorized trails have been constructed within this PNVN; this equates to roughly 1.9 linear miles of road per square mile. Roads and trails are one of the primary access points for noxious and invasive weed transport and their right-of-way are areas of establishment.

Insects and Disease: Between 2000 and 2004, insects and disease have impacted approximately 15 percent of this PNVN.

Herbivory: According to Fletcher and Robbie (2004), one situation that makes grassland particularly vulnerable to degradation is a higher complement of cool season grasses, which are more sought after by livestock during spring and late fall, and are less resistant to grazing than warm season grasses, coupled with the soils prone to erosion across the majority of the Great Basin grassland. The complement of factors degrading other grasslands - mainly interruption of the fire regime and heavy use by livestock during dry years - may have caused greater change here than even in the semi-desert grassland. Acre for acre, the Great Basin grassland prior to Euro-American settlement condition had greater hydrologic function (infiltration) and higher primary productivity than the semi-desert grassland. According to Fleischner et al. (1994), herbivory has had detrimental effects on the composition, structure and function of grassland ecosystems, and has led to a decrease in native species richness.

The most current A-SNFs data, 2007-2008 (USFS, 2008b), indicates that within the capable grazing lands (99% of the total PNVN's area) associated with the Great Basin grassland (table 25); approximately 87 percent of the herbaceous understory is in low to moderately-low ecological status or very-poor to poor range condition, while only 10 percent is in moderately-high ecological status or fair range condition. Movement in the direction of low to moderately-low ecological status has resulted in lower levels of herbaceous vegetation ground cover and lower levels of vigor and growth, as well as species compositional shifts, and possible changes in site potential. Total herbage production is considered to be correlated with the condition of the range (Osborn, 1956; Goebel and Cook, 1960). The majority of the herbaceous understory vegetation within the Great Basin grassland capable grazing lands is highly to severely departed from DCs. According to Osborn (1952), for maximum moisture infiltration, two conditions are essential: 1) an adequate surface [vegetation] cover to cushion the impact of the falling raindrops and 2) favorable soil conditions associated with a relatively advanced stage of ecological succession for the site, typical of one of the higher range condition classes.

At present, much of this grassland more closely resembles woodland than grassland. Overall, approximately 68 percent or nearly 126,156 acres of this PNVN have been encroached, to a lesser or greater degree by woody species, primarily piñon and juniper. According to Vander Lee et al. (2006) approximately 70 percent (88,309 acres) of these invaded acres may be non-restorable to their former grassland state. Historically these grasslands were dominated by herbaceous vegetation.

Table 25. Most current (USFS, 2008b) understory vegetation ecological status, range condition, and departure from desired conditions (DC) on capability grazing lands within the Great Basin grassland PNVT on the A-SNFs

No Capability Grazing Lands (DC departure status unknown)†	Vegetation Ecological Status ¹⁵ and Range Condition ^{16, 18} Ratings of Capable Grazing Lands within the Great Basin Grassland PNVT on the A-SNFs‡													Total Acres	
	high ecological status				moderately-high ecological status		moderately-low ecological status		low ecological status		no data (DC departure status unknown)		total acres		
	excellent range condition		good range condition		fair range condition		poor range condition		very-poor range condition						
	acres	%	acres	%	acres	%	acres	%	acres	%	acres	%			
	627	0.3	0	0.0	1,187	0.6	17,767	9.6	128,068	69.3	32,896	17.8	4,979		2.7
DC departure	no		low		moderate		high		severe						

† See footnote 14 on page 18

‡ See footnotes 15, 16 and 18 on page 18

Threats: The most important threats under agency authority to this PNVT include fire suppression, which effectively ended the frequent fire regime typical of this grassland, woody species encroachment and establishment, human-caused fires, roads, highways and energy corridors, noxious weeds and invasive plants, and livestock grazing. These threat types include modification of natural processes and habitat conversion which have negative consequences to ecological composition, structure, function and processes. Continuation of current management along with ecological threshold changes (woody species encroachment, loss of understory productivity, loss of soil and soil productivity (there are also areas (roughly 94%) where the soils are in impaired and/or unsatisfactory condition) is not likely to move this PNVT towards DC and HRV. According to Printz et al. (2014), soil health is the capacity of a soil to maintain its function and flow of ecosystem services given a specific set of physical, chemical, and environmental boundaries (Doran and Parken, 1994; USDA NRCS, 2013b). When a soil's health deteriorates, its capacity to support and regulate ecosystems is diminished, affecting energy flows, nutrient cycling, and productivity. Overall, based on VDDT modeling, under current management, there is considerable change in the DI from current to DC and HRV, which would indicate a continued trend in departure movement away from DC, and HRV, and a more improperly functioning system. These trends appear to be constant from 30 to 50 years. See Appendix E for a more complete discussion of the threats affecting the Great Basin grassland and the risks they pose to this PNVT.

According to Gori and Enquist (2003), changes in the structure and function of grassland systems have been noted as the primary cause of the loss of native diversity within grasslands (Stacey, 1995). Finch (2004) identified and summarized the major threats to grassland biological diversity as the loss of natural fire cycles, overgrazing by livestock (Fleischner et al., 1994), prairie dog eradication, exotic grasses, shrub encroachment, erosion, and habitat fragmentation.

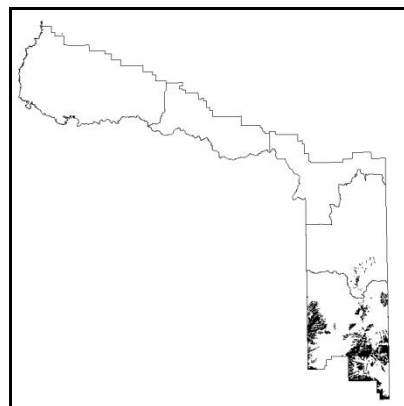
Semi-desert grassland (map 9 and appendix A map 2): This PNVT occurs primarily on the Clifton RD closely associated with the Madrean pine-oak woodland. At roughly 106,952 acres of NFS lands, or approximately 5 percent of the forests (table 4), the semi-desert grassland represents the seventh largest PNVT on the A-SNFs.

This PNVT occurs below the Mogollon Rim at elevations ranging from 3,200 to 4,500 feet. These grasslands are bounded by Chihuahuan Desert at the lowest elevations and Madrean pine-oak woodland or interior chaparral at the higher elevations. Generally, annual precipitation ranges from 12.6 to 21.3 inches, with 40 percent coming between October 1st and March 31st (table 26).

Species composition and dominance varies across the broad range of soils and topography. Dominant grassland associations/types are black grama (*Bouteloua eriopoda* (Torr.) Torr.) grassland, blue

grama/hairy grama (*Bouteloua hirsuta* Lag.) grassland, tobossa (*Pleuraphis mutica* Buckl.) grassland, giant sacaton (*Sporobolus giganteus* Nash) grassland, and mixed native perennial grassland. Shrubs may also inhabit these grasslands and their abundance and species composition also varies.

The A-SNFs' niche for this PNVT is approximately 14 percent of the White Mountains-San Francisco Peaks-Mogollon Rim ecoregion section (table 4). Within the White Mountains Woodland and Burro Mountains Oak-Juniper Woodland subsections, the A-SNFs contribute 58 and 24 percent of this PNVT, respectively. The A-SNFs' contribution to the sustainability of the semi-desert grassland PNVT is moderate (figure 1). With nearly 86 percent (table 4) of this PNVT located off-forest and having a low departure rating from HRV.



Map 9. General location of the semi-desert grassland PNVT

Table 26. Semi-desert grassland PNVT temperature and moisture data (Laing et al., 1987)

Average Annual Air Temperature ¹ (° F)		Average Annual Precipitation (inches)			Average Snowfall ² (inches)			Frost-free Days per Year
low	high	low	high	percent occurring between Oct 1 st and Mar 31 st	annual	accumulation	major accumulation period	
54	63	12.6	21.3	40	0 - 8	0	-	170 - 200

¹ Winters are mild

² Snowfall moisture is included in average annual precipitation data

Semi-desert grassland PNVT burn severity acres produced by the 2011 Wallow Fire can be seen in table 27. Overall, the fire did not cause a substantial impact to the semi-desert grassland PNVT. Less than two percent of this PNVT was within the perimeter of the Wallow Fire. Of the acres within the fire perimeter, approximately 59 percent were burned, and of that; nearly 19 percent (287 acres) were classified as experiencing a moderate to high severity burn (see Appendix C table 8 for a comparison of pre and post-2011 Wallow Fire semi-desert grassland PNVT overstory vegetation structural states).

Table 27. 2011 Wallow Fire burn severity within the semi-desert grassland PNVT (see Appendix C table 8)

Item	Burn Severity by Soil Burn Severity Class					Outside Fire Perimeter	Total PNVT
	within fire perimeter						
	high	moderate	low	unburned	total		
Acres	35	251	606	624	1,517		
Percent	2.3	16.5	40.0	41.2	100		
	Total Semi-desert Grassland PNVT						
Acres	35	251	606	624	1,517	105,435	106,952
Percent	0.0	0.2	0.6	0.6	1.4	98.6	100

Current conditions within the semi-desert grassland are highly departed from DC and HRV (table 2) with a DI of 79 percent; this PNVT is the 1st and 2nd most departed from DC and HV, respectively, on the forests. With respect to the DI there is a considerable (77%) over-representation of encroaching shrubs and trees of all sizes with open and closed canopies (vegetation structural states C and D) (see Appendix D figure 8 and Appendix D tables 69 through 76) and a major (81%) under representation of open, dense stands of perennial grasses and forbs (late successional) with less than ten percent woody canopy cover (vegetation structural states A and B). There is also an uncharacteristic state where various noxious weeds and invasive plants makeup a significant portion of the herbaceous vegetation composition represented by vegetation structural state E (roughly 2,100 acres); a more open canopy should promote an increase in herbaceous diversity and abundance.

Disturbances

Fire: According to Gori and Enquist (2003) and Schussman (2006a), it is documented, through direct and indirect evidence, that fire played a key role in semi-desert grasslands in southeastern Arizona before 1890 (Humphrey, 1953; Wright, 1960; Bahre, 1985; McPherson, 1995; Kaib et al., 1996; Turner et al., 2003). Specifically, stand replacing fires swept across the grasslands between June and July at intervals of every 2.5 to 10 years and covered hundreds of square miles at a time (Kaib et al., 1996; McPherson, 1995; Bahre, 1985). Passive fire suppression, through livestock grazing beginning in the late 1800s as well as active suppression increasing over the last 120 years, has resulted in reduced fire return intervals in semi-desert grassland (Davis et al., 2002; Kaib et al., 1996; McPherson, 1995). The SDG PNVT is characterized by historic fire regime group II, with an average fire return interval of 0-35 years from stand replacing fire. Recurring fire is important in this type to maintain open conditions, prevent shrub and tree invasion, and retain species diversity. TNC (Vander-Lee et al., 2006) synthesis of fire history in this ERU reports large scale fire events occurring every 2.5-10 years and typically occurring in the early summer. This coincides with pre-monsoon lightning activity in the region and contemporary fire behavior suggests that historic ignitions would likely have burned until they ran out of contiguous fuel or were rained out. Based its current DI rating, this PNVT has a FRCC of III.

Lack of fire has been implicated in the increased density and cover of mesquite, juniper, broom snakeweed (*Gutierrezia sarothrae* (Pursh) Britton & Rusby), burrowed (*Isocoma tenuisecta* Greene), creosote bush (*Larrea tridentata* (DC.) Coville), and cacti (Humphrey and Mehrhoff, 1958; Buffington and Herbel, 1965; Gori and Enquist, 2003; Hennessy et al., 1983; Muldavin et al., 2002; Turner et al., 2003). This increase in woody species has been documented both with and without the presence of livestock grazing and has not been convincingly tied to climatic changes (McPherson and Weltzin, 1998, 2000; Turner et al., 2003). Ultimately, the increase in trees and shrubs has changed vegetation in the semi-desert grasslands from a predominantly open perennial grass system to mixed shrub, tree, and perennial grass system with multiple areas having been converted to shrublands (Gibbens et al., 2005; Gori and Enquist, 2003), and woodlands (Vander Lee et al., 2006).

Non-native Invasive Plants: Non-native invasive plants infest roughly 1,730 to 2,470 acres; primarily mullein, Lehmann lovegrass, and field bindweed (*Convolvulus arvensis* L.). According to Jordan et al. (2008), noxious and invasive weeds are of special concern because there is ample evidence that non-native invasive plants can modify the physical and/or chemical attributes of soil, including inputs and cycling of N and other elements (Ehrenfeld, 2003; Haubensak et al., 2004; Hawkes et al., 2005; Sperry et al., 2006; Norton et al., 2007), pH (Kourtev et al., 2003), and soil organic matter and aggregation (Saggar et al., 1999). There is also evidence of direct modification of various components of the biotic composition of invaded soil, e.g., affecting the soil food web (Duda et al., 2003), total soil microbial communities (Kourtev et al., 2002a and 2002b; Kourtev et al., 2003), and mutualistic fungi (Allen et al., 2003; Hawkes et al., 2006; Mummey and Rillig, 2006; Mack and Rudgers 2008).

Non-native plant invasions are widely recognized as significant threats to biodiversity conservation worldwide (Brooks et al., 2004; Brooks, 2008). One way invasions can affect native ecosystems is by changing fuel properties, which can in turn affect fire behavior and, ultimately, alter fire regime characteristics such as frequency, intensity, extent, type, and seasonality of fire (Levine et al., 2003; Brooks et al., 2004; Brooks, 2008). If the regime changes subsequently promote the dominance of the invaders, then an invasive plant-fire regime cycle can be established. This change in fire regime is one of the most significant ways that plant invasions can affect ecosystems (Brooks, 2008).

Roads: According to the forests' GIS database, approximately 100 miles of roads and motorized trails have been constructed within this PNVT; this equates to roughly 0.6 linear miles of road per square mile.

Roads and trails are one of the primary access points for noxious and invasive weed transport and their right-of-way are areas of establishment.

Insect and Disease: Between 2000 and 2004, insects and disease have impacted approximately seven percent of this PNVT.

Herbivory: Native herbivores in the semi-desert grasslands ranged from insects and rodents to pronghorn antelope and deer (Finch, 2004). According to Fleischner et al. (1994), herbivory has had detrimental effects on the composition, structure and function of grassland ecosystems, and has led to a decrease in native species richness.

The most current A-SNFs data, 2007-2008 (USFS, 2008b), indicates that within the capable grazing lands (80% of the total PNVT's area) associated with the semi-desert grassland (table 28); approximately 52 percent of the herbaceous understory is in low to moderately-low ecological status or very-poor to poor range condition, while only 34 percent is in moderately-high to high ecological status or fair range condition. Movement in the direction of low to moderately-low ecological status has resulted in lower levels of herbaceous vegetation ground cover and lower levels of vigor and growth, as well as species compositional shifts, and possible changes in site potential. Total herbage production is considered to be correlated with the condition of the range (Osborn, 1956; Goebel and Cook, 1960). The majority of the herbaceous understory vegetation within the semi-desert grassland capable grazing lands is highly departed from DCs. According to Osborn (1952), for maximum moisture infiltration, two conditions are essential: 1) an adequate surface [vegetation] cover to cushion the impact of the falling raindrops and 2) favorable soil conditions associated with a relatively advanced stage of ecological succession for the site, typical of one of the higher range condition classes.

Table 28. Most current (USFS, 2008b) understory vegetation ecological status, range condition, and departure from desired conditions (DC) on capability grazing lands within the semi-desert grassland PNVT on the A-SNFs

No Capability Grazing Lands (DC departure status unknown)†	Vegetation Ecological Status ¹⁵ and Range Condition ^{16, 18} Ratings of Capable Grazing Lands within the Semi-desert Grassland PNVT on the A-SNFs‡														Total Acres	
	high ecological status						moderately-high ecological status		moderately-low ecological status		low ecological status		no data (DC departure status unknown)			total acres
	excellent range condition		good range condition		fair range condition		poor range condition		very-poor range condition							
	acres	%	acres	%	acres	%	acres	%	acres	%	acres	%				
21,301	19.9	0	0.0	3,236	3.8	25,533	29.8	42,987	50.2	1,859	2.2	12,035	14.1	85,650	106,592	
DC departure	no		low		moderate		high		severe							

† See footnote 14 on page 18

‡ See footnotes 15, 16 and 18 on page 18

At present, much of this grassland more closely resembles woodland than grassland. Overall, approximately 80 percent or nearly 85,562 acres of this PNVT have been encroached, to a lesser or greater degree by woody species, primarily juniper and mesquite. According to Vander Lee et al. (2006) approximately 36 percent (30,802 acres) of these invaded acres may be non-restorable to their former grassland state. Historically these grasslands were dominated by herbaceous vegetation.

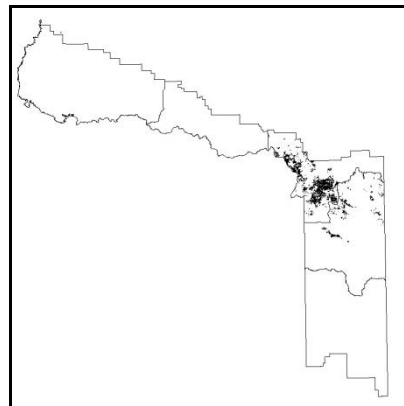
Threats: The threats to semi-desert grassland are the same as those listed for Great Basin grassland. Continuation of current management along with ecological threshold changes, such as woody species encroachment, loss of understory productivity, loss of soil and soil productivity (there are also areas (roughly 41%) where the soils are in impaired and/or unsatisfactory condition, and another 52 percent are classified as inherently unstable) is not likely to move this PNVT towards DC and HRV. According to Printz et al. (2014), soil health is the capacity of a soil to maintain its function and flow of ecosystem

services given a specific set of physical, chemical, and environmental boundaries (Doran and Parken, 1994; USDA NRCS, 2013b). When a soil's health deteriorates, its capacity to support and regulate ecosystems is diminished, affecting energy flows, nutrient cycling, and productivity. Overall, based on VDDT modeling, under current management, there is considerable change in the DI from current to DC and HRV, which would indicate a continued trend in departure movement away from DC, and HRV, and a more improperly functioning system. These trends appear to be constant to 50 years. See Appendix E for a more complete discussion of the threats affecting the semi-desert grassland and the risks they pose to this PNVT.

Montane/subalpine grasslands (map10 and appendix A map 2): This PNVT occurs primarily on the Alpine and Springerville RDs and at roughly 51,559 acres of NFS lands, or approximately 3 percent of the forests (table 4), is the smallest of the grassland types, and represents the ninth largest PNVT on the A-SNFs.

This PNVT contains a mix of dominant and co-dominant species in both dry and moister environments. This PNVT typically occurs at elevations ranging from approximately 7,500 to 11,000 feet on gentle to steep gradient slopes. Generally, annual precipitation ranges from 19.7 to 30.7 inches, with 50-55 percent coming between October 1st and March 31st (table 29).

Soils in swales and on riparian benches are usually moist throughout the year, and often harbor several plant associations with varying dominant grasses and herbaceous species. Upland and swale vegetation composition are characterized by different dominant species.



Map 10. General location of the montane/subalpine grasslands PNVT

Table 29. Montane/subalpine grasslands PNVT temperature and moisture data (Laing et al., 1987)

Average Annual Air Temperature ¹ (° F)		Average Annual Precipitation (inches)			Average Snowfall ² (inches)			Number of Frost-free Days per Year
low	high	low	high	percent occurring between Oct 1 st and Mar 31 st	annual	accumulation	major accumulation period	
36	43	19.7	30.7	50 - 55	47 - 63	15 - 35	Oct 1 st - Apr 30 th	80 - 100

¹ Winters are cold

² Snowfall moisture is included in average annual precipitation data

Common species at higher elevations in more mesic sites include tufted hairgrass (*Deschampsia cespitosa* (L.) Beauv.), non-native Canada bluegrass (*Poa compressa* L.) and Kentucky bluegrass, sheep fescue (*Festuca ovina* L.), Nebraska sedge (*Carex nebrascensis* Dewey), yarrow (*Achillea millefolium* L.), dryspike sedge (*Carex siccata* Dewey), and Baltic rush (*Juncus balticus* L.).

The more xeric upland sites at the higher elevations are dominated by mutton bluegrass (*Poa fendleriana* L.), Arizona fescue, pine dropseed, mountain muhly, White Mountain sedge (*Carex geophila* Mackenzie), sheep fescue, woolly cinquefoil (*Potentilla hippiana* Lehm.), and small-leaf pussytoes (*Antennaria parvifolia* Nutt.).

Common species at lower elevations in more mesic sites include Canada and Kentucky bluegrass, spike muhly (*Muhlenbergia wrightii* Vasey ex Coult.), spreading fleabane (*Erigeron flagellaris* Gray), annual muhly (*Muhlenbergia minutissima* (Steud.) Swallen), white clover (*Trifolium repens* L.), yarrow, and dandelion (*Taraxacum officinale* L.).

The more xeric upland sites at lower elevations are dominated by pine dropseed, blue grama, spreading fleabane, prairie junegrass (*Koeleria macrantha* (Ledeb.) J.A. Schultes), White Mountain sedge, non-native Canada bluegrass, annual muhly, and Fendler's sandwort (*Arenaria fendleri* Gray).

Size of montane/subalpine grasslands range from small park-like openings to extensive landscapes covering several thousand acres. Trees occur along the periphery of these grasslands; primarily ponderosa pine, southwestern white pine, Engelmann spruce, and subalpine fir, depending on elevation and moisture gradient. Some shrubs may also be present.

The A-SNFs' niche for this PNVT is approximately 30 percent of the White Mountains-San Francisco Peaks-Mogollon Rim ecoregion section (table 4). Within the White Mountains Woodland and White Mountains Coniferous Forest subsections, the A-SNFs contribute 96 and 74 percent of this PNVT, respectively. The A-SNFs' contribution to the sustainability of the montane/subalpine grasslands PNVT is moderate (figure 1). With roughly 70 percent (table 4) of this PNVT located off-forest and having a moderate departure rating from HRV.

Montane/subalpine grasslands PNVT burn severity acres produced by the 2011 Wallow Fire can be seen in table 30. Overall, the fire did cause a significant impact to the montane/subalpine grasslands PNVT. Somewhat more than 70 percent of this PNVT was within the perimeter of the Wallow Fire. Of the acres within the fire perimeter, roughly 80 percent were burned, and of that; five percent (1,855 acres) were classified as undergoing a moderate to high severity burn (see Appendix C table 9 for a comparison of pre and post-2011 Wallow Fire montane/subalpine grasslands PNVT overstory vegetation structural states).

Table 30. 2011 Wallow Fire burn severity within the montane/subalpine grasslands PNVT (see Appendix C table 9)

Item	Burn Severity by Soil Burn Severity Class					Outside Fire Perimeter	Total PNVT
	within fire perimeter						
	high	moderate	low	unburned	total		
Acres	176	1,679	27,422	7,159	36,436		
Percent	0.5	4.6	75.3	19.6	100		
	Total Montane/Subalpine Grasslands PNVT						
Acres	176	1,679	27,422	7,159	36,436	15,020	51,559
Percent	0.3	3.3	53.2	13.9	70.7	29.1	100

Current conditions within the montane/subalpine grasslands are moderately departed from DC (table 2) with a DI of 54 percent from both DC²⁰ and HRV; this PNVT is the 6th and 8th most departed from DC and HV, respectively, on the forests. With respect to the DI there is an over-representation (50%) of mid development (mid successional), open canopy (herbaceous vegetation) (vegetation structural state B), encroaching shrubs and trees of all sizes with open and closed canopies (vegetation structural state D) (see Appendix D figure 9), and an important (41%) under-representation of late development (late successional), open canopy (herbaceous vegetation) vegetation structural state C). There is also an uncharacteristic state where various noxious weeds and invasive plants makeup a significant portion of the herbaceous vegetation composition represented by vegetation structural state E (roughly 520 acres). Overall, approximately ten percent or nearly 5,156 acres of this PNVT have been encroached, to a lesser or greater degree by woody species, primarily mixed conifer, ponderosa pine and piñon-juniper, depending on elevation and slope aspect.

²⁰ Montane/subalpine grasslands PNVT has the equivalent departure from DC as the wet mixed conifer forest PNVT (montane/subalpine grasslands PNVT should not have a significant woody overstory; < 10 percent)

Disturbances

Fire: Most grassland is subject to encroachment by woody vegetation, and montane/subalpine grasslands are found within a mosaic of reproductive coniferous forests. However, fire is acknowledged to be the most influential force in checking tree encroachment (Daubenmire, 1968; Allen, 1984). Adjacent grasslands, with drier microclimates and annual accumulation of fuels are assumed to have burned at least as frequently as surrounding forest types (Allen, 1984). During these grassland fires, young tree seedlings would have been killed due to the intensity of fire behavior in grassland fuels, maintaining intact grasslands (Daubenmire, 1968). Based its DI rating, this PNVNT has a FRCC of II. The MSG PNVNT is characterized by historic fire regime group II, with an average fire return interval of 0-35 years from stand replacing fire (Wahlberg et al., 2014). However, according to Vander-Lee et al. (2006), historic fire return interval is estimated to have been between 2 and 400 years depending on the adjacent forest type.

Non-native Invasive Plants: Non-native invasive plants infest roughly 1,100 to 1,650 acres; primarily mullein and bull thistle. However, according to White (2002), non-native Kentucky and Canada bluegrasses are dominant species within the floristic assemblages of these grasslands. In addition, another six non-native grass species have become naturalized within these grassland communities. All eight of these cool-season, perennial, non-native grasses have been seeded by the USDA Forest Service for either: 1) rehabilitation of skid trails, logging roads, landings, fire lines and severely burned areas, 2) riparian and meadow restoration, and/or 3) forage enhancement for domestic livestock (Jardine and Anderson, 1919; Sampson, 1923; USFS, 1937; White, 2002). According to Jordan et al. (2008), noxious and invasive weeds are of special concern because there is ample evidence that non-native invasive plants can modify the physical and/or chemical attributes of soil, including inputs and cycling of N and other elements (Ehrenfeld, 2003; Haubensak et al., 2004; Hawkes et al., 2005; Sperry et al., 2006; Norton et al., 2007), pH (Kourtev et al., 2003), and soil organic matter and aggregation (Saggar et al., 1999). There is also evidence of direct modification of various components of the biotic composition of invaded soil, e.g., affecting the soil food web (Duda et al., 2003), total soil microbial communities (Kourtev et al., 2002a and 2002b; Kourtev et al., 2003), and mutualistic fungi (Allen et al., 2003; Hawkes et al., 2006; Mummey and Rillig, 2006; Mack and Rudgers, 2008).

Non-native plant invasions are widely recognized as significant threats to biodiversity conservation worldwide (Brooks et al., 2004; Brooks, 2008). One way invasions can affect native ecosystems is by changing fuel properties, which can in turn affect fire behavior and, ultimately, alter fire regime characteristics such as frequency, intensity, extent, type, and seasonality of fire (Levine et al., 2003; Brooks et al., 2004; Brooks, 2008). If the regime changes subsequently promote the dominance of the invaders, then an invasive plant-fire regime cycle can be established. This change in fire regime is one of the most significant ways that plant invasions can affect ecosystems (Brooks, 2008).

Roads: According to the forests' GIS database, approximately 170 miles of roads and motorized trails have been constructed within this PNVNT; this equates to roughly 2.1 linear miles of road per square mile. Roads and trails are one of the primary access points for noxious and invasive weed transport and their right-of-way are areas of establishment.

Insects and Disease: Between 2000 and 2004, insects and disease have impacted approximately 13 percent of this PNVNT.

Herbivory: Smith (2007) could find no studies that documented herbivory as an important historical ecological determinant for the montane/subalpine grasslands. Turner and Paulsen (1976), and Vankat (2006) accept that herbivores did use grasslands for forage, including mule deer, Merriam's elk, pronghorn, and various rodents and insects. Different grazers show preference for different species of grasses, grasslike plants and/or forbs, and reduce the more palatable species with high variability spatially

and temporally, but little is known about direct effects on high elevation grasslands. According to Fleischner et al. (1994), herbivory has had detrimental effects on the composition, structure and function of grassland ecosystems, and has led to a decrease in native species richness.

The most current A-SNFs data (White, 2002; USFS, 2008b); indicates that within the capable grazing lands (99% of the total PNVT's area) associated with the montane/subalpine grasslands (table 31); approximately 79 percent of the herbaceous understory is in moderately-high to high ecological status or fair, good and excellent range conditions, while nearly 20 percent is in low to moderately low ecological status or very-poor to poor range condition. Moderately-high to high ecological status has resulted in maintaining levels of herbaceous vegetation ground cover and levels of vigor and growth, as well as species composition, and site potential. Total herbage production is considered to be correlated with the condition of the range (Osborn, 1956; Goebel and Cook, 1960). The majority of the herbaceous understory vegetation within the montane/subalpine grasslands capable grazing lands is moderately to highly departed from DCs. According to Osborn (1952), for maximum moisture infiltration, two conditions are essential: 1) an adequate surface [vegetation] cover to cushion the impact of the falling raindrops and 2) favorable soil conditions associated with a relatively advanced stage of ecological succession for the site, typical of one of the higher range condition classes.

Table 31. Most current (White 2002; USFS, 2008b) understory vegetation ecological status, range condition, and departure from desired conditions (DC) on capability grazing lands within the montane/subalpine grasslands PNVT on the A-SNFs

No Capability Grazing Lands (DC departure status unknown)†	Vegetation Ecological Status ¹⁵ and Range Condition ^{16, 18} Ratings of Capable Grazing Lands within the Montane/Subalpine Grasslands PNVT on the A-SNFs‡														Total Acres
	high ecological status				moderately-high ecological status		moderately-low ecological status		low ecological status		no data (DC departure status unknown)		total acres		
	excellent range condition		good range condition		fair range condition		poor range condition		very-poor range condition						
	acres	%	acres	%	acres	%	acres	%	acres	%	acres	%			
307	0.7	1,860	3.6	3,756	7.3	34,607	67.6	8,899	17.4	1,438	2.8	628	1.2	51,188	51,559
DC departure		no		low		moderate		high		severe					

† See footnote 14 on page 18

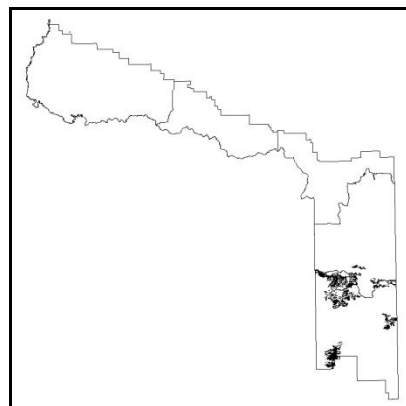
‡ See footnotes 15, 16 and 18 on page 18

Threats: The threats to montane/subalpine grasslands are the same as those listed for Great Basin and semi-desert grasslands. A Region 3 VDDT model was not developed for this PNVT, however, continuation of current management along with ecological threshold changes, such as woody species encroachment, loss of understory productivity, loss of soil and soil productivity (there are also areas (roughly 8%) where the soils are in impaired condition) is likely to continue to move this PNVT way DC and HRV. According to Printz et al. (2014), soil health is the capacity of a soil to maintain its function and flow of ecosystem services given a specific set of physical, chemical, and environmental boundaries (Doran and Parken, 1994; USDA NRCS, 2013b). When a soil's health deteriorates, its capacity to support and regulate ecosystems is diminished, affecting energy flows, nutrient cycling, and productivity. See Appendix E for a more complete discussion of the threats affecting the montane/subalpine grasslands and the risks they pose to this PNVT.

Chaparral PNVT

Interior chaparral (map 11, and appendix A maps 1 and 2): This PNVT occurs primarily on the Clifton RD and at roughly 55,981 acres of NFS lands, or approximately 3 percent of the forests (table 4), represents the eighth largest PNVT on the A-SNFs. This PNVT is typically found on mountain foothills and lower slopes where low-elevation desert landscapes transition into Madrean pine-oak woodlands.

Interior chaparral consists of mixed shrub associations including but not limited to the following species: Manzanita (*Arctostaphylos* spp. Adans.), desert ceanothus (*Ceanothus greggii* Gray), mountain mahogany (*Cercocarpus montanus* Raf.), silktassles (*Garrya* spp. Dougl. ex Lindl.), Stansbury cliffrose (*Purshia stansburiana* (Torr.) Henrickson), yerba de pasmo (*Baccharis pteronioides* DC.), evergreen oaks, various cactus such as prickly pear (*Opuntia* spp. P. Mill.), cholla (*Cylindropuntia* spp. (Engelm.) Kreuzinger), hedgehog cactus (*Echinocereus* spp. Engelm.), and globe cactus (*Mammillaria* spp. Haw.), Arizona cypress (*Cupressus arizonica* Greene), and sumacs (*Rhus* spp. L.). Grasses typically include bullgrass (*Muhlenbergia emersleyi* Vasey) and longtongue muhly (*M. longiligula* A.S. Hitchc.).



Map 11. General location of the interior chaparral PNVT

Generally, annual precipitation ranges from 17.3 to 23.6 inches, with 45 percent coming between October 1st and March 31st (table 32).

Table 32. Interior chaparral PNVT temperature and moisture data (Laing et al., 1987)

Average Annual Air Temperature ¹ (° F)		Average Annual Precipitation (inches)			Average Snowfall ² (inches)			Number of Frost-free Days per Year
low	high	low	high	percent occurring between Oct 1 st and Mar 31 st	annual	accumulation	major accumulation period	
41	54	17.3	23.6	45	12 - 39	0 - 6	Dec 1 st - Mar 31 st	130 - 160

¹ Winters can be mild or cold depending on elevation and aspect

² Snowfall moisture is included in average annual precipitation data

The A-SNFs' niche for this PNVT is approximately 24 percent of the White Mountains-San Francisco Peaks-Mogollon Rim ecoregion section (table 4). Within the White Mountains Woodland and White Mountains Coniferous Forest subsections, the A-SNFs contribute 78 and 61 percent of this PNVT, respectively. The A-SNFs' contribution to the sustainability of the interior chaparral PNVT is low (figure 1). With 76 percent (table 4) of this PNVT located off-forest and having a low departure rating from HRV.

Interior chaparral PNVT burn severity acres produced by the 2011 Wallow Fire can be seen in table 33. Overall, the fire did not cause a substantial impact to the interior chaparral PNVT. Somewhat more than 18 percent of this PNVT was within the perimeter of the Wallow Fire. Of the acres within the fire perimeter, roughly 61 percent were burned, and of that; 28 percent (2,783 acres) were classified as experiencing a moderate to high severity burn (see Appendix C table 10 for a comparison of pre and post-2011 Wallow Fire interior chaparral PNVT overstory vegetation structural states).

Current conditions within the interior chaparral are not departed from DC and HRV (table 2) with a DI of 8 percent for both, making it the least departed PNVT on the forests for DC and HRV, respectively (see Appendix D figure 10). With respect to DI, there is a small over-representation (8 percent) of early development (early seral) open canopy herbaceous dominated conditions in a historically shrub dominated vegetation type.

Table 33. 2011 Wallow Fire burn severity within the interior chaparral PNV (see Appendix C table 10)

Item	Burn Severity by Soil Burn Severity Class					Outside Fire Perimeter	Total PNV
	within fire perimeter						
	high	moderate	low	unburned	total		
Acres	357	2,426	3,266	3,900	9,949		
Percent	3.6	24.4	32.8	39.2	100		
Total Interior Chaparral PNV							
Acres	357	2,426	3,266	3,900	9,949	46,032	55,981
Percent	0.6	4.3	5.8	7.0	17.8	82.2	100

Disturbances

Fire: The IC PNV is characterized by historic fire regime group IV, with an average fire return interval of 35-200+ years from stand replacement fire (Wahlberg et al., 2014). Given the relatively less frequent and broad fire return interval that chaparral shrublands are adapted to, the last 120 years of fire suppression has had less effect on chaparral than frequent fire regime adapted PNVTs. In general, structural changes, such as changes from a grass dominated structure to a shrub dominated one, have not occurred within chaparral. The only change that has been documented within this PNV is an increase in shrub cover densities within already existing chaparral stands (Huebner et al., 1999; Huebner and Vankat 2003). Based its current DI rating, this PNV has a FRCC of I.

Non-native Invasive Plants: Non-native invasive plants have become established and infest roughly 100 to 150 acres; primarily mullein. According to Jordan et al. (2008), noxious and invasive weeds are of special concern because there is ample evidence that non-native invasive plants can modify the physical and/or chemical attributes of soil, including inputs and cycling of N and other elements (Ehrenfeld, 2003; Haubensak et al., 2004; Hawkes et al., 2005; Sperry et al., 2006; Norton et al., 2007), pH (Kourtev et al., 2003), and soil organic matter and aggregation (Saggar et al., 1999). There is also evidence of direct modification of various components of the biotic composition of invaded soil, e.g., affecting the soil food web (Duda et al., 2003), total soil microbial communities (Kourtev et al., 2002a and 2002b; Kourtev et al., 2003), and mutualistic fungi (Allen et al., 2003; Hawkes et al., 2006; Mummey and Rillig, 2006; Mack and Rudgers, 2008).

Non-native plant invasions are widely recognized as significant threats to biodiversity conservation worldwide (Brooks et al., 2004; Brooks, 2008). One way invasions can affect native ecosystems is by changing fuel properties, which can in turn affect fire behavior and, ultimately, alter fire regime characteristics such as frequency, intensity, extent, type, and seasonality of fire (Levine et al., 2003; Brooks et al., 2004; Brooks, 2008). If the regime changes subsequently promote the dominance of the invaders, then an invasive plant-fire regime cycle can be established. This change in fire regime is one of the most significant ways that plant invasions can affect ecosystems (Brooks, 2008).

Roads: According to the forests' GIS database, approximately 5 miles of roads and motorized trails have been constructed within this PNV; this equates to roughly 0.1 linear miles of road per square mile. Roads and trails are one of the primary access points for noxious and invasive weed transport and their right-of-way are areas of establishment.

Insects and Disease: Between 2000 and 2004, insects and disease have impacted approximately 19 percent of this PNV.

Herbivory: Mule deer, white-tailed deer, and black bears are key herbivores in interior chaparral. Deer eat a variety of forbs, shrubs and browse, as well as mast and other fruits (Cable, 1975; Baker, 1999).

Conversion treatments of chaparral to grassland were shown to increase forage for deer, elk, and cattle. However, the decrease in protective cover following conversion was also shown to negatively affect deer, especially when treatments occurred on large landscape scales (Cable, 1975; Baker, 1999). Additionally, cover and food for black bear is best when there are shrubs and low trees due to presence of numerous mast and fruit producing species (Baker, 1999). According to Fleischner et al. (1994), herbivory has had detrimental effects on the composition, structure and function of chaparral ecosystems, and has led to a decrease in native species richness.

The most current A-SNFs data, 2007-2008 (USFS, 2008b), indicates that within the capable grazing lands (44% of the total PNVT's area) associated with the interior chaparral (table 34); approximately 54 percent of the herbaceous understory is in moderately-high ecological status or fair range condition, while nearly 45 percent is in moderately-low ecological status or poor range condition. Movement in the direction of moderately-low ecological status has resulted in lower levels of herbaceous vegetation ground cover and lower levels of vigor and growth, as well as species compositional shifts, and possible changes in site potential. Total herbage production is considered to be correlated with the condition of the range (Osborn, 1956; Goebel and Cook, 1960). The majority of the herbaceous understory vegetation within the interior chaparral capable grazing lands is moderately to highly departed from DCs. According to Osborn (1952), for maximum moisture infiltration, two conditions are essential: 1) an adequate surface [vegetation] cover to cushion the impact of the falling raindrops and 2) favorable soil conditions associated with a relatively advanced stage of ecological succession for the site, typical of one of the higher range condition classes.

Table 34. Most current (USFS, 2008b) understory vegetation ecological status, range condition, and departure from desired conditions (DC) on capability grazing lands within the interior chaparral PNVT on the A-SNFs

No Capability Grazing Lands (DC departure status unknown)†	Vegetation Ecological Status ¹⁵ and Range Condition ^{16, 18} Ratings of Capable Grazing Lands within the Interior Chaparral PNVT on the A-SNFs‡														Total Acres
	high ecological status		moderately-high ecological status		moderately-low ecological status		low ecological status		no data (DC departure status unknown)		total acres				
	excellent range condition		good range condition		fair range condition		poor range condition		very-poor range condition						
	acres	%	acres	%	acres	%	acres	%	acres	%	acres	%	acres	%	
31,403	56.1	0	0.0	299	1.2	11,756	47.8	9,789	39.8	0	0.0	2,734	11.1	24,578	55,981
DC departure		no		low		moderate		high		severe					

† See footnote 14 on page 18

‡ See footnotes 15, 16 and 18 on page 18

Threats: The most important and far reaching threat under agency authority for this PNVT is the potential for human-caused fires, invasive species establishment, livestock grazing, loss of soil and soil productivity (there are also areas (19%) where the soils are in unsatisfactory condition, and another 81 percent are classified as inherently unstable). According to Printz et al. (2014), soil health is the capacity of a soil to maintain its function and flow of ecosystem services given a specific set of physical, chemical, and environmental boundaries (Doran and Parken, 1994; USDA NRCS, 2013b). When a soil's health deteriorates, its capacity to support and regulate ecosystems is diminished, affecting energy flows, nutrient cycling, and productivity. Under current management risks are addressed. See Appendix E for a more complete discussion of the threats affecting the interior chaparral and the risks they pose to this PNVT.

Riparian PNVTs

Riparian areas are of primary importance because of the scarcity of water in the Southwest. In Arizona and New Mexico, 80 percent of all vertebrate species use riparian areas for at least half their life cycles, and more than half of these are totally dependent on riparian areas (Chaney et al., 1990). According to the Arizona Riparian Council (ARC, 2004), 60 to 75 percent of the state's wildlife species depend on riparian areas to sustain their populations, even though riparian habitats occupy less than half a percent of Arizona's land area (ARC, 2004). Likewise, aquatic habitats and fish productivity are directly related to properly functioning riparian systems (Knutson and Naef, 1997). All of the riparian PNVTs are unique in the fact that they represent a very small portion (less than three percent total) of the A-SNFs' land area. However, the A-SNFs are responsible for the management of the majority of this type within the landscape of the ecoregion (table 4). These areas on the A-SNFs are a focal point for humans, terrestrial wildlife, and livestock activities, as well as species that are obligate-dependence on wetland, riparian and aquatic habitats. Therefore, both demand and impacts are high. Currently, 72 to 75 percent of riparian communities on the A-SNFs are either functioning-at-risk or non-functioning²¹. In addition, monitoring across the forests has found that riparian area soils and herbaceous vegetation (sedges, grasses, forbs) and deciduous trees and shrubs (cottonwood, willow) receive far greater impacts from grazing and browsing ungulates, both domestic and wild, as compared to uplands.

In addition, recent studies by Beckman and Wohl (2014) found that headwater streams are particularly important in fluvial carbon dynamics because of their relatively close connection to adjacent uplands, headwater streams receive most of the terrestrial dissolved organic carbon and and fine and coarse particulate organic matter (Battin et al., 2008) during downstream transport. Fluvial examples of storage and retention zones include marginal eddies, lee deposits downstream from obstacles (Thompson, 2008), river and stream segments ponded by beaver dams, logjams or other downstream constrictions (Lautz et al., 2006 and 2010; Fanelli and Lautz, 2008; Hester and Doyle, 2008; Hester et al., 2009), and where there is mixing of shallow groundwater and surface water beneath and adjacent to streams (Lawrence et al., 2013); also known as the hyporheic zone - hyporheic zones are areas of the streambed and near-stream aquifers through which stream water flows; these areas have been identified as critically important in stream nutrient cycling, in moderating stream temperature regimes, and in creating unique habitats within streams (Wondzell et al., no-date) and fish spawning, among other processes (Harvey and Fuller, 1998).

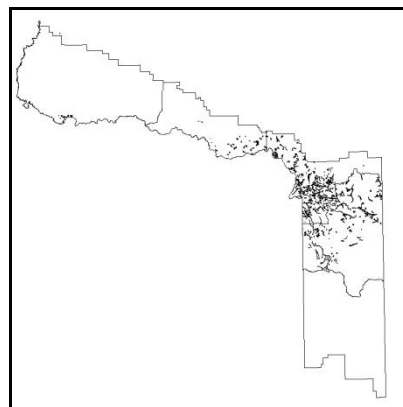
Wetland/cienega riparian areas (map 12, and appendix A maps 1 and 2): This PNVt occurs primarily on the Alpine, Lakeside, and Springerville RDs and at roughly 17,900 acres of NFS lands, or approximately 1 percent of the forests (table 4), represents the tenth largest PNVt on the A-SNFs. This PNVt is associated with perennial springs or headwater streams, bogs, and fens where ground water intersects the surface and creates pools of standing water, sometimes with channels flowing between pools. Generally, annual precipitation ranges from 19.7 to 31.5 inches, with 50-55 percent coming between October 1st and March 31st (table 35).

Some vegetation types found in wetland/cienegas include saltgrass (*Distichlis spicata* (L.) Greene), yerba mansa (*Anemopsis californica* (Nutt.) Hook. & Arn.), sacaton (*Sporobolus airoides* (Torr.) Torr.), giant sacaton, and bog alkaligrass (*Puccinellia parishii* A.S. Hitchc.) in more saline areas at lower elevations. At medium and higher elevations tufted hairgrass, mannagrasses (*Glyceria* spp. R. Br.), non-native

²¹ Functional-At-Risk (FAR): Riparian-wetland areas that are in functional condition, but an existing soil, water, or vegetation attribute makes them susceptible to degradation. Non-functional (NF): Riparian-wetland areas that clearly are not providing adequate vegetation, landform, or large woody debris to dissipate stream energy associated with high flows, and are not reducing erosion, improving water quality, etc. (USDI BLM, 1993, 1994, 1998, 1999 and 2003).

Canada and Kentucky bluegrass, rushes, sedges, flat sedges (*Cyperus* spp. L.), and spikerushes (*Eleocharis* spp. R. Br.) can be found, and deep pools support a variety of other aquatic vegetation.

The A-SNFs' niche for this PNVNT is approximately 64 percent of the White Mountains-San Francisco Peaks-Mogollon Rim ecoregion section (table 4). Within the White Mountains Coniferous Forest and White Mountains Scarp Woodland-Coniferous Forest subsections, the A-SNFs contribute 95 and 79 percent of this PNVNT, respectively. With 36 percent (table 4) of this PNVNT located off-forest and having an overall estimated moderate departure rating from HRV; nevertheless, given the importance of riparian areas in the Southwest in general and the forests specifically, the A-SNFs' contribution to the sustainability of the wetland/cienega riparian areas PNVNT is high (figure 1). Historically these riparian areas were dominated by herbaceous vegetation.



Map 12. General location of the wetland/cienega riparian areas PNVNT

Table 35. Wetland/cienega riparian areas PNVNT temperature and moisture data (Laing et al., 1987)

Average Annual Air Temperature ¹ (° F)		Average Annual Precipitation (inches)			Average Snowfall ² (inches)			Number of Frost-free Days per Year
low	high	low	high	percent occurring between Oct 1 st and Mar 31 st	annual	accumulation	major accumulation period	
34	43	19.7	31.5	50 - 55	47 - 67	14 - 39	Nov 1 st - Apr 30 th	70 - 100

¹ Winters are cold

² Snowfall moisture is included in average annual precipitation data

Wetland/cienega riparian areas PNVNT burn severity acres produced by the 2011 Wallow Fire can be seen in table 36. Overall, the fire did cause a significant impact to the wetland/cienega riparian areas PNVNT. Approximately 60 percent of this PNVNT was within the perimeter of the Wallow Fire. Of the acres within the fire perimeter, roughly 73 percent were burned, and of that; slightly more than ten percent (1,200 acres) were classified as undergoing a moderate to high severity burn (see Appendix C table 11 for a comparison of pre and post-2011 Wallow Fire wetland/cienega riparian areas PNVNT overstory vegetation structural states).

Table 36. 2011 Wallow Fire burn severity within the wetland/cienega riparian areas PNVNT (see Appendix C table 11)

Item	Burn Severity by Soil Burn Severity Class					Outside Fire Perimeter	Total PNVNT
	within fire perimeter						
	high	moderate	low	unburned	total		
Acres	441	759	7,406	3,212	11,818		
Percent	3.7	6.4	62.7	27.2	100		
	Total Wetland/Cienega Riparian Areas PNVNT						
Acres	441	759	7,406	3,212	11,818	6,082	17,900
Percent	2.5	4.2	41.4	17.9	66.0	34.0	100

Current conditions within wetland/cienega riparian areas are rated at low departure from DC and HRV (table 2) with a DI of 36 percent for both DC and HRV; this PNVNT is the 7th and 9th most departed from DC and HV, respectively, on the forests. With respect to the DI there is an under-representation (27%) of mid development (mid successional), open canopy (herbaceous vegetation) (vegetation structural state B), and an over-representation (37%) of encroaching shrubs and trees of all sizes with open and closed canopies (vegetation structural states C and D) (see Appendix D figure 11). Historically, wetland/cienega riparian areas were capable of producing herbaceous vegetation that provided from 95 to 100 percent

ground cover. Today ground cover provided by herbaceous vegetation ranges from 55 to 100 percent (Laing et al., 1989). This is a decline in herbaceous cover ranging from 0 to 42 percent; a more open canopy should promote an increase in herbaceous diversity and abundance.

Disturbances

Fire: The moisture associated with riparian areas promotes lower fire frequency compared with adjacent uplands, and rapid recovery from fire events. Wet meadow types seldom burn (LANDFIRE, 2007f). However, fire behavior in these systems is strongly influenced by the adjacent PNVTs. However, with two of the largest wildfires in Arizona (2002- Rodeo/Chediski Fire and 2011 Wallow Fire), wildfire severity has increased in riparian PNVTs (Stone et al., 2010), as well as in the forest, woodland and grassland PNVTs

Hydrologic Events: Hydrological events (i.e., flooding) are/were the major disturbance agents in these systems.

Non-native Invasive Plants: Non-native invasive plants infest roughly 250 to 350 acres; primarily mullein and bull thistle. However, many of these areas are dominated by non-native Canada and Kentucky bluegrass. According to Jordan et al. (2008), noxious and invasive weeds are of special concern because there is ample evidence that non-native invasive plants can modify the physical and/or chemical attributes of soil, including inputs and cycling of N and other elements (Ehrenfeld, 2003; Haubensak et al., 2004; Hawkes et al., 2005; Sperry et al., 2006; Norton et al., 2007), pH (Kourtev et al., 2003), and soil organic matter and aggregation (Saggar et al., 1999). There is also evidence of direct modification of various components of the biotic composition of invaded soil, e.g., affecting the soil food web (Duda et al., 2003), total soil microbial communities (Kourtev et al., 2002a and 2002b; Kourtev et al., 2003), and mutualistic fungi (Allen et al., 2003; Hawkes et al., 2006; Mummey and Rillig, 2006; Mack and Rudgers, 2008).

Non-native plant invasions are widely recognized as significant threats to biodiversity conservation worldwide (Brooks et al., 2004; Brooks, 2008). One way invasions can affect native ecosystems is by changing fuel properties, which can in turn affect fire behavior and, ultimately, alter fire regime characteristics such as frequency, intensity, extent, type, and seasonality of fire (Levine et al., 2003; Brooks et al., 2004; Brooks, 2008). If the regime changes subsequently promote the dominance of the invaders, then an invasive plant-fire regime cycle can be established. This change in fire regime is one of the most significant ways that plant invasions can affect ecosystems (Brooks, 2008).

Roads: According to the forests' GIS database, approximately 70 miles of roads and motorized trails have been constructed within this PNVt; this equates to roughly 2.5 linear miles of road per square mile. Roads and trails are one of the primary access points for noxious and invasive weed transport and their right-of-way are areas of establishment.

Insects and Disease: Between 2000 and 2004, insects and disease have impacted approximately 23 percent of this PNVt.

Herbivory: Because these areas have water available, and have the potential to produce from 3,895 to 4,810 pounds of herbaceous vegetation per acre, they are areas of concentrated livestock use as well as wild ungulates. According to White (2002), livestock and elk grazing have been major negative influences in the alteration of structure, composition and function of the vegetation community. The majority of this PNVt has very low to low ecological similarity with historic conditions (White, 2002). According to Fleischner et al. (1994), herbivory has had detrimental effects on the composition, structure and function of riparian ecosystems, and has led to a decrease in native species richness. According to Hoorman and McCutcheon (2005a and 2005b), livestock grazing riparian areas can increase sediment

load from the watershed, increase instream trampling, increase disturbance and erosion from overgrazed streambanks, reduced sediment trapping by riparian and instream vegetation, decreased bank stability and increased peak flows from compaction. Livestock grazing has been found to negatively affect water quality and seasonal quantity, stream channel morphology, hydrology, riparian zone soils, instream and streambank vegetation, and aquatic and riparian wildlife (Platt, 1979; Armour et al., 1991; Fleischner 1994; Belsky et al., 1999; among others).

The most current A-SNFs data, 2007-2008 (USFS, 2008b), indicates that within the capable grazing lands (94% of the total PNVT's area) associated with wetland/cienegas riparian areas (table 37); the herbaceous understory is split almost equally between moderately-high to high (49 percent) and low to moderately-low (48 percent) ecological status or fair to good and very-poor to poor range conditions. Movement in the direction of low to moderately-low ecological status has resulted in lower levels of herbaceous vegetation ground cover and lower levels of vigor and growth, as well as species compositional shifts, and possible changes in site potential. Total herbage production is considered to be correlated with the condition of the range (Osborn, 1956; Goebel and Cook, 1960). The majority of the herbaceous understory vegetation within the wetland/cienega riparian areas capable grazing lands is moderately to highly departed from DCs. According to Osborn (1952), for maximum moisture infiltration, two conditions are essential: 1) an adequate surface [vegetation] cover to cushion the impact of the falling raindrops and 2) favorable soil conditions associated with a relatively advanced stage of ecological succession for the site, typical of one of the higher range condition classes.

Table 37. Most current (USFS, 2008b) understory vegetation ecological status, range condition, and departure from desired conditions (DC) on capability grazing lands within the wetland/cienega riparian areas PNVT on the A-SNFs

No Capability Grazing Lands (DC departure status unknown)†	Vegetation Ecological Status ¹⁵ and Range Condition ^{16, 18} Ratings of Capable Grazing Lands within the Wetland/Cienega Riparian Areas PNVT on the A-SNFs‡															Total Acres
	high ecological status				moderately-high ecological status		moderately-low ecological status		low ecological status		no data (DC departure status unknown)		total acres			
	excellent range condition		good range condition		fair range condition		poor range condition		very-poor range condition							
	acres	%	acres	%	acres	%	acres	%	acres	%						
	acres	%	acres	%	acres	%	acres	%	acres	%	acres	%				
1,013	5.7	52	0.3	816	4.8	7,445	44.1	7,227	42.8	823	4.9	524	3.1	16,887	17,900	
DC departure	no		low		moderate		high		severe							

† See footnote 14 on page 18

‡ See footnotes 15, 16 and 18 on page 18

Other disturbances: As a result of this PNVT's landscape position and its close association with water and runoff, it is directly and cumulatively affected by all of the threats and risks from adjacent, upland, PNVTs.

Changes in the structure and function of wetland/cienega systems have been noted as the primary cause of the loss of biological diversity within these systems. The causes of adverse change in the ecological character of wetland/cienegas can be grouped in five broad categories: 1) changes to the water regime; 2) water pollution; 3) physical modification; 4) exploitation of biological products; and 5) introduction of invasive species (Bodner and Simms, 2008).

Threats: The most important threats under agency management authority to all of the riparian areas and riparian forest PNVTs include fire suppression which has allowed non-riparian species expansion into these communities, inundation (diversions, dams and impoundments (Krueper, 1995)) which has allowed for de-watering and drying of these communities below these structures, human-caused fires, and roads, highways and energy corridors, and livestock grazing (Krueper, 1995), and wild ungulates. These threats types include modification of natural processes and habitat conversion which have negative consequences

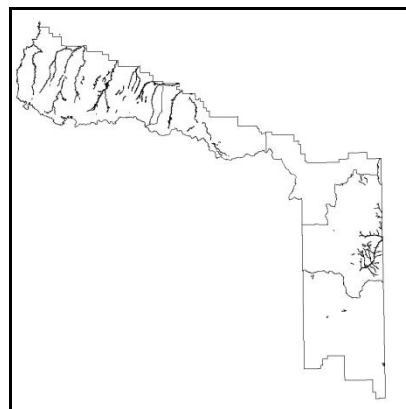
to ecological composition, structure, function and processes. A Region 3 VDDT model was not developed for this PNVT, however, continuation of current management along with ecological threshold changes (upland woody species encroachment, loss of understory productivity, loss of soil and soil productivity (27% of the soils are rated as being impaired), and the inability to reverse the malfunctioning physical processes within these riparian areas is likely to continue to move this PNVT away from DC and HRV. According to Printz et al. (2014), soil health is the capacity of a soil to maintain its function and flow of ecosystem services given a specific set of physical, chemical, and environmental boundaries (Doran and Parken, 1994; USDA NRCS, 2013b). When a soil's health deteriorates, its capacity to support and regulate ecosystems is diminished, affecting energy flows, nutrient cycling, and productivity. See Appendix E for a more complete discussion of the threats affecting the wetland/cienega riparian areas and the risks they pose to this PNVT.

Cottonwood-willow riparian forest (map 13, and appendix A maps 1 and 2): This PNVT occurs primarily on the Alpine, Black Mesa and Lakeside RDs along approximately 800 miles of rivers and streams. At roughly 15,876 acres of NFS lands, or approximately 1 percent of the forests (table 4), represents the largest PNVT on the A-SNFs. Generally, annual precipitation ranges from 11.0 to 24.0 inches, with 40-55 percent coming between October 1st and March 31st (table 38).

Dominant woody species include narrowleaf cottonwood and a variety of willow; Bebb (*Salix bebbiana* Sarg.), greenleaf (*S. lucida* Muhl. ssp. *caudata* (Nutt.) E. Murr.), and dewystem (*S. irrorata* Anderss.). Various grasses and forbs are usually present.

These areas are often subjected to water withdrawal, heavy grazing and recreational pressure and can be profoundly degraded and the water table can be severely depleted. Vegetation can be dependent upon annual or periodic flooding for growth and reproduction, especially at lower elevations.

The A-SNFs' niche for this PNVT is approximately 81 percent of the White Mountains-San Francisco Peaks-Mogollon Rim ecoregion section (table 4). Within the Coconino Plateau Woodland and Coconino Plateau Coniferous Forest subsections, the A-SNFs contribute 92 and 82 percent of this PNVT, respectively. With 19 percent (table 4) of this PNVT located off-forest and having an overall estimated low departure rating from HRV; nevertheless, given the importance of riparian areas in the Southwest in general and the forests specifically, the A-SNFs' contribution to the sustainability of the cottonwood-willow riparian forest PNVT is high (figure 1).



Map 13. General location of the cottonwood-willow riparian forest PNVT

Table 38. Cottonwood-willow riparian forest PNVT temperature and moisture data (Laing et al., 1987)

Average Annual Air Temperature ¹ (° F)		Average Annual Precipitation (inches)			Average Snowfall ² (inches)			Number of Frost-free Days per Year
low	high	low	high	percent occurring between Oct 1 st and Mar 31 st	annual	accumulation	major accumulation period	
41	54	11.0	24.0	40 - 55	0 - 47	0 - 16	Nov 1 st - Apr 30 th	100 - 150

¹ Winters are cold

² Snowfall moisture is included in average annual precipitation data

Cottonwood-willow riparian forest PNVT burn severity acres produced by the 2011 Wallow Fire can be seen in table 39. Overall, the fire did not cause a substantial impact to the cottonwood-willow riparian forest PNVT. Approximately 11 percent of this PNVT was within the perimeter of the Wallow Fire. Of the

acres within the fire perimeter, roughly 56 percent were burned, and of that; slightly more than 14 percent (249 acres) were classified as experiencing a moderate to high severity burn (see Appendix C table 12 for a comparison of pre and post-2011 Wallow Fire cottonwood-willow riparian forest PNVNT overstory vegetation structural states).

Table 39. 2011 Wallow Fire burn severity within the cottonwood-willow riparian forest PNVNT (see Appendix C table 12)

Item	Burn Severity by Soil Burn Severity Class					Outside Fire Perimeter	Total PNVNT
	within fire perimeter						
	high	moderate	low	unburned	total		
Acres	72	176	731	759	1,738		
Percent	4.2	10.1	42.0	43.7	100		
	Total Cottonwood-Willow Riparian Forest PNVNT						
Acres	72	176	731	759	1,738	14,137	15,876
Percent	0.5	1.1	4.6	4.8	11.0	89.0	100

Current conditions within the cottonwood-willow riparian forest are not departed from DC and HRV (table 2) with a DI of 20 percent for both, making it the 12th and 13th most departed PNVNT on the forests for DC and HRV, respectively. With respect to the DI there is an under-representation (20%) of small size trees with open and closed canopies (vegetation structural states B) (see Appendix D figure 12), and over-representation (16%) of medium to very large size trees with open and closed canopies (vegetation structural state C). These conditions are indicative of an older stand structure which lacks young tree recruitment. Historically these forests were dominated by very shade intolerant and shade intolerant shrub and tree species with open canopy characteristics allowing for an abundance of herbaceous species. Generally, cottonwood-willow riparian forests were capable of producing herbaceous vegetation that provided from 65 to 90 percent ground cover. Today ground cover provided by herbaceous vegetation ranges from 35 to 80 percent (Laing et al., 1989). This is a decline in herbaceous cover ranging from 11 to 46 percent.

Disturbances

Fire: The moisture associated with riparian areas promotes lower fire frequency compared with adjacent uplands, and rapid recovery from fire events. Wet meadow/riparian types seldom burn (LANDFIRE, 2007f). However, fire behavior in these systems is strongly influenced by the adjacent uplands. Based on a departure index rating of 42 percent (tables 96 and 98), this PNVNT has a FRCC of II. Historic fire return interval is estimated to have been infrequent - similar to adjacent PNVNT fire regimes (Vander Lee et al., 2006) as compared to the forests' current fire return intervals. Fire severity was lower than current condition, with stand replacing fires rarely occurring. In riparian systems the pre-burn herbaceous plant community is not permanently destroyed, and rapidly recovers. Recovery is possible within a single growing season. Woody species (i.e., cottonwood, willows) can be top-killed, but generally resprout within a short period of time.

Hydrological Events: Hydrological events (i.e., flooding) are/were the major disturbance agents in these systems.

Non-native Invasive Plants: Non-native invasive plants infest roughly 100 to 150 acres; consisting primarily of mullein, saltcedar (*Tamarix* spp. L.), Siberian elm (*Ulmus pumila* L.), Russian olive (*Elaeagnus angustifolia* L.), yellow and white sweetclovers (*Melilotus officinalis* (L.) Lam. and *M. albus* Medik., respectively), and weeping lovegrass. According to Jordan et al. (2008), noxious and invasive weeds are of special concern because there is ample evidence that non-native invasive plants can modify the physical and/or chemical attributes of soil (Vivrette and Muller, 1977; Ramakrishnan and Vitousek,

1989), including inputs and cycling of N and other elements (Ehrenfeld, 2003; Haubensak et al., 2004; Hawkes et al., 2005; Sperry et al., 2006; Norton et al., 2007), pH (Kourtev et al., 2003), and soil organic matter and aggregation (Saggar et al., 1999). There is also evidence of direct modification of various components of the biotic composition of invaded soil, e.g., affecting the soil food web (Duda et al., 2003), total soil microbial communities (Kourtev et al., 2002a and 2002b; Kourtev et al., 2003), and mutualistic fungi (Allen et al., 2003; Hawkes et al., 2006; Mummey and Rillig, 2006; Mack and Rudgers, 2008).

Non-native plant invasions are widely recognized as significant threats to biodiversity conservation worldwide (Brooks et al., 2004; Brooks, 2008). One way invasions can affect native ecosystems is by changing fuel properties, which can in turn affect fire behavior and, ultimately, alter fire regime characteristics such as frequency, intensity, extent, type, and seasonality of fire (Levine et al., 2003; Brooks et al., 2004; Brooks, 2008). If the regime changes subsequently promote the dominance of the invaders, then an invasive plant-fire regime cycle can be established. This change in fire regime is one of the most significant ways that plant invasions can affect ecosystems (Brooks, 2008).

Roads: Approximately 50 miles of roads have been constructed within this PNVT; this equates to nearly 1.9 linear miles of road per square mile. Roads and trails are one of the primary access points for noxious and invasive weed transport and their right-of-way are areas of establishment.

Insects and Disease: Between 2000 and 2004, insects and disease have impacted approximately 16 percent of this PNVT.

Herbivory: Because these areas have water available, and have the potential to produce from 340 to 1,265 pounds of herbaceous vegetation per acre, they are areas of concentrated livestock use as well as wild ungulates. Livestock and elk grazing have been major negative influences in the alteration of structure, composition and function of the vegetation community. According to Fleischner et al. (1994), herbivory has had detrimental effects on the composition, structure and function of riparian ecosystems, and has led to a decrease in native species richness. According to Hoorman and McCutcheon (2005a and 2005b), Livestock grazing riparian areas can increase sediment load from the watershed, increase instream trampling, increase disturbance and erosion from overgrazed streambanks, reduced sediment trapping by riparian and instream vegetation, decreased bank stability and increased peak flows from compaction. Livestock grazing has been found to negatively affect water quality and seasonal quantity, stream channel morphology, hydrology, riparian zone soils, instream and streambank vegetation, and aquatic and riparian wildlife (Platt, 1979; Armour et al., 1991; Fleischner, 1994; Belsky et al., 1999; among others).

The most current A-SNFs data, 2007-2008 (USFS, 2008b), indicates that within the capable grazing lands (97% of the total PNVT's area) associated with the cottonwood-willow riparian forest (table 40); approximately 86 percent of the herbaceous understory is in low to moderately-low ecological status or very-poor to poor range condition, while only 11 percent is in moderately-high ecological status or fair range condition. Movement in the direction of low to moderately-low ecological status has resulted in lower levels of herbaceous vegetation ground cover and lower levels of vigor and growth, as well as species compositional shifts, and possible changes in site potential. Total herbage production is considered to be correlated with the condition of the range (Osborn, 1956; Goebel and Cook, 1960). The majority of the herbaceous understory vegetation within the cottonwood-willow riparian forest capable grazing lands is highly severely departed from DCs. According to Osborn (1952), for maximum moisture infiltration, two conditions are essential: 1) an adequate surface [vegetation] cover to cushion the impact of the falling raindrops and 2) favorable soil conditions associated with a relatively advanced stage of ecological succession for the site, typical of one of the higher range condition classes.

Wildlife: Beaver were historically important in many of these cottonwood-willow riparian forest systems.

Other disturbances: As a result of this PNVТ's landscape position and its close association with water and runoff, it is directly and cumulatively affected by all of the threats and risks from adjacent, upland, PNVТs.

Table 40. Most current (USFS, 2008b) understory vegetation ecological status, range condition, and departure from desired conditions (DC) on capability grazing lands within the cottonwood-willow riparian forest PNVТ on the A-SNFs

No Capability Grazing Lands (DC departure status unknown)†	Vegetation Ecological Status ¹⁵ and Range Condition ^{16, 18} Ratings of Capable Grazing Lands within the Cottonwood-Willow Riparian Forest PNVT on the A-SNFs‡														Total Acres	
	high ecological status						moderately-high ecological status		moderately-low ecological status		low ecological status		no data (DC departure status unknown)			total acres
	excellent range condition		good range condition		fair range condition		poor range condition		very-poor range condition							
	acres	%	acres	%	acres	%	acres	%	acres	%	acres	%				
	427	2.7	0	0.0	111	0.7	1,542	10.0	8,839	57.2	4,496	29.1	461	3.0		
DC departure	no		low		moderate		high		severe							

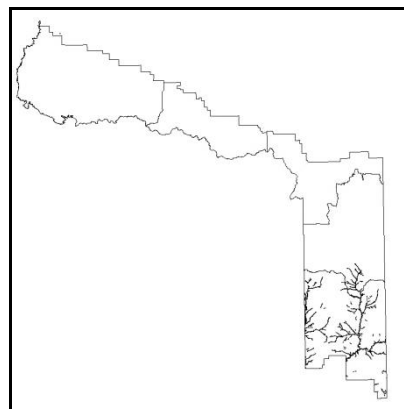
† See footnote 14 on page 18

‡ See footnotes 15, 16 and 18 on page 18

Threats: The threats to cottonwood-willow riparian forest are the same as those listed for wetland/cienega riparian areas. A Region 3 VDDT model was not developed for this PNVТ, however, continuation of current management along with ecological threshold changes, such as upland woody species encroachment, loss of understory productivity, loss of soil and soil productivity (100% of the soils are rated as being impaired and/or unsatisfactory), and the inability to reverse the malfunctioning physical processes within these riparian areas is likely to move this PNVТ away from DC and HRV. According to Printz et al. (2014), soil health is the capacity of a soil to maintain its function and flow of ecosystem services given a specific set of physical, chemical, and environmental boundaries (Doran and Parken, 1994; USDA NRCS, 2013b). When a soil's health deteriorates, its capacity to support and regulate ecosystems is diminished, affecting energy flows, nutrient cycling, and productivity. See Appendix E for a more complete discussion of the threats affecting the cottonwood-willow riparian forest and the risks they pose to this PNVТ.

Mixed broadleaf deciduous riparian forest (map 14 and appendix A map 2): This PNVТ occurs primarily on the Alpine and Clifton RDs along approximately 860 miles of rivers and streams. At roughly 9,657 acres of NFS lands, or approximately 0.5 percent of the forests (table 4), represents the 13th largest PNVТ on the A-SNFs. Generally, annual precipitation ranges from 11.0 to 24.0 inches, with 40-55 percent coming between October 1st and March 31st (table 41).

The vegetation is a mix of riparian woodlands and shrublands with a variety of vegetation associations. The dominant vegetation is likely to depend upon a suite of site-specific characteristics including elevation, substrate, stream gradient, and depth to groundwater. For example, one vegetation association is dominated by bigtooth maple (*Acer grandidentatum* Nutt.) with mixed stands of Emory oak and scattered conifers (pines and junipers).



Map 14. General location of the mixed broadleaf deciduous riparian forest PNVТ

Other sites can be dominated by a mixture of the following woody species: boxelder (*Acer negundo* L.), Fremont cottonwood (*Populus fremontii* S. Wats.), Arizona sycamore (*Platanus wrightii* S. Wats.), velvet ash (*Fraxinus velutina* Torr.), Arizona walnut (*Juglans major* (Torr.) Heller), desert willow (*Chilopsis*

linearis (Cav.) Sweet), and willow species (*Salix* spp. L.), as well as numerous shrub, grass and forb species.

Table 41. Mixed broadleaf deciduous riparian forest PNVT temperature and moisture data (Laing et al., 1987)

Average Annual Air Temperature ¹ (° F)		Average Annual Precipitation (inches)			Average Snowfall ² (inches)			Number of Frost-free Days per Year
low	high	low	high	percent occurring between Oct 1 st and Mar 31 st	annual	accumulation	major accumulation period	
54	61	12.6	19.7	40	0 - 8	0	-	170 - 200

¹ Winters are cold

² Snowfall moisture is included in average annual precipitation data

The PNVT often contains several species of oak and conifers (pines and junipers) from upstream and adjacent uplands. Vegetation can be dependent upon annual or periodic flooding for growth and reproduction, especially at lower elevations.

The A-SNFs' niche for this PNVT is approximately 34 percent of the White Mountains-San Francisco Peaks-Mogollon Rim ecoregion section (table 4). Within the White Mountains Woodland and White Mountains Coniferous Forest subsections, the A-SNFs contribute 86 and 83 percent of this PNVT, respectively. With 66 percent (table 4) of this PNVT located off-forest and having an overall estimated low departure rating from HRV; nevertheless, given the importance of riparian areas in the Southwest in general and the forests specifically, the A-SNFs' contribution to the sustainability of the mixed broadleaf deciduous riparian forest PNVT is high (figure 1).

Mixed broadleaf deciduous riparian forest PNVT burn severity acres produced by the 2011 Wallow Fire can be seen in table 42. Overall, the fire did not cause a substantial impact to the mixed broadleaf deciduous riparian forest PNVT. Approximately five percent of this PNVT was within the perimeter of the Wallow Fire. Of the acres within the fire perimeter, roughly 49 percent were burned, and of that; nearly six percent (27 acres) were classified as undergoing a moderate to high severity burn (for a comparison of pre and post-2011 Wallow Fire mixed broadleaf deciduous riparian forest PNVT overstory vegetation structural states).

Table 42. 2011 Wallow Fire burn severity within the mixed broadleaf deciduous riparian forest PNVT (see Appendix C table 13)

Item	Burn Severity by Soil Burn Severity Class					Outside Fire Perimeter	Total PNVT
	within fire perimeter						
	high	moderate	low	unburned	total		
Acres	0	27	212	251	491		
Percent	0.1	5.6	43.2	51.1	100		
	Total Mixed Broadleaf Deciduous Riparian Forest PNVT						
Acres	0	27	212	251	491	9,166	9,657
Percent	0.0	0.3	2.2	2.6	5.1	94.9	100

Current conditions within the mixed broadleaf deciduous riparian forest are at a low departure from DC and HRV (table 2) with a DI of 33 percent, this PNVT is 8th and 10th most departed on the forests for DC and HRV, respectively. With respect to the DI there is an over-representation (31%) of seedlings, saplings, and small to medium size trees with closed canopies (vegetation structural state B) (see Appendix D figure 13) and an under-representation (29%) of seedlings, saplings, and small to very large size trees with open canopies (vegetation structural states C and D). Historically these forests were dominated by very shade intolerant and shade intolerant shrub and tree species with open canopy characteristics allowing for an abundance of herbaceous species. Generally, mixed broadleaf deciduous riparian forests were capable of producing herbaceous vegetation that provided from 25 to 90 percent ground cover.

Today ground cover provided by herbaceous vegetation ranges from 5 to 20 percent (Laing et al., 1989). This is a decline in herbaceous cover ranging from 78 to 80 percent.

Disturbances

Fire: The moisture associated with riparian areas promotes lower fire frequency compared with adjacent uplands, and rapid recovery from fire events. Wet meadow/riparian types seldom burn (LANDFIRE, 2007f). However, Fire behavior in these systems is strongly influenced by the adjacent uplands. Based on a departure index rating of 28 percent (tables 82 and 84), this PNVT has a FRCC of I. In riparian systems the pre-burn herbaceous plant community is not permanently destroyed, and rapidly recovers. Recovery is possible within a single growing season. Woody species (i.e., willows, boxelder) can be top-killed, but generally sprout within a short period of time.

Hydrological Events: Hydrological events (i.e., flooding) are/were the major disturbance agents in these systems.

Non-native Invasive Plants: Non-native invasive plants infest roughly 500 to 750 acres; primarily yellow and white sweetclovers, weeping lovegrass, saltcedar, and mullein. According to Jordan et al. (2008), noxious and invasive weeds are of special concern because there is ample evidence that non-native invasive plants can modify the physical and/or chemical attributes of soil, including inputs and cycling of N and other elements (Ehrenfeld 2003; Haubensak et al., 2004; Hawkes et al., 2005; Sperry et al., 2006; Norton et al., 2007), pH (Kourtev et al., 2003), and soil organic matter and aggregation (Saggar et al., 1999). There is also evidence of direct modification of various components of the biotic composition of invaded soil, e.g., affecting the soil food web (Duda et al., 2003), total soil microbial communities (Kourtev et al., 2002a and 2002b; Kourtev et al., 2003), and mutualistic fungi (Allen et al., 2003; Hawkes et al., 2006; Mummey and Rillig, 2006; Mack and Rudgers, 2008).

Non-native plant invasions are widely recognized as significant threats to biodiversity conservation worldwide (Brooks et al., 2004; Brooks, 2008). One way invasions can affect native ecosystems is by changing fuel properties, which can in turn affect fire behavior and, ultimately, alter fire regime characteristics such as frequency, intensity, extent, type, and seasonality of fire (Levine et al., 2003; Brooks et al., 2004; Brooks, 2008). If the regime changes subsequently promote the dominance of the invaders, then an invasive plant-fire regime cycle can be established. This change in fire regime is one of the most significant ways that plant invasions can affect ecosystems (Brooks, 2008).

Roads: Approximately 20 miles of roads have been constructed within this PNVT; this equates to nearly 1.4 linear miles of road per square mile. Roads and trails are one of the primary access points for noxious and invasive weed transport and their right-of-way are areas of establishment.

Insects and Disease: Between 2000 and 2004, insects and disease have impacted approximately 11 percent of this PNVT.

Herbivory: Because these areas have water available, and have the potential to produce from 490 to 740 pounds of herbaceous vegetation per acre, they are areas of concentrated livestock use as well as wild ungulates. Livestock and elk grazing have been major negative influences in the alteration of structure, composition and function of the vegetation community. According to Fleischner et al. (1994), herbivory has had detrimental effects on the composition, structure and function of riparian ecosystems, and has led to a decrease in native species richness. According to Hoorman and McCutcheon (2005a and 2005b), Livestock grazing riparian areas can increase sediment load from the watershed, increase instream trampling, increase disturbance and erosion from overgrazed streambanks, reduced sediment trapping by riparian and instream vegetation, decreased bank stability and increased peak flows from compaction.

Livestock grazing has been found to negatively affect water quality and seasonal quantity, stream channel morphology, hydrology, riparian zone soils, instream and streambank vegetation, and aquatic and riparian wildlife (Platt, 1979; Armour et al., 1991; Fleischner 1994; Belsky et al., 1999; among others).

The most current A-SNFs data, 2007-2008 (USFS, 2008b), indicates that within the capable grazing lands (85% of the total PNVNT's area) associated with the mixed broadleaf deciduous riparian forest (table 43); approximately 55 percent of the herbaceous understory is in low to moderately-low ecological status or very-poor to poor range condition, while nearly 35 percent is in moderately-high to high ecological status or fair to good range condition. Movement in the direction of low to moderately low ecological status has resulted in lower levels of herbaceous vegetation ground cover and lower levels of vigor and growth, as well as species compositional shifts, and possible changes in site potential. Total herbage production is considered to be correlated with the condition of the range (Osborn, 1956; Goebel and Cook, 1960). The majority of the herbaceous understory vegetation within the mixed broadleaf deciduous riparian forest capable grazing lands is highly departed from DCs. According to Osborn (1952), for maximum moisture infiltration, two conditions are essential: 1) an adequate surface [vegetation] cover to cushion the impact of the falling raindrops and 2) favorable soil conditions associated with a relatively advanced stage of ecological succession for the site, typical of one of the higher range condition classes.

Table 43. Most current (USFS, 2008b) vegetation ecological status, range condition, and departure from desired conditions (DC) on capability grazing lands within the mixed broadleaf deciduous riparian forest PNVNT on the A-SNFs

No Capability Grazing Lands (DC departure status unknown)†		Vegetation Ecological Status ¹⁵ and Range Condition ^{16, 18} Ratings of Capable Grazing Lands within the Mixed Broadleaf Deciduous Riparian Forest PNVNT on the A-SNFs‡														Total Acres
		high ecological status				moderately-high ecological status		moderately-low ecological status		low ecological status		no data (DC departure status unknown)		total acres		
		excellent range condition		good range condition		fair range condition		poor range condition		very-poor range condition						
		acres	%	acres	%	acres	%	acres	%	acres	%	acres	%			
1,476	15.3	0	0.0	1,209	14.8	1,619	19.8	4,172	51.0	348	4.3	833	10.2	8,181	9,657	
DC departure		no		low		moderate		high		severe						

† See footnote 14 on page 18

‡ See footnotes 15, 16 and 18 on page 18

Wildlife: Beaver were historically important in many of these mixed broadleaf deciduous riparian forest systems.

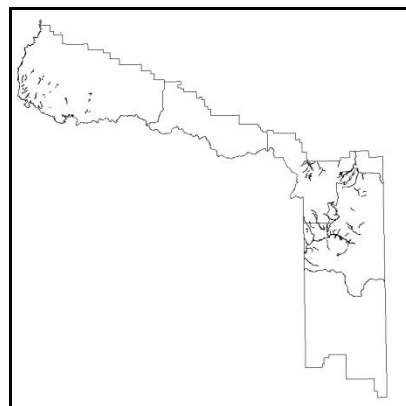
Other disturbances: As a result of this PNVNT's landscape position and its close association with water and runoff, it is directly and cumulatively affected by all of the threats and risks from adjacent, upland, PNVNTs.

Threats: The threats to mixed broadleaf deciduous riparian forest are the same as those listed for wetland/cienega riparian areas and cottonwood-willow riparian forests. A Region 3 VDDT model was not developed for this PNVNT, however, continuation of current management along with ecological threshold changes, such as upland woody species encroachment, loss of understory productivity, loss of soil and soil productivity (73% of the soils are rated as being impaired and/or unsatisfactory), and the inability to reverse the malfunctioning physical processes within these riparian areas is likely to move this PNVNT away from DC and HRV. According to Printz et al. (2014), soil health is the capacity of a soil to maintain its function and flow of ecosystem services given a specific set of physical, chemical, and environmental boundaries (Doran and Parken, 1994; USDA NRCS, 2013b). When a soil's health deteriorates, its capacity to support and regulate ecosystems is diminished, affecting energy flows, nutrient cycling, and productivity. See Appendix E for a more complete discussion of the threats affecting the mixed broadleaf deciduous riparian forest and the risks they pose to this PNVNT.

Montane willow riparian forest (map 15, and appendix A maps 1 and 2): This PNVT occurs primarily on the Alpine, Black Mesa and Springerville RDs along approximately 1,130 miles of rivers and streams. At roughly 4,808 acres of NFS lands, or approximately 0.2 percent of the forests (table 4), represents the smallest PNVT on the A-SNFs. Generally, annual precipitation ranges from 19.7 to 30.7 inches, with 50-55 percent coming between October 1st and March 31st (table 44).

At the lowest elevations the dominant woody vegetation includes Fremont cottonwood, Arizona sycamore, Arizona walnut, velvet ash, and soapberry (*Sapindus saponaria* L.). Shrubs include a variety of willows, chokecherry (*Prunus virginiana* L.), and Arizona alder (*Alnus oblongifolia* Torr.).

A variety of herbaceous species are usually present. At higher elevations, this PNVT is found along streambanks, seeps, fens, and isolated springs narrowleaf cottonwood (*Populus angustifolia* James) may be present. In addition, this PNVT can be shrub and herb dominated. Dominant shrubs may include thinleaf alder (*Alnus incana* (L.) Moench ssp. *tenuifolia* (Nutt.) Breitung), birch (*Betula* spp. L.), redosier dogwood (*Cornus sericea* L.), and a variety of willows. In many high elevations situations within this PNVT the herbaceous species component is dominated by non-native Kentucky and Canada bluegrass.



Map 15. General location of the montane willow riparian forest PNVT

Table 44. Montane willow riparian forest PNVT temperature and moisture data (Laing et al., 1987)

Average Annual Air Temperature ¹ (° F)		Average Annual Precipitation (inches)			Average Snowfall ² (inches)			Number of Frost-free Days per Year
low	high	low	high	percent occurring between Oct 1 st and Mar 31 st	annual	accumulation	major accumulation period	
37	46	19.7	30.7	50 - 55	47 - 63	14 - 35	Oct 1 st - Apr 30 th	80 - 100

¹ Winters are cold

² Snowfall moisture is included in average annual precipitation data

The A-SNFs' niche for this PNVT is approximately 22 percent of the White Mountains-San Francisco Peaks-Mogollon Rim ecoregion section (table 4). Within the White Mountains Coniferous Forest and Coconino Plateau Coniferous Forest subsections, the A-SNFs contribute 63 and 53 percent of this PNVT, respectively. With 78 percent (table 4) of this PNVT located off-forest and having an overall estimated high departure rating from HRV; nevertheless, given the importance of riparian areas in the Southwest in general and the forests specifically, the A-SNFs' contribution to the sustainability of the montane willow riparian forest PNVT is high (figure 1).

Montane willow riparian forest PNVT burn severity acres produced by the 2011 Wallow Fire can be seen in table 45. Overall, the fire did cause a significant impact to the montane willow riparian forest PNVT. Approximately 69 percent of this PNVT was within the perimeter of the Wallow Fire. Of the acres within the fire perimeter, roughly 69 percent were burned, and of that; nearly 19 percent (620 acres) were classified as experiencing a moderate to high severity burn (see Appendix C table 14 for a comparison of pre and post-2011 Wallow Fire montane willow riparian forest PNVT overstory vegetation structural states).

Current conditions within the montane willow riparian forest are at a low departure from DC and HRV (table 2) with a DI of 21 percent, this PNVT is the 10th and 12th most departed PNVT on the forests for

DC and HRV, respectively. With respect to the DI there is an over-representation (21%) of seedlings, saplings, and small to very large size trees with open and closed canopies (vegetation structural state B) (see Appendix D figure 14) and an under-representation (21%) of herbaceous vegetation, and seedlings and saplings with open canopies (vegetation structural state A). Historically these forests were dominated by very shade intolerant and shade intolerant shrub and tree species with open canopy characteristics allowing for an abundance of herbaceous species. Generally, montane willow riparian forests were capable of producing herbaceous vegetation that provided from 70 to 90 percent ground cover. Today ground cover provided by herbaceous vegetation ranges from 55 to 90 percent (Laing et al., 1989). This is a decline in herbaceous cover ranging from 0 to 21 percent.

Table 45. 2011 Wallow Fire burn severity within the montane willow riparian forest PNVT (see Appendix C table 14)

Item	Burn Severity by Soil Burn Severity Class					Outside Fire Perimeter	Total PNVT
	within fire perimeter						
	high	moderate	low	unburned	total		
Acres	196	424	1,674	1,041	3,336		
Percent	5.9	12.7	50.2	31.2	100		
	Total Montane Willow Riparian Forest PNVT						
Acres	196	424	1,674	1,041	3,336	1,472	4,808
Percent	4.1	8.8	34.8	21.6	69.4	30.6	100

Disturbances

Fire: The moisture associated with riparian areas promotes lower fire frequency compared with adjacent uplands, and rapid recovery from fire events. Wet meadow/riparian types seldom burn (LANDFIRE, 2007f). However, fire behavior in these systems is strongly influenced by the adjacent uplands. Ninety-two percent of this PNVT is within FRCCs II and III.

Hydrological Events: Hydrological events (i.e., flooding) are/were the major disturbance agents in these systems.

Non-native Invasive Plants: Non-native invasive plants infest roughly 500 to 750 acres; primarily saltcedar, Russian olive, Siberian elm, yellow and white sweetclovers, weeping lovegrass, and mullein. According to Jordan et al. (2008), noxious and invasive weeds are of special concern because there is ample evidence that non-native invasive plants can modify the physical and/or chemical attributes of soil, including inputs and cycling of N and other elements (Ehrenfeld, 2003; Haubensak et al., 2004; Hawkes et al., 2005; Sperry et al., 2006; Norton et al., 2007), pH (Kourtev et al., 2003), and soil organic matter and aggregation (Saggar et al., 1999). There is also evidence of direct modification of various components of the biotic composition of invaded soil, e.g., affecting the soil food web (Duda et al., 2003), total soil microbial communities (Kourtev et al., 2002a and 2002b; Kourtev et al., 2003), and mutualistic fungi (Allen et al., 2003; Hawkes et al., 2006; Mummey and Rillig, 2006; Mack and Rudgers, 2008).

Non-native plant invasions are widely recognized as significant threats to biodiversity conservation worldwide (Brooks et al., 2004; Brooks, 2008). One way invasions can affect native ecosystems is by changing fuel properties, which can in turn affect fire behavior and, ultimately, alter fire regime characteristics such as frequency, intensity, extent, type, and seasonality of fire (Levine et al., 2003; Brooks et al., 2004; Brooks, 2008). If the regime changes subsequently promote the dominance of the invaders, then an invasive plant-fire regime cycle can be established. This change in fire regime is one of the most significant ways that plant invasions can affect ecosystems (Brooks, 2008).

Roads: Approximately 25 miles of roads have been constructed within this PNV; this equates to nearly 3.4 linear miles of road per square mile. Roads and trails are one of the primary access points for noxious and invasive weed transport and their right-of-way are areas of establishment.

Insects and Disease: Between 2000 and 2004, insects and disease have impacted approximately 11 percent of this PNV.

Herbivory: Because these areas have water available, and have the potential to produce from 140 to 1,255 pounds of herbaceous vegetation per acre, they are areas of concentrated livestock use as well as wild ungulates. According to White (2002), livestock and elk grazing have been major influences in the alteration of structure, composition and function of the vegetation community. The majority of this PNV has very low to low ecological similarity with historic conditions (White, 2002). According to Fleischner et al. (1994), herbivory has had detrimental effects on the composition, structure and function of riparian ecosystems, and has led to a decrease in native species richness. According to Hoorman and McCutcheon (2005a and 2005b), Livestock grazing riparian areas can increase sediment load from the watershed, increase instream trampling, increase disturbance and erosion from overgrazed streambanks, reduced sediment trapping by riparian and instream vegetation, decreased bank stability and increased peak flows from compaction. Livestock grazing has been found to negatively affect water quality and seasonal quantity, stream channel morphology, hydrology, riparian zone soils, instream and streambank vegetation, and aquatic and riparian wildlife (Platt, 1979; Armour et al., 1991; Fleischner 1994; Belsky et al., 1999; among others).

The most current A-SNFs data, 2007-2008 (USFS, 2008b), indicates that within the capable grazing lands (85% of the total PNV's area) associated with the montane willow riparian forest (table 46); approximately 80 percent of the herbaceous understory is in low to moderately-low ecological status or very-poor to poor range condition, while only 15 percent is in moderately-high ecological status or fair range condition. Movement in the direction of low to moderately-low ecological status has resulted in lower levels of herbaceous vegetation ground cover and lower levels of vigor and growth, as well as species compositional shifts, and possible changes in site potential. Total herbage production is considered to be correlated with the condition of the range (Osborn, 1956; Goebel and Cook, 1960). The majority of the herbaceous understory vegetation within the montane willow riparian forest capable grazing lands is highly to severely departed from DCs. According to Osborn (1952), for maximum moisture infiltration, two conditions are essential: 1) an adequate surface [vegetation] cover to cushion the impact of the falling raindrops and 2) favorable soil conditions associated with a relatively advanced stage of ecological succession for the site, typical of one of the higher range condition classes.

Table 46. Most current (USFS, 2008b) understory vegetation ecological status, range condition, and departure from desired conditions (DC) on capability grazing lands within the montane willow riparian forest PNV on the A-SNFs

No Capability Grazing Lands (DC departure status unknown)†	Vegetation Ecological Status ¹⁵ and Range Condition ^{16, 18} Ratings of Capable Grazing Lands within the Montane Willow Riparian Forest on the A-SNFs‡															Total Acres
	high ecological status				moderately-high ecological status		moderately-low ecological status		low ecological status		no data (DC departure status unknown)		total acres			
	excellent range condition		good range condition		fair range condition		poor range condition		very-poor range condition							
	acres	%	acres	%	acres	%	acres	%	acres	%	acres	%				
	1,368	28.5	0	0.0	101	2.9	428	12.4	1,868	54.3	872	25.3	171	5.0	3,440	
DC departure	no		low		moderate		high		severe							

† See footnote 14 on page 18

‡ See footnotes 15, 16 and 18 on page 18

Wildlife: Beaver were historically important in many of these montane willow riparian forest systems.

Other disturbances: As a result of this PNVT's landscape position and its close association with water and runoff, it is directly and cumulatively affected by all of the threats and risks from adjacent, upland, PNVTs.

Threats: The threats to montane willow riparian forest are the same as those listed for wetland/cienega riparian areas and cottonwood-willow and mixed broadleaf deciduous riparian forests. A Region 3 VDDT model was not developed for this PNVT, however, continuation of current management along with ecological threshold changes, such as upland woody species encroachment, loss of understory productivity, loss of soil and soil productivity (72% of the soils are rated as being impaired and/or unsatisfactory), and the inability to reverse the malfunctioning physical processes within these riparian areas is likely to continue to move this PNVT away from DC and HRV. According to Printz et al. (2014), soil health is the capacity of a soil to maintain its function and flow of ecosystem services given a specific set of physical, chemical, and environmental boundaries (Doran and Parken 1994; USDA NRCS 2013b). When a soil's health deteriorates, its capacity to support and regulate ecosystems is diminished, affecting energy flows, nutrient cycling, and productivity. See Appendix E for a more complete discussion of the threats affecting the montane willow riparian forest and the risks they pose to this PNVT.

Common Threats and Risks to All PNVTs

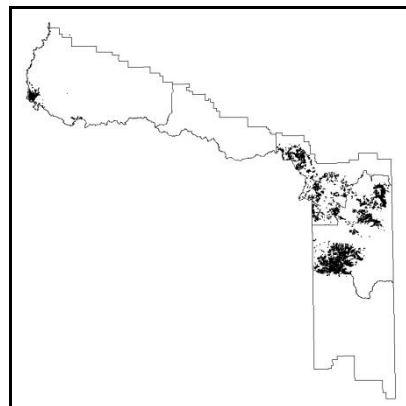
The threats to the PNVTs from disturbances pose the following risks, many of these risks when functioning together are additive and have compounding affects with negative consequences to ecological composition, structure, function and processes. Specifically by affecting:

- Ecological processes, functions, and services
- Vegetation health (e.g., resulting in atypical composition, structure, and function of both the overstory and understory vegetation);
- Soil compaction, erosion, sedimentation and loss of soil fertility
- Altered watershed and hydrologic functions
- Reduced water quality and quantity
- Riparian, aquatic and terrestrial site loss, and/or degradation and fragmentation of these habitats within these PNVT
- Altered fire regime, uncharacteristic wildfire, and inability to re-establish natural wildfire processes
- Introduction and spread of invasive plants
- Modification of natural processes and changes in ecological potentials
- Species extinction and/or reduction in population(s) and/or habitat(s)

Additionally, climate influences a variety of ecological processes. Because of the unidentified aspects about the complex interactions between the spatial and temporal variability of climate, ecosystem processes, disturbance regimes, hydrology, and forest management activities, the true consequences of the risks posed by the threats are unknown.

Quaking Aspen

In western North America, quaking aspen (aspen) (*Populus tremuloides* Michx.) occurs with conifer in mixed stands as well as in adjacent pure communities (Mittanck et al., 2014). Within this landscape aspen is often assumed to be seral to conifer species (Baker 1918; Bartos et al., 1983). The successional trajectory of aspen to conifer is described as deterministic, where aspen requires disturbance or will eventually be replaced by encroaching conifer (Shepperd and Jones, 1985). However, many studies show evidence for not only a seral but a stable aspen community or functional type (Langenheim, 1962; Betters and Wood, 1981; Mueggler, 1988; Romme et al., 2001; Rogers et al., 2014); describing such a community as one that persists free of conifers and is self-regenerating (Mittanck et al., 2014).



Map 16. General location of quaking aspen

However, on the A-SNFs, aspen occurs as a species (vegetation type) primarily within the conifer forest types (ponderosa pine, wet mixed conifer, dry mixed conifer, and spruce-fir forest PNVTs) and is found primarily on the Alpine, Black Mesa, and Springerville RDs (map 16).

Successfully recruiting aspen sprouts and seedlings provide important sources of structural, functional and genetic diversity vital to resilient aspen forests (Seager et al., 2013). As a species, aspen is adapted to a much broader range of environmental conditions than most plant species associated with it. This highly variable ecological community can be comprised mostly of aspen (roughly 24,000 acres) or aspen co-dominating with few to several conifer species (roughly 52,000 acres). At lower elevations conifers include ponderosa pine, Rocky Mountain Douglas-fir (*Pseudotsuga menziesii* (Mirb.) Franco var. *glauca* (Beissn.) Franco), and white fir (*Abies concolor* (Gord. & Glend.) Lindl. ex Hildebr.). At mid-elevations conifers include Rocky Mountain Douglas-fir, white fir, blue spruce (*Picea pungens* Engelm.), southwestern white pine (*Pinus strobiformis* Engelm.), and ponderosa pine (*Pinus ponderosa* Lawson & C. Lawson var. *scopulorum* Engelm.). Rocky Mountain juniper (*Juniperus scopulorum* Sarg.) can also be present. At higher elevations conifers include Rocky Mountain Douglas-fir, southwestern white pine, subalpine fir (*Abies lasiocarpa* (Hook.) Nutt.), corkbark fir (*A. lasiocarpa* (Hook.) Nutt. var. *arizonica* (Merriam) Lemmon), and Engelmann spruce (*Picea engelmannii* Parry ex Engelm.).

Aspen may exist in single-storied or, more commonly, multi-storied stands (Seager et al., 2013) depending on disturbance history and local stand dynamics. Aspen stands are usually closed canopied. Due to its high productivity and structural diversity, aspen is capable of supporting the broadest array of plant and animal species of any forest type in the West (Rogers and Mittanck, 2013), and is considered second only to riparian areas in its support of biological diversity (Mueggler, 1985; Kay, 1997; Chong et al., 2001). According to Woods et al. (1982) aspen stands can have significantly more herbage and species richness (Reich et al., 2001) and diversity (Potter, 1998) in their understory than other forest types. The understory structure may be complex with multiple shrub and herbaceous layers, or simple with just an herbaceous layer (Betters 1983). This herbaceous layer may be dense or sparse, depending on soil type and moisture conditions, dominated by grasses and grass-like plants or forbs. Some of the species typically found associated with aspen include bracken fern (*Pteridium aquilinum* (L.) Kuhn), grassleaf pea (*Lathyrus graminifolius* (S. Watson) T.G. White), Fendler's meadow rue (*Thalictrum fendleri* Engelm. ex A. Gray), deer's ears (*Frasera speciosa* Douglas ex Griseb.), yarrow (*Achillea millefolium* L. var. *occidentalis* DC.), violet (*Viola* spp. L.), paintbrush (*Castilleja* spp. Mutis ex L. f.), arnica (*Arnica* spp. L.), and a variety of grasses and sedges. Decaying coarse woody debris is common.

According to Simard et al. (2001), aspen have a role in early succession. Aspen leaves are very rich in nutrients and have a high photosynthesis rate and are high in nitrogen (N). When their litter falls to the forest floor their nutrients are cycled back into the soil for the conifers to pick up. Aspen are a very shade intolerant pioneer tree on burned areas, forming clonal thickets of short-lived trees subsequently replaced by conifers (Little 1976). According to Bartos and Mueggler (1981), aspen reaches maturity in 80 to 120 years, with a few individual trees reaching 300 years or more in age (Jones and Schier, 1985). Relatively pure aspen stands may function as natural fire breaks across the landscape, support watershed stability, and contribute to scenic landscapes.

Aspen primarily reproduces asexually from underground root suckers that are stimulated by hormonal changes within an adult tree affected by disturbance (Bartos, 2001). However, reproduction by sexual means or seed production does occur (Romme et al., 1997; Quinn and Wu, 2001; Smith, 2006a; Vance et al., 2010a and 2010b; among others). Fairweather et al. (2014) found that aspen clones can persist vegetatively in landscapes for long periods of time, however, this reproductive strategy allow for only colonization of adjacently vacant habitat, nor does it allow rapid adaptation through sexual recombination. According to Vance et al. (2010a and 2010b), natural seedling establishment is limited to years of viable seed production and seedling recruitment is limited to sites where there is adequate soil moisture following seed dispersal in early summer. In Arizona, Fairweather et al. (2014) reported finding naturally occurring, and recurring aspen seedling establishment in a xeric landscape after a severe stand-replacing fire, during a period of severe drought and high temperatures.

Aspen is considered a shade intolerant, disturbance dependent species, in that it is perpetuated on sites where fire, windthrow, fungal diseases, tent caterpillars and other insects, snow damage, hail, lightning, and sunscald (Jones and DeByle, 1985a and 1985b; Jones et al., 1985; Shepperd et al., 2001; Romme et al., 2009a; Veblen, 2000; WDNR, 2011; among others), or other stand replacing events are active (Bartos, 2001). Fire has long been recognized as a vital natural force in the perpetuation of aspen groves and forests in the Rocky Mountains (Baker, 1925).

A key factor influencing fire regime parameters for aspen is the relative dominance, competitive influence, and fuel contribution of conifer species (Shinneman et al., 2013). According to Smith (2006a), fire regimes for aspen are determined by the adjacent forest type, ranging at low elevation for ponderosa pine from 2 to 20 years fire return interval, to 10 to 30 years for mixed conifer at middle elevations, up to 30 to 300 years for spruce-fir forests. Both spruce-fir and wet mixed conifer forests have mixed severity fire regimes, experiencing both frequent, low intensity surface fires, as well as infrequent, stand-replacing crown fires (White and Vankat, 1993; Grissino-Mayer et al., 1995; Fulé et al., 2003; Smith, 2006b, 2006c and 2006d). Thus aspen forest fire return interval is affected by the surrounding forest.

Fire suppression over the last century has increased conifer expansion and dominance in aspen-conifer forests, which appears to be a driving force behind aspen decline in some areas (Smith et al., 2011). According to Romme et al. (2001), the most important agent of disturbance in aspen forests of the southern Rocky Mountains before 1900 was fire, although other natural disturbances were locally important. Without periodic fire or with high levels of herbivory, conifers will replace aspen. In some areas, chronic levels of herbivory have been observed to be detrimental to aspen reproduction (Shepperd and Fairweather, 1994; Fairweather et al., 2008; Fairweather, 2008; USFS, 2009; Rogers, 2009 and 2011; Beschta and Ripple, 2010; Lynch et al., 2010; WSDNR, 2011, Fairweather et al., 2014, among others). As a result, this type is significantly altered today and is very difficult to identify because of conifer succession. The presence of even a single aspen tree in a conifer stand provides strong evidence that the area historically supported aspen. Mature aspen canopies also reduce frost damage to seedlings in the understory by restricting radiant heat loss during the night and improving air temperatures at seedling height. Because of its communal root system, aspen is mechanically stable and a highly resilient species

(Lieffers et al., 2001), and its presence may increase resistance of neighboring conifers to windthrow (Simard et al., 2001).

The cessation of historically frequent fires for the last 130 years, within the drier portions of the mixed conifer forest PNVTs, has likely altered the current aspen age and stand structures (Margolis et al., 2011). According to Smith (2006a), fire regimes for aspen are determined by the adjacent forest type, ranging from 2 to 20 years fire return interval at low elevation in ponderosa pine to 10 to 30 years for mixed conifer at middle elevations, up to 30 to 400 years for spruce-fir forests. Both spruce-fir and mixed conifer forests have mixed severity fire regimes, experiencing both frequent, low-intensity surface fires, as well as infrequent, stand-replacing crown fires. Overall, aspen is an important successional community in ponderosa pine, mixed conifer, and spruce-fir forests. Aspen is primarily affected by fire, wind, insects (tent caterpillars), disease, pathogens, herbivores, and climate interactions.

The decline in aspen throughout its western range is an ecological concern. This dieback process has tremendous ecological and economic importance, yet remains poorly understood (Korb, 2012; Korb et al., 2014). This declining trend has been noted for the past 50 years, but aspen mortality has become more pronounced since about 2002 (Worrall et al., 2008). Not only are trees dying, but their clonal root systems are dying as well. Low aspen recruitment has been attributed to climate patterns, past management, herbivore increases, competitive interactions with conifers, predator and beaver extirpation, and livestock grazing. Several of these potential causes result from direct or indirect actions of human agency (UFRWG, 2010; Crawford, 2011; Korb, 2012; Rogers et al., 2013; Korb et al., 2014).

However, as a consequence of the 2011 Wallow Fire, the acreage dominated by aspen is expected to increase on the A-SNFs. However, given all of the agents of decline mentioned previously, the longevity of this increase in aspen is unknown. Under HRV, aspen comprised roughly 50,200 acres on the A-SNFs; with approximately 37,400 acres in wet mixed conifer and 2,300 acres in spruce-fir forest, with the remainder of 10,500 acres in ponderosa pine and dry mixed conifer. Currently there is roughly 76,500 acres of aspen on the forests.

As a direct result of the 2011 Wallow Fire, roughly 33 percent of the aspen overstory was eliminated and those acres are now being recruited into the seedling/sapling size class with open canopy characteristics, largely through clonal root sprouting (additional acres, previously unoccupied may be established through seed production and seedling recruitment). The majority (34%) of the trees in the remaining aspen overstory are ten inches or greater in diameter and exist in a closed canopy condition (table 47). This would indicate that most of the remaining aspen on the A-SNFs are mature trees and are being overtopped by conifers within the individual forest types. The greatest acreage of aspen is located within the wet mixed conifer forest PNV. However; as a percentage, the spruce-fir forest PNV contain the greatest proportion, at nearly 33 percent. Proportionally, at one-percent the ponderosa pine forest PNV contains the least aspen, although its overall aspen acreage is slightly more than that found in the spruce-fir forest PNV.

The Forests' objective is to have aspen dominate or co-dominate acres within the forest types, representing a range of size and age classes to maintain a viable aspen community of at least 50,200 acres during the planning period. The DCs for aspen are that the species is occurring throughout the forested landscapes, are successfully regenerating and recruiting into older and larger size classes. Size classes have a natural distribution, with the greatest number of stems being in the smaller size classes.

Common Threats and Risks to Aspen

Alterations to historic patterns of aspen distribution, range, regeneration, and recruitment have been attributed to human-caused changes. Direct and indirect human impacts to aspen have occurred via

manipulation of game and predator populations, livestock and wild ungulate grazing, timber harvest, fire suppression, and climate change (Leopold et al., 1947; Hessler, 2002; Binkley et al., 2003; White et al., 2003; Seager et al., 2013; Rogers and Mitten, 2013). Consequently, many of the threats to the forested PNVTs from disturbances pose the following risks to aspen as well, many of these risks when functioning together are additive and have compounding affects with negative consequences to ecological composition, structure, function and processes. Specifically by affecting:

- Vegetation health (e.g., resulting in atypical composition, structure, and function of both the overstory and understory vegetation)
- Herbivory, both domestic and wild ungulates
- Soil compaction, erosion, sedimentation and loss of soil fertility
- Altered watershed and hydrologic functions
- Reduced water quality and quantity
- Degradation and fragmentation of these habitats within these PNVT
- Altered fire regime, uncharacteristic wildfire, and inability to re-establish natural wildfire processes
- Introduction and spread of invasive plants
- Modification of natural processes and changes in ecological potentials

Table 47. Current status of aspen on the A-SNFs (all data is post-2011 Wallow Fire)

Aspen Vegetation Structural States	Current Amount (acres) and Type of the A-SNFs' Forested PNVTs Containing Aspen								Total Forested PNVTs 945,753 acres	
	ponderosa pine forest		wet mixed conifer forest		dry mixed conifer forest		spruce-fir forest			
	602,206 acres		177,995 acres		147,885 acres		17,667 acres			
	current amount of aspen within each forested PNVT									
	acres	percent	acres	percent	acres	percent	acres	percent	acres	percent
Percent of total A-SNFs aspen	5,988	1.0	50,355	28.3	14,287	9.7	5,875	33.3	76,506	8.1
Herbaceous vegetation										
Grass, forb, shrub with very open (< 10%) overstory canopy cover	0	0.0	35	0.1	0	0.0	2	0.0	37	0.0
Seedling and sapling size (< 5-inch diameter) trees, plus recently burned acres										
Open (≤ 30%) woody canopy cover	380	6.3	20,542	40.8	1,389	9.7	2,627	44.7	24,938	32.6
Closed (> 30%) woody canopy cover	213	3.6	3,087	6.1	319	2.2	522	8.9	4,142	5.4
Small size (5-inch to 9.9-inch diameter) trees										
Open canopy cover	461	7.7	1,124	2.2	800	5.6	77	1.3	2,462	3.2
Closed canopy cover	2,175	36.3	6,993	13.9	3,350	23.4	856	14.6	13,374	17.5
Medium size (10-inch to 19.9-inch diameter) trees										
Open canopy cover	556	9.3	2,153	4.2	1,704	11.9	187	3.2	4,550	5.9
Closed canopy cover	1,865	32.1	14,002	27.8	6,001	42.0	1,417	24.1	23,285	30.4
Large to very large size (≥ 20-inch diameter) trees										
Open canopy cover	152	31.1	263	0.5	230	1.6	48	0.8	693	0.9
Closed canopy cover	186	3.1	2,205	4.4	495	3.5	138	2.4	3,025	4.0

Significant impacts to aspen by elk have been documented where aspen occurred prior to the 2011 Wallow Fire (Shepperd and Fairweather, 1994; Fairweather, 2008; USFS, 2009; Rogers, 2009 and 2011; Beschta and Ripple, 2010; Lynch et al., 2010). As mentioned in the forested PNVT descriptions, it has been suggested (Smith, 2006c) that the extinction of large carnivores such as grey wolf and grizzly bear has affected aspen regeneration, which experiences increased mortality due to high levels of herbivory by native and introduced ungulates, especially elk. Predator control has allowed herbivores to increase in numbers, and to exert longer duration and higher intensity grazing and browsing effects on select

vegetation types, especially aspen (Shepperd and Fairweather, 1994; Romme et al., 1995; Kay, 1997; White et al., 1998; Ripple et al., 2001; Bailey and Whitham, 2002; Fairweather et al., 2014). Numerous elk browsing studies have documented their impacts on aspen regeneration (Shepperd and Fairweather, 1994; Rolf, 2001; Kay, and Bartos, 2000; Kay, 2001; Bailey and Whitham, 2002; Kaye et al., 2004; Seager et al., 2013), herbivory can reduce community resilience and significantly alter future aspen cover (Rogers et al., 2013), leading some to suggest that successful aspen management should include adequate control of browsing animals (Shepperd and Fairweather, 1994; Bartos, 2001; Weisberg and Coughenour, 2003; Rogers et al., 2013; Fairweather et al., 2014).

Sudden aspen decline (SAD) was first noted in Arizona on the Coconino NF in the late 1990s and early 2000s (Fairweather et al., 2008). SAD is different from what is traditionally referred to as aspen decline. It is occurring on a landscape scale, versus the stand-level changes that are typically noted with aspen forest related to disturbance and succession. The mortality is rapidly occurring over a few years, versus the typical changes occurring over decades. In addition, pathogens and insects associated with SAD are different from those usually associated with aspen mortality (USFS, 2014). SAD is characterized by rapid, synchronous branch dieback (Marchetti et al., 2011), crown thinning and mortality of aspen stems on a landscape scale, without the association of destructive, pathogens and insects. According to Marchetti et al. (2011), cytospora canker, bronze poplar borer, and aspen bark were the primary causes of mortality and played complex and varied roles in healthy versus declining stands. Preliminary evidence suggested that affected stands may fail to produce suckers in response to the crown loss and mortality (Worrall et al., 2008).

Additionally, climate influences a variety of ecological processes. According to Morelli and Carr (2011), the overall, research indicates a complex, unpredictable future for aspen in the West, where increased drought, ozone, and insect outbreaks will compete with CO₂ fertilization (Romme et al., 2009b) and warmer soils, resulting in unknown cumulative effects. Because of the unidentified aspects about the complex interactions between the spatial and temporal variability of climate change, ecosystem processes, disturbance regimes, hydrology, and forest management activities, the true consequences of the risks posed by the threats are unknown (Zoltai et al., 1991; Hogg, 2001; Iverson et al., 2004; Shepperd et al., 2006; Nitschke and Innes, 2008; Rehfeldt et al., 2009). Considering its positive moisture influence on the landscape, its economic impact, and its many benefits to the resilience of wildlife in terms of habitat and forage, aspen is a valuable, yet vulnerable, species in the face of global warming (Morelli and Carr, 2011).

Woody Overstory/Herbaceous Understory Vegetation Cover Relationship

According to Browning et al. (2008), one of the most striking land cover changes in grasslands in the past 150 years has been the proliferation of trees and shrubs at the expense of perennial grasses (Heisler et al., 2003). This is ecologically significant because it represents a potentially irreversible shift in dominant species composition and life forms (Hobbs and Mooney, 1986; Knight et al., 1994; Archer, 1995; Hoch and Briggs, 1999; Roques et al., 2001; Briggs et al., 2002a and 2002b; among others). The Southwest has been no different, the landscape has been unavoidably altered over the past century by an extensive encroachment of woody plants into areas that were formerly grasslands (Merola-Zwartjes, 2004; among others). Woodlands (Pieper, 1990 and 1995; among others) and forests (Covington and Moore, 1994; among others) have all seen increased densities of woody species.

These changes in vegetation structure may reflect historical shifts in climate and land use; and are likely to influence biodiversity, productivity, above- and belowground C and N sequestration and biophysical aspects of land surface-atmosphere interaction (Wessman et al., 2004). According to Archer and Smeins (1991), the concept of community resistance and resilience suggests the existence of transition thresholds.

The existence of such thresholds may account for the abrupt, non-linear development of woody plant communities in areas formerly dominated by grasses (Buffington and Herbel, 1965; Herbel et al., 1972; Archer et al., 1988), such as the Great Basin and semi-desert grassland PNVTs. Several studies (Chew and Chew, 1965; Blackburn and Tueller, 1970; Young and Evans, 1981; Archer, 1989; Brown and Archer, 1987, 1989 and 1999; Van Auken, 2000) suggest periods of drought followed by rainfall may trigger woody plant encroachment on areas exposed to livestock grazing (Archer and Smeins, 1991).

The understory light environment is a key contributing factor to vegetation pattern and ecosystem processes, and varies spatially perhaps more than any resource used by plants (Martens et al., 2000). According to Moir (1966), increased light interception by the pine canopies and the poorer soil N supply under trees act together in bringing about a decline in herbaceous plants. The first expression of this decline is a reduction in inflorescence production of grass species and later by decreased canopy coverage of the herbaceous community. Continued tree growth unchecked by fire or artificial thinning appears to lead to total or near-total loss of the herbaceous understory. Competition for space, light, water and nutrients between overstory trees and herbaceous understory plants have been studied in a variety of forest types, with differing results (Woods et al., 1982). Ponderosa pine (Moir, 1966; McConnell and Smith, 1970; Smith, 2006b) and dry mixed conifer (Lindh, 2005; Smith, 2006c; Dodson et al., 2008) forests, both woodlands (Fulé and Covington, 1998; Barton, 2002; Schussman and Gori, 2006; Gori and Bate, 2007), and the three grasslands (Livingston et al., 1997; Gori and Enquist, 2003; Schussman, 2006a; Vander Lee et al., 2006) on the A-SNFs developed with frequent, low-intensity fires.

Fire is acknowledged to be the most influential force in checking woody species encroachment (Daubenmire, 1968; Allen, 1984) into grasslands. The removal of the natural process of fire by human suppression efforts, the introduction of livestock, variability in climate, atmospheric CO₂ enrichment, and reduced soil moisture have disrupted these ecosystems in many ways (Romme et al., 2009b), including the loss of much grassy vegetation as woody plants have expanded in distribution into non forested and woodland PNVTs and increased in density within the forested and woodland PNVTs. Woody plant encroachment also leads to significant declines in understory species richness and productivity in forests (Moir, 1966; Naumberg and DeWald, 1999; Griffis et al., 2001; Lindh, 2005; among others) grassland (Browning et al., 2008), and savanna communities (Jameson, 1967; Clary, 1971; Ratajczak et al., 2012). Jacobs et al. (2008), noted that areas of the southwestern United States with strong monsoonal (summer moisture) patterns appear too had been the most susceptible to historical woodland expansion. According to Archer (1994), and De Deyn et al. (2008), shifts in grass and woody plant abundance have broad implications for the following:

- Biological diversity
- Primary and secondary productivity
- Soil development and stability
- Livestock and wildlife composition and carrying capacity
- Recreational opportunities
- Water quality and water distribution
- Global climate feedback by affecting CO₂ sequestration, non-methane hydrocarbon emissions, and biophysical land surface-atmosphere interactions (albedo, evapotranspiration, surface roughness, boundary layer dynamics)

According to Briggs et al. (2005), important consequences of this shift in plant life-form abundance include alterations in plant productivity, species diversity, and C storage (Browning et al., 2008); and potential soil alteration (Abella et al., 2013). Ecologically, the most far reaching, long term negative affect due to shifts in grass and woody plant abundance is concurrent loss of soil, soil productivity, and species

diversity; including some wildlife species (Peek et al., 2001), and alters the amount and distribution of water reaching the soil, and ultimately overall productivity (Thurow and Hester, 2011).

Overall, if an ecosystem is degraded due to overuse, soil C is lost to the atmosphere (Archer et al., 2001; Schuman et al., 2002). According to Havstad et al. (2007), even though soil C is relatively stable when soil disturbance is minimized (Follett et al., 2001; Heath et al., 2003), accelerated wind and water erosion can result in the substantial losses of organic C over a period of years (Heath et al., 2003). Losses of inorganic C may also be significant sources of CO₂ flux to the atmosphere (Monger and Martinez-Rios, 2001). A potential pitfall in evaluating the benefits of C sequestration occurs when encroaching woody plants are considered to sequester C (Havstad et al., 2007). Deeper rooting woody plants access sources of water and nutrients inaccessible to grasses, and may stimulate productivity and store C as wood, increasing levels of ecosystem C even as other ecological processes and ecosystems services degrade (Archer et al., 2001; Asner et al., 2004).

Additionally, as mentioned earlier, from 10-94 percent of the grassland soils are in impaired and/or unsatisfactory condition; much of this can be attributed directly to the loss of the herbaceous vegetation. According to Friedel (1991), once grass has been displaced, this alteration may result in a transition across a threshold to woody vegetation that is difficult to reverse. A second threshold may occur when soil erosion irreversibly alters the physical, chemical and biological properties of the soil (CRC, 1994). Soil erosion thereby irreversibly alters the kind and amount of vegetation a site can support and the attainment of ecological goals necessary for achieving DCs (Baker et al., 1995).

Increasing densities of established forest and woodland stands, and encroachment of new forest and woodland stands into grasslands have reduced the amount of available herbaceous understory vegetation (Cooper, 1960; Clary, 1971; Wilcox and Davenport, 1995; Allen, 1998; Donahue, 1999; Archer et al., 2001) since the arrival of Euro-Americans. The relationship of woody overstory/herbaceous understory vegetation is well documented in forests (Cooper, 1960; Moir, 1966; Betters, 1983; Clary, 1983; Ffolliott, 1983; Larson and Wolters, 1983; Mitchell, 1983; Thill et al., 1983; Riegel et al., 1992; Griffis et al., 2001; Abella, 2004; Lindh, 2005; among others), aspen (Woods et al., 1983; Berger and Puettmann, 2000; Bandeff et al., 2006; LaRade and Bork, 2011; Coop et al., 2014; among others), woodlands (Jameson, 1967 and 1971; Gallina and Ffolliott, 1983; Armentrout and Pieper, 1988; Pieper, 1983, 1990 and 1995; Breshears et al., 1997; McPherson and Weltzin, 1998; Harris et al., 2003; among others), savannas (Bidwell et al., no-date; Johnsen, 1962; Adamoli et al., 1990; Archer, 1994; Miller and Wigand, 1994; Mast et al. 1997; Archer et al., 2001; among others), and grasslands (Campbell and Bomberger, 1934; Hennessy et al., 1983; Schott and Pieper, 1985; Friedel, 1991; McDaniel et al., 1993; Livingston et al., 1997; Van Auken, 2000, 2009; Brockway et al., 2002; among others).

Herbaceous vegetation cover and production within all PNVTs on the A-SNFs is departed from potential (table 48); anywhere from 1 to 87 percent, and 8 to 91 percent, for cover and production, respectively. Overall, the least departure from potential in herbaceous cover and production has occurred in the spruce-fir forest PNVT, while the greatest departure from potential in herbaceous cover and production has occurred in the montane willow riparian forest PNVT.

Herbaceous understory vegetation is an important response variable to monitor after mechanical tree removal and prescribed burning treatments designed to restore composition and structure and/or remove overstory woody vegetation for grassland restoration. According to Abella (2004), understanding vegetation responses to thinning and burning is fundamental to better comprehend the ecology of Southwest forests and woodlands (McClaran and McPherson, 1999; Platt, 1999), and is of practical importance for predicting vegetation changes after treatments to improve outcomes of ecological restoration.

Trees limit the establishment, growth and development of understory vegetation. Trees do this in several ways; above ground, for example, there is light interception (shading), rain and snow interception, temperature modification, litter, allelopathy²², and site occupation. Below ground, such as, site occupation, competition for soil moisture, nutrients and minerals, and allelopathy. Historically, ponderosa pine and dry mixed conifer forests, and piñon-juniper and Madrean pine-oak woodlands were generally characterized by open (10-30%) canopies; and Great Basin, semi-desert, and montane/subalpine grasslands were generally characterized by very open (less than 10%) woody canopy cover with a majority of the overall landscape covered by grasses and forbs.

Understory herbaceous vegetation provided the fine fuels that maintained and supported the natural fire regimes (periodic (relatively frequent), low-intensity fires) needed to renew these frequent fire forest, woodland, and grassland PNVTs. In addition, understory vegetation, and grassland vegetation both provide habitat, hiding and thermal cover, nesting sites and foraging behavior (Finch et al., 1997), and food sources for a myriad of dependent plant and animal species.

The DCs for herbaceous understory vegetation within the forest, woodland, and riparian vegetation types have the composition, structure, and function of the herbaceous and shrub (where appropriate) layers to provide for a balance of species within these communities and promote a greater level of ecosystem health. The DCs for the grassland communities have the composition, structure, and function and to promote a greater level of ecosystem health, namely by removing woody vegetation and invasive species.

Environmental Consequences

The underlying assumption is, that for each PNVT the closer their ecological composition, structure, and processes are to their reference conditions (having a low departure indices²³ (DI) versus a high DI), the more properly each PNVT is functioning and the more secure dependent species (plants and animals) are within the associated habitats. This is particularly important with potential changes in the climate. The intent is to re-establish the natural patterns and processes within these vegetation communities that allowed for natural resiliency; especially important when faced with, uncharacteristic wildfire, and the presence of invasive plant species, and coupled with climate change.

The land management plan provides a programmatic framework that guides site-specific actions but does not authorize, fund, or carryout any project or activity. Because the land management plan does not authorize or mandate any ground-disturbing actions there can be no direct effects. However, there may be

²² Allelopathy (the suppression of neighboring plants) is the secretion into the environment by one plant of a toxic substance that inhibits the germination or growth of other potential competitor plants of the same or another species (Lapedes, 1974).

²³ Departure Index (DI) measures the degree to which the state composition, structure and cover between current and reference conditions are dissimilar is being used as an inference of sustainability; the lower the DI - the closer to reference conditions – the greater the sustain ability. The DIs are: 1) within reference condition (0-20%), minimal risk of losing key ecosystem components. Vegetation attributes (composition and structure) are intact and functioning within reference conditions. These areas can be maintained within the historical fire regime by such treatments as fire use; 2) Low departure (21-40%), low risk of losing key ecosystem components. Vegetation attributes (composition and structure) have been somewhat altered from reference conditions. These areas may need some level of restoration treatments, such as fire use, hand or mechanical treatments to be restored to reference conditions; 3) Moderate departure (41-60%), moderate risk of losing key ecosystem components. Vegetation attributes (composition and structure) have been moderately altered from reference conditions. These areas may need moderate levels of restoration treatments, such as fire use, hand or mechanical treatments to be restored to reference conditions; 4) High departure (61-80%), high risk of losing key ecosystem components. Vegetation attributes (composition and structure) have been quite altered from reference conditions. These areas may need greater levels of restoration treatments to be restored to reference conditions; and 5) Severe departure (81-100%), great risk of losing key ecosystem components. Vegetation attributes (composition and structure) have been significantly altered from reference conditions. These areas may need very high levels of restoration treatments, such as hand or mechanical before fire is used to restore to reference conditions. The higher the condition class number the more altered the ecosystem is from reference conditions. The DI provides a quantitative value used for reference and comparison in discussions regarding the PNVTs. Current DI can also be compared to results derived from modeling potential change.

implications, or longer term environmental consequences, of managing the forests under this programmatic framework.

Programmatic plan alternatives describe differing means for achieving DCs. Therefore the programmatic EIS more correctly identifies environmental consequences for choosing one alternative over another, rather than the more site specific environmental effects.

Table 48. Current and potential herbaceous and woody understory vegetation cover, production and plant heights by PNVt on the A-SNFs

Potential Natural Vegetation Type (PNVT)	Percent Average Low and High Understory Vegetation Ground Cover ¹ (forbs, grasses & grass-like plants)			Average Low and High Understory Pounds of Herbage Production ¹ (forbs, grasses & grass-like plants)			Range of Average Vegetation ¹ Stature ² in Inches		
	current (a)	potential (b)	average percent difference between columns a & b	current (estimated) (c)	potential (d)	average percent difference between columns c & d	shrubs (woody)	all herbaceous vegetation (forbs, grasses & grass-like plants)	grass & grass-like plants only
Forests									
Ponderosa pine	45 - 78	76 - 93	27	255 - 390	415 - 630	39	28 - 108	8 - 30	9 - 33
Wet mixed conifer	73 - 94	94 - 98	13	60 - 140	70 - 165	16	45 - 131	7 - 27	13 - 36
Dry mixed conifer	57 - 89	81 - 100	19	205 - 500	280 - 680	27	57 - 161	9 - 35	8 - 34
Spruce-fir	90 - 95	96 - 100	6	25 - 50	26 - 53	5	45 - 135	8 - 30	13 - 36
Woodlands									
Madrean pine-oak	6 - 35	20 - 52	43	100 - 155	495 - 740	79	31 - 104	11 - 36	12 - 34
Piñon-juniper	17 - 37	58 - 78	60	100 - 225	430 - 770	73	30 - 105	7 - 32	7 - 35
Grasslands									
Great Basin	23 - 45	52 - 74	46	260 - 440	765 - 1,305	66	40 - 97	7 - 29	7 - 32
Semi-desert	7 - 16	21 - 31	56	50 - 105	460 - 940	89	28 - 101	10 - 32	11 - 37
Montane/subalpine	28 - 36 ³	86 - 99	65	845 - 990	2,675 - 3,130	68	-	7 - 26	9 - 33
Chaparral									
Interior	23 - 41	29 - 56	25	5 - 55	20 - 175	68	40 - 119	9 - 36	10 - 41
Riparian Areas									
Wetland/cienega	30 - 41 ³	96 - 100	64	1,375 - 1,700	3,895 - 4,810	65	-	8 - 29	9 - 33
Riparian Forests									
Cottonwood-willow	33 - 55	61 - 87	41	150 - 555	340 - 1,265	56	37 - 110	7 - 31	8 - 33
Mixed broadleaf deciduous	5 - 18	15 - 78	75	55 - 85	490 - 740	88	31 - 112	11 - 39	11 - 37
Montane willow	6 - 12	47 - 88	87	15 - 115	140 - 1,255	91	77 - 158	8 - 29	9 - 34

¹ Values and vegetation species derived from Terrestrial Ecosystem Survey of the A-SNFs (Laing et al., 1989) and White, 2014

² Vegetation stature source material: Vine, 1960; Hermann, 1970 and 1975; Hitchcock and Chase, 1971; McDougall, 1973; Correll and Correll, 1975; Gould, 1977; Martin and Hutchins, 1980; Benson and Darrow, 1981; Hickman, 1993; Cronquist et al., 1997; Ruyle and Young, 1997; Welsh et al., 1997; Hurd et al., 1998; Barkworth et al., 2003 and 2007; Flora of North America, 2008; Springer et al., 2009

³ Data from White, 2002

Potential Natural Vegetation Types (PNVTs) Relationship to Desired Conditions (percent departure)

The values presented either come directly from the VDDT model outputs, and other information derived from research (when available) or professional judgment. For a list of management treatments and acres treated by PNVT see Appendix E, tables 1 through 3. The following indicators will be used to compare alternatives: relationship to DCs (percent departure); acres of aspen; percent grassland restoration; and reduction in overstory as it relates to understory herbaceous composition and production. All of the data that was derived from VDDT modeling and used to provide information for the following discussion can be found in the project record.

Forested PNVTs

Ponderosa pine forest:

Table 49 presents the proposed treatment objectives within the ponderosa pine forest PNVT by alternative.

Table 49. Proposed annual vegetation overstory treatment objectives within the ponderosa pine forest PNVT(see Appendix F tables 1 through 8 for a more complete description of the individual treatments and the annual acres of each proposed treatment objective by PNVT for alternatives B, C and D, and alternative A)

Alternative	High Acre Treatment Objectives		Low Acre Treatment Objectives		Average Acre Treatment Objectives		Alternative A Treatment Acres	
	mechanical	prescribed fire	mechanical	prescribed fire	mechanical	prescribed fire	mechanical	prescribed fire
A	-	-	-	-	-	-	7,119	3,150
B	11,025	11,025	1,552	1,575	6,289	6,300	-	-
C	24,255	10,187	2,426	1,040	13,341	5,614	-	-
D	9,450	22,050	1,417	3,308	5,434	12,679	-	-

Vegetation Outcome

After one planning cycle (15 years), the proposed high acre treatment objectives under alternative C produces the greatest movement toward DC, from the current rating of 77 to 52 (table 50). This is a change of one departure class, from high to moderate. Under this alternative there is the greatest overall reduction in the representation of all size and age trees, single or multi-storied with closed canopy cover (combined values of vegetation structural states G, H, I, L, M). And the greatest overall increase in representation of medium to very large size, single or multi-storied trees with open canopy cover (combined values of vegetation structural states D, E, J, and K). Reduction in overstory canopy cover will favor shade intolerant and very shade intolerant species, including the herbaceous understory vegetation.

The proposed average acre treatment objectives under alternative C produce the second greatest movement toward DC, from the current rating of 77 to 60. This is also a change of one departure class, from high to moderate. The proposed high acre treatment objectives under alternative D produce the third greatest movement toward DC, from the current rating of 77 to 61. However, this does not change its high departure rating. The proposed high and average acre treatment objectives under alternative B produce the fourth greatest movement toward DC, from the current rating of 77 to 63. However, this does not change the high departure rating. The low acre treatment objectives proposed under alternatives B, C and D, and the average acre treatment objectives proposed under alternative D provide less movement towards DC than alternative A. For more information regarding ponderosa pine vegetation structural state model run outcomes see Appendix D tables 1 through 10.

Table 50. Fifteen-year planning period ponderosa pine forest PNVT overstory departure from DC and HRV comparisons by alternative (B, C and D) for the proposed high, low and average acre treatment objectives, and alternative A; alternatives are arranged in the order of departure from DC (lowest to highest)

Alternative and Percent Acres Treated Annually (arranged from least to most departed from DC)	Percent Within Each Ponderosa Pine Forest Vegetation Structural State															Overall Departure ¹	
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	DC	HRV	
<i>Desired Condition</i>	0	1	1	7	22	1	1	2	2	16	45	2	2	0	0 ^N	-	
<i>Current Condition</i>	6	1	2	4	3	3	14	11	7	3	3	17	16	11	77 ^H	94 ^S	
C High Treatment (6.0)	8	4	5	6	11	5	11	7	3	7	14	11	5	2	52 ^M	75 ^H	
C Average (3.4)	6	4	4	5	10	5	12	9	5	6	10	14	9	2	60 ^M	81 ^S	
D High Treatment (5.3)	5	3	4	5	14	3	8	8	19	4	4	12	8	3	61 ^H	82 ^S	
B High Treatment (3.9)	5	4	4	6	11	5	11	9	5	6	9	14	9	2	63 ^H	80 ^H	
B Average (2.3)	5	3	4	5	9	5	12	10	6	5	7	16	11	2	63 ^H	83 ^S	
Alternative A (1.8)	5	3	3	5	10	5	12	10	9	4	6	15	11	3	65 ^H	84 ^S	
D Average (3.1)	5	3	3	4	11	4	10	9	14	4	4	14	11	3	66 ^H	85 ^S	
C Low Treatment (0.7)	4	3	3	4	8	5	13	10	7	4	6	17	13	2	69 ^H	86 ^S	
B Low Treatment (0.6)	5	3	3	4	8	5	13	11	7	4	5	17	13	2	69 ^H	87 ^S	
D Low Treatment (0.8)	5	2	3	4	8	4	13	10	10	4	4	17	13	3	70 ^H	87 ^S	

¹ Departure from DC and HRV Ratings: (0-20% = no departure^N); (21-40% = low departure^L); (41-60% = moderate departure^M); (61-80% = high departure^H); and (81-100% = severe departure^S)

Figure 2 displays the long-term trend toward DC for all ponderosa pine forest alternatives, based on their proposed average acre treatments. All alternatives produce reductions in departure from DC immediately, and continue to trend in movement toward DC through all modeling periods (out to 50 years). All alternatives move from a high to moderate departure class. Overall, alternatives A, B and C produce the greatest movement towards DC, respectively; followed by alternative D.

After one planning period (15 years), the proposed high acre treatment objectives under alternative C also produces the greatest movement toward HRV, from the current rating of 94 to 75 (table 50). This is a change of one departure class, from severe too high. The proposed high acre treatment objectives under alternative B produce the second greatest movement toward HRV, from the current rating of 94 to 80. This is also a change of one departure class, from severe to high. The proposed average acre treatment objectives under alternative C produce the third greatest movement toward HRV, from the current rating of 94 to 81. However, this does not change its severe departure rating. The low acre treatment objectives proposed under each of the action alternatives, and the average acre treatment objectives proposed under alternative D provide less movement towards HRV than alternative A.

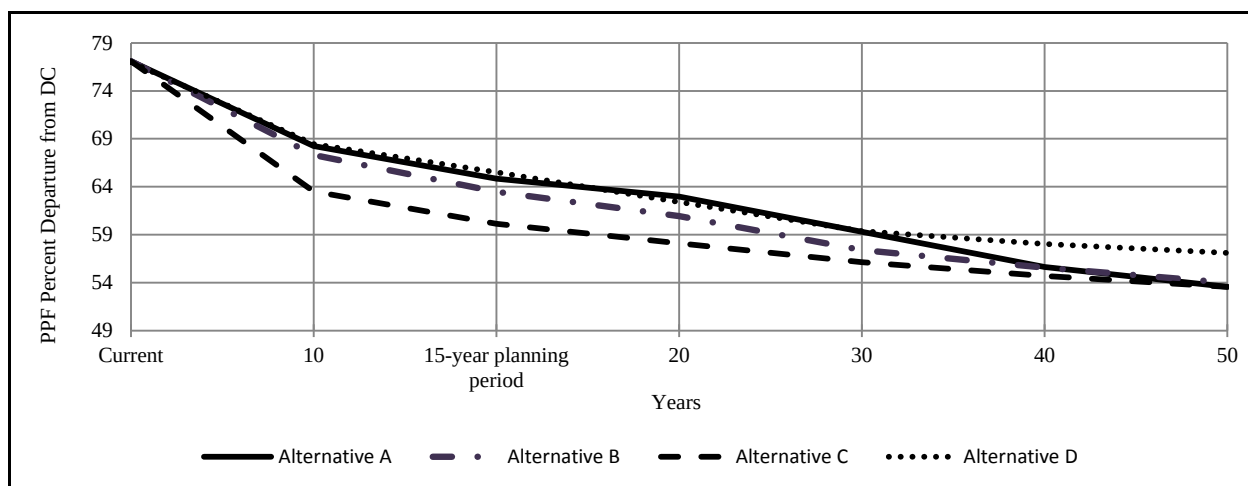


Figure 2. Overstory departure from DC trend comparisons for the ponderosa pine forest PNVT by alternative, over a 50-year time period, for alternative A and the average of the proposed high and low acre treatment objectives for alternatives B, C, and D

Figure 3 displays the long-term trend toward HRV for all ponderosa pine forest alternatives, based on their proposed average acre treatments. All alternatives produce reductions in departure from HRV immediately, and continue to trend in movement toward HRV through all modeling periods (out to 50 years). All alternatives move from a severe to high departure class. Overall, alternative D produces the greatest movement towards HRV over the other alternatives.

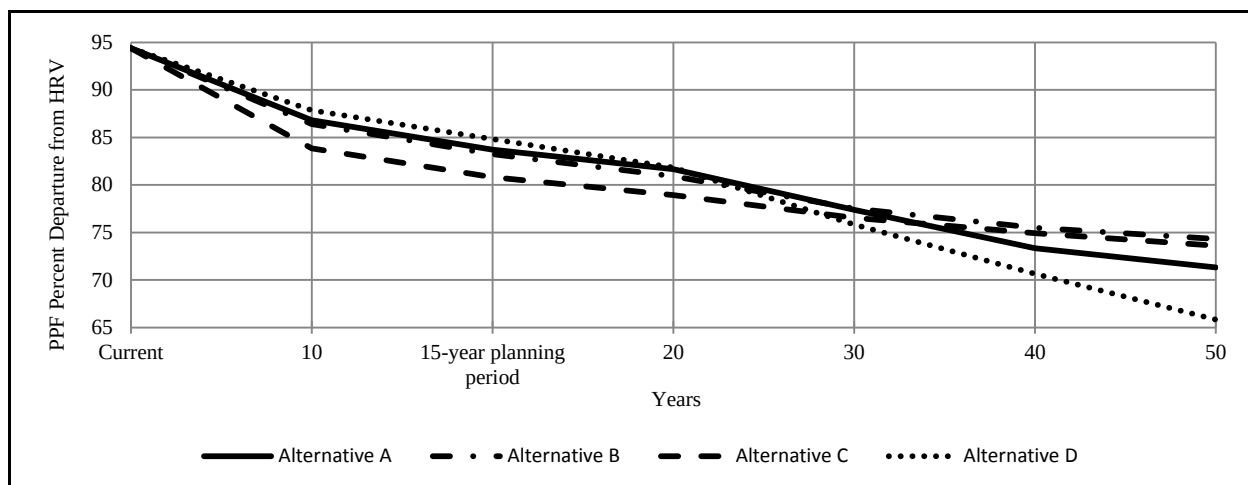


Figure 3. Overstory departure from HRV trend comparisons for the ponderosa pine forest PNVT by alternative, over a 50-year time period, for alternative A and the average of the proposed high and low acre treatment objectives for alternatives B, C, and D

In summary (for a complete display of the tabular summations of the 15-year planning period and the 50-year modeling period comparisons of the environmental consequences to the vegetation indicators between the proposed high, average, and low acre treatment objectives for alternatives B, C, and D, and alternative A see Appendix G tables 1 through 6, and Appendix H tables 1 through 6 for comparisons of the percent departures from DC and HRV by the end of the 15-year planning period and the 50-year modeling period, by alternative proposed high, average, and low acre treatment objectives and alternative A), for the proposed high acre treatment objectives, by the end of the 15-year planning period, alternative C does more to address the threats and risks when assessing movement toward DC, followed by alternative D, then B, and lastly A. In addition, by the end of the 15-year planning period, alternative C

also does more to address the threats and risks when assessing movement toward HRV, but followed by alternative B, then D, and lastly A. By the end of the 50-year modeling period, alternative B does more to address the threats and risks when assessing movement toward DC, followed by alternative C, and lastly, by the equally rated alternatives A and D. However, by the end of the 50-year modeling period, alternative D does more to address the threats and risks when assessing movement toward HRV, followed by alternative B, then C, and lastly A.

For the proposed average acre treatment objectives, by the end of the 15-year planning period, alternative C does more to address the threats and risks when assessing movement towards both DC and HRV, followed by alternative B, then A, and lastly D. By the end of the 50-year modeling period, the equally rated alternatives A, B and C do more to address the threats and risks when assessing movement toward DC, than alternative D. However, by the end of the 50-year modeling period, alternative D does more to address the threats and risks when assessing movement toward HRV, followed by alternative A, and lastly, by the equally rated alternatives B and C.

For the proposed low acre treatment objectives, by the end of the 15-year planning period, alternative A does more to address the threats and risks when assessing movement toward DC followed by the equally rated alternatives B and C, and lastly D. In addition, by the end of the 15-year planning period, alternative A also does more to address the threats and risks when assessing movement toward HRV, but followed by alternative C, then B, and lastly D. Furthermore, by the end of the 50-year modeling period, alternative A also does more to address the threats and risks when assessing movement toward DC, followed by alternative C, then B, and lastly D. In addition, by the end of the 50-year modeling period, alternative A also does more to address the threats and risks when assessing movement toward HRV, but followed by the equally rated alternatives C and D, and lastly B.

Large/Old Trees, Snags and Coarse Woody Debris

In brief, large trees/old trees contribute to old growth forest conditions. According to Binkley et al. (2007), ecological processes are the driving forces behind any ecosystem, those processes are reflected and supported by the composition of the ecosystem, that is by the living and non-living entities that exist in the ecosystem. Old-growth forests, by definition, have old/large trees, but the presence of old/large trees is just the beginning of a description of the composition of an old-growth forest (Binkley et al., 2007). Old growth forests are a significant and unique part of the diverse ecological web formed by natural forest landscapes. Human activities or natural disturbances in one part of the forest landscape can affect many other parts of the landscape (SEC, 1992). As an important part of the landscape ecology of natural forests, old growth provides unique resources for plants and animals (including people) within the landscape (Harris, 1984; Franklin et al., 1986). In addition, Beckman and Wohl (2014), found that in the Colorado Front Range, old-growth forests were highly correlated with more C storage in headwater rivers and streams than those in altered forests. Old growth forests are also important because we do not fully understand their functions, the life forms they support, or their importance to the ecology of A-SNFs.

Ecologically, a dead tree is as important to the forest ecosystem as a live one (Franklin et al., 1989), and according to Marcot (2002), provide several key ecological functions that influence the ecosystem through trophic relations, species interactions, soil aeration, primary cavity and burrow excavation, and dispersal of fungi, lichens, seeds, fruits, plants, and invertebrates. Snags (standing dead trees) and rotting logs are essential to healthy forest ecosystems in several ways: Snags provide homes for birds that eat insects. When they fall and become coarse woody debris, they provide habitat for small animals and insects. When these logs rot they store water and provide nutrients for the continued growth of the forest. Dead wood rotting on the forest floor eventually gets incorporated into the soil. This underground wood

feeds many insects and bacteria which provide N to feed the trees and other plants in the forest. Underground wood is the major source of N for dry forests.

The importance of coarse woody debris in forests has been partially documented, although much remains to be discovered (Stevens, 1997). What is known of these roles is divided into four, inter-related categories: 1) the role in productivity of forest trees; 2) the role in providing habitat and structure to maintain biological diversity; 3) the role in geomorphology of streams and slopes; and 4) the role in long-term carbon storage. The importance of each of these roles to an ecosystem varies throughout the forests by natural disturbance type, biogeoclimatic zone and moisture regime (Stevens, 1997).

Large/Old Trees: By the end of the 15-year planning period, none of the alternatives would achieve the DCs for number of acres of large/old tree retention (table 51). However, the proposed high acre treatment objectives under alternatives D would provide the greatest movement toward DCs. This is followed by alternative D proposed average acre treatment objectives, alternative A, alternative D proposed low acre treatment objectives, alternative B proposed average acre treatment objectives, alternative C proposed low acre treatment objectives, alternative B proposed high acre treatment objectives, alternative B proposed low acre treatment objectives, alternative C proposed average acre treatment objectives, and lastly, alternative C proposed high acre treatment objectives. By the end of the 50-year modeling period, none of the alternatives would achieve the DCs for number of acres of large/old tree retention. However, the proposed high acre treatment objectives under alternatives D would provide the greatest movement toward DCs. This is followed by alternative D proposed average acre treatment objectives, alternative A, alternative D proposed low acre treatment objectives, alternative B proposed high acre treatment objectives, alternative C proposed low acre treatment objectives, alternative B proposed average acre treatment objectives, alternative B proposed low acre treatment objectives, alternative C proposed average acre treatment objectives, and lastly, alternative C proposed high acre treatment objectives.

Snags (18 inches or larger DBH): By the end of the 15-year planning period, none of the alternatives would achieve the DCs for the number of snags 18 inches or greater DBH per acre (table 51). However, the low acre treatment objectives proposed under both alternatives B and C provide the greatest movement toward DCs. This is followed equally by the alternative B proposed high acre treatment objectives, alternative B proposed average acre treatment objectives, alternative C proposed high acre treatment objectives, alternative C proposed average acre treatment objectives, and alternative D proposed low acre treatment objectives, then alternative A, alternative D proposed high acre treatment objectives, and lastly, alternative D proposed average acre treatment objectives. By the end of the 50-year modeling period, all alternatives are even further departed from DCs than they were at the end of the 15-year planning period.

Coarse Woody Debris: By the end of the 15-year planning period, none of the alternatives would achieve the DCs for the amount of coarse woody debris per acre (table 51). However, the proposed average acre treatment objectives under alternatives C would provide the greatest movement toward DCs. This is followed by alternative B proposed average acre treatment objectives, alternative C proposed high acre treatment objectives, alternative B proposed high acre treatment objectives, alternative B proposed low acre treatment objectives, alternative C proposed low acre treatment objectives, alternative A, alternative D proposed low acre treatment objectives, alternative D proposed high acre treatment objectives, and lastly, alternative D proposed average acre treatment objectives. By the end of the 50-year modeling period, all alternatives, except alternative C proposed high acre treatment objectives, are even further departed from DCs than they were at the end of the 15-year planning period.

In summary, for a complete display of the tabular summations of the 15-year planning period and 50-year modeling period comparisons of the environmental consequences to the vegetation indicators between the proposed high, average, and low acre treatment objectives for alternatives B, C, and D, and alternative A

see Appendix G tables 1 through 6, for the proposed high acre treatment objectives, by the end of the 15-year planning period, alternative D does more, when assessing movement toward DC for acres of large/old trees per acre, followed by alternative A, then B, and lastly C. In addition, by the end of the 50-year modeling period, alternative D also does more, when assessing movement toward DC for acres of large/old trees per acre, but followed by alternative B, then C, and lastly A. By the end of the 15-year planning period, the equally rated alternatives B and C do more, when assessing movement toward DC for number of large snags per acre, followed by alternative A, and lastly D. However, by the end of the 50-year modeling period, alternative C does more, when assessing movement toward DC for number of large snags per acre, followed by alternative B, then A, and lastly D. By the end of the 15-year planning period and the 50-year modeling period, alternative C does more, when assessing movement toward DC for tons of coarse woody debris per acre, followed by alternative B, then A, and lastly D.

Table 51. Acres of large/old trees, number of snags greater than 18 inch diameter at breast height (DBH) per acre, and tons of the three size classes of coarse woody debris per acre by the end of the 15-year planning period and the 50-year modeling period within the ponderosa pine forest PNVF for the proposed high, low and average treatment objectives for alters B, C and D, and alternative A

Alternative	Acres of Large/Old Trees ponderosa pine forest vegetation structural states E, I, K, M	Across All Ponderosa Pine Forest Vegetation Structural States					total
		number of snags/acre		tons of coarse woody debris/acre			
		DBH		DBH			
		5" - 17.9"	≥ 18"	≤ 3"	> 3" & ≤ 12"	> 12"	
<i>Desired Condition</i>	424,555	<i>Non-defined¹ average 1 - 2</i>		<i>range from 3 - 10</i>			
<i>Current Condition</i>	175,013	10.9	3.1	4.4	6.5	2.9	13.8
15-year Planning Period							
Alternative A	219,145	10.3	3.7	4.6	7.1	3.5	15.2
B High Treatment	202,935	9.9	3.6	4.5	6.9	3.4	14.8
B Average Treatment	206,655	10.4	3.5	4.4	6.7	3.4	14.5
B Low Treatment	201,048	10.9	3.5	4.6	7.0	3.3	14.9
C High Treatment	199,004	8.9	3.6	4.5	6.7	3.4	14.6
C Average Treatment	200,026	9.8	3.5	4.0	6.3	3.3	13.6
C Low Treatment	204,795	10.9	3.5	4.7	7.0	3.4	15.1
D High Treatment	270,289	9.4	4.1	4.7	7.4	3.6	15.7
D Average Treatment	241,884	10.1	3.8	4.7	7.5	3.8	16.0
D Low Treatment	213,478	10.8	3.6	4.7	7.2	3.4	15.3
50-year Modeling Period							
Alternative A	281,337	9.9	4.4	5.9	7.7	4.1	16.7
B High Treatment	238,992	9.2	4.1	4.4	7.0	3.8	15.2
B Average Treatment	237,166	10.1	4.0	4.7	7.3	3.8	15.8
B Low Treatment	235,339	10.9	3.9	5.0	7.5	3.8	16.3
C High Treatment	205,515	8.5	3.8	4.0	6.3	3.5	13.8
C Average Treatment	221,966	9.7	3.9	4.5	6.9	3.7	15.0
C Low Treatment	238,417	10.8	4.0	4.9	7.5	3.8	16.3
D High Treatment	405,289	8.2	5.5	5.2	8.3	5.0	18.5
D Average Treatment	342,964	9.3	4.9	5.2	8.1	4.5	17.8
D Low Treatment	280,639	10.6	4.3	5.2	7.9	4.1	17.2

¹ Proposed Forest Plan desired conditions for ponderosa pine forest do not specify any DCs for this size class of snags; data is provide for additional information only

For the proposed average acre treatment objectives, by the end of the 15-year planning period and the 50-year modeling period, alternative D does more, when assessing movement toward DC for acres of large/old trees per acre, followed by alternative A, then B, and lastly C. By the end of the 15-year planning period, alternative D does more, when assessing movement toward DC for number of large snags per acre, followed by alternative C, then A, and lastly D. However, by the end of the 50-year modeling period, alternative C does more, when assessing movement toward DC for number of large snags per acre, followed by alternative B, then A, and lastly D. By the end of the 15-year planning period

and the 50-year modeling period, alternative C does more, when assessing movement toward DC for tons of coarse woody debris per acre, followed by alternative B, then A, and lastly D.

For the proposed low acre treatment objectives, by the end of the 15-year planning period and the 50-year modeling period, alternative A does more, when assessing movement toward DC for acres of large/old trees per acre, followed by alternative D, then C, and lastly B. By the end of the 15-year planning period, the equally rated alternatives B and C do more, when assessing movement toward DC for number of large snags per acre, followed by alternative D, and lastly A. However, by the end of the 50-year modeling period, alternative B does more, when assessing movement toward DC for number of large snags per acre, followed by alternative C, then D, and lastly A. By the end of the 15-year planning period, alternative B does more, when assessing movement toward DC for tons of coarse woody debris per acre, followed by alternative C, then A, and lastly D. However, by the end of the 50-year modeling period, the equally rated alternatives B and C do more, when assessing movement toward DC for number of large snags per acre, followed by alternative A, and lastly D.

Wet mixed conifer forest:

Table 52 presents the proposed treatment objectives within the wet mixed conifer forest PNVT by alternative.

Table 52. Proposed annual vegetation overstory treatment objectives within the wet mixed conifer forest PNVT(see Appendix F tables 1 through 8 for a more complete description of the individual treatments and the annual acres of each proposed treatment objective by PNVT for alternatives B, C and D, and alternative A)

Alternative	High Acre Treatment Objectives		Low Acre Treatment Objectives		Average Acre Treatment Objectives		Alternative A Treatment Acres	
	mechanical	prescribed fire	mechanical	prescribed fire	mechanical	prescribed fire	mechanical	prescribed fire
A	-	-	-	-	-	-	2,147	950
B	3,325	3,325	475	475	1,900	1,900	-	-
C	7,315	3,135	731	313	4,023	1,725	-	-
D	2,851	6,650	428	998	1,640	3,824	-	-

Vegetation Outcome

After one planning period (15 years), the average acre treatment objectives under alternative A produce the greatest movement toward DC, from the current rating of 54 to 49 (table 53). However, this does not produce a change in the departure class; it remains moderate. Under this alternative there is the greatest overall reduction in the representation of vegetation structural states that are lacking aspen regeneration (combined values of vegetation structural states K, L, M, N, O, and Q). And the greatest overall increase in representation of medium to very large size, single or multi-storied trees with open canopy cover (combined values of vegetation structural states E and F). Reduction in overstory canopy cover will favor aspen and mixed-shade tolerant species, including the herbaceous understory vegetation; however, this is inappropriate for later seral states of this PNVT. This forest type is supposed to be dense with closed canopy. Aspen is only dominant following high severity disturbances in the early seral conditions.

The proposed high acre treatment objectives under alternative D produce the second greatest movement toward DC, from the current rating of 54 to 50. However, this does not produce a change in the departure class; it remains moderate. The proposed high acre treatment objectives under alternative B and the average acre treatment objectives under alternative D produce the third greatest movement toward DC, from the current rating of 54 to 52. Again, this does not produce a change in the departure classes; they remain moderate. The proposed alternative B low and average acre treatment objectives, all aspects of alternatives C, and the proposed low acre treatment objectives in alternative D produce less change or no

change in the movement towards DC when compared to alternative A. For more information regarding wet mixed conifer vegetation structural state model run outcomes see Appendix D tables 11 through 20.

Figure 4 displays the long-term trend in relation to DC for all wet mixed conifer forest alternatives, based on their proposed average acre treatments. Alternative A produces the greatest DC departure reduction during the planning period and continues throughout all modeling periods. Alternatives B and D produce some movement toward DC. Alternative C continues to trend away from DC throughout all modeling periods.

Table 53. Fifteen-year planning period wet mixed conifer forest PNVTV overstory departure from DC and HRV comparisons by alternative (B, C and D) for the proposed high, low and average acre treatment objectives, and alternative A; alternatives are arranged in the order of departure from DC (lowest to highest)

Alternative and Percent Acres Treated Annually (arranged from least to most departed from DC)	Percent Within Each Wet Mixed Conifer Forest Vegetation Structural State																			Overall Departure ¹	
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	DC	HRV
<i>Desired Condition</i>	7	21	9	7	20	20	9	7	0	0	0	0	0	0	0	0	0	0	0	0 ^N	-
<i>Current Conditions</i>	13	28	4	5	1	1	1	10	0	0	13	6	5	1	1	1	10	0	0	54 ^M	61 ^H
Alternative A (1.9)	0	29	15	8	1	3	6	4	2	8	1	5	4	1	2	7	3	1	2	49 ^M	46 ^M
D High Treatment (5.3)	0	22	7	9	1	3	3	6	4	3	1	11	6	1	3	11	5	2	2	50 ^M	47 ^M
B High Treatment (4.0)	0	23	9	9	1	3	4	4	2	4	1	12	7	1	3	12	3	1	2	52 ^M	44 ^M
D Average (4.9)	0	23	8	8	1	3	3	5	3	3	1	13	7	1	3	12	5	1	2	52 ^M	47 ^M
B Average (2.3)	0	24	9	8	1	2	3	4	2	3	0	14	7	1	3	12	4	1	2	53 ^M	46 ^M
B Low Treatment (0.6)	0	24	9	7	1	2	3	3	2	2	0	15	8	1	3	13	5	1	2	54 ^M	47 ^M
D Low Treatment (4.4)	0	24	8	7	1	2	3	4	2	2	0	15	8	1	3	13	5	1	2	54 ^M	46 ^M
C Low Treatment (0.8)	0	24	9	6	1	2	3	3	2	2	0	15	8	1	3	13	4	1	2	55 ^M	47 ^M
C High Treatment (6.3)	1	20	9	5	1	3	4	3	2	6	2	14	7	0	3	15	2	1	2	56 ^M	51 ^M
C Average (3.6)	1	22	9	6	1	2	4	3	2	4	1	14	7	1	3	14	3	1	2	56 ^M	49 ^M

¹ Departure from DC and HRV Ratings: (0-20% = no departure^N); (21-40% = low departure^L); (41-60% = moderate departure^M); (61-80% = high departure^H); and (81-100% = severe departure^S)

After one planning period (15 years), the proposed high acre treatment objectives under alternative B produces the greatest movement toward HRV, from the current rating of 61 to 44 (table 53). This is a change of one departure class, from high moderate. The treatment objectives under alternative A, the proposed average acre treatment objectives under alternative B, and the proposed low acre treatment objectives under alternative D all produce the same departure from HRV, from 61 to 46. This is a change of one departure class, from high moderate. The proposed high acre treatment objectives under alternative C produce the least movement towards HRV, from 61 to 51; however, this does lowers its high departure rating to moderate.

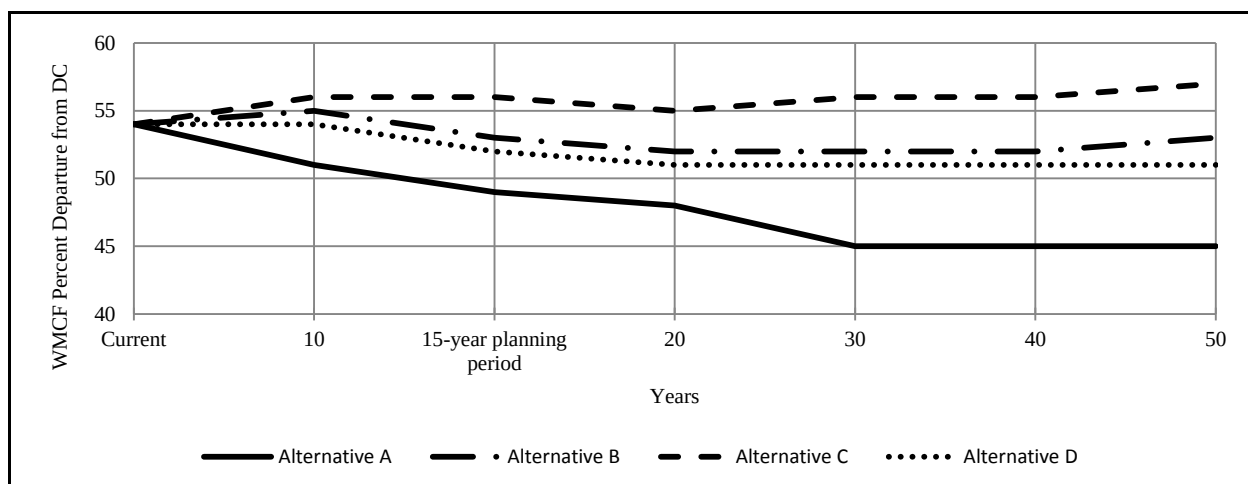


Figure 4. Overstory departure from DC trend comparisons for wet mixed conifer forest PNVT by alternative over a 50-year time period for alternative A and the average of the proposed high and low acre treatment objectives for alternatives B, C, and D

Figure 5 displays the long-term trend in relation to HRV for all wet mixed conifer forest alternatives, based on their proposed average acre treatments. All alternatives produce a decline in departure from high to moderate. Alternatives A and B produce the greatest HRV departure reduction during the planning period. All alternatives maintain a moderate departure throughout the modeling periods.

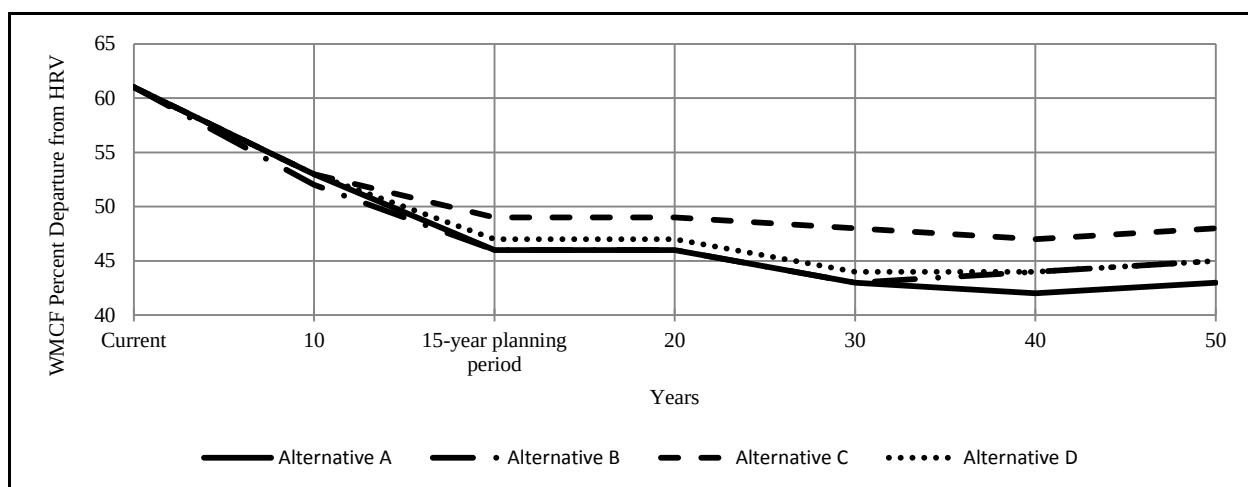


Figure 5. Overstory departure from HRV trend comparisons for wet mixed conifer forest PNVT by alternative over a 50-year time period for alternative A and the average of the proposed high and low acre treatment objectives for alternatives B, C, and D

In summary, for a complete display of the tabular summations of the 15-year planning period and the 50-year modeling period comparisons of the environmental consequences to the vegetation indicators between the proposed high, average, and low acre treatment objectives for alternatives B, C, and D, and alternative A see Appendix G tables 1 through 6, and Appendix H tables 1 through 6, for comparisons of the percent departures from DC and HRV by the end of the 15-year planning period and the 50-year modeling period, by alternative proposed high, average, and low acre treatment objectives and alternative A, for the proposed high acre treatment objectives, by the end of the 15-year planning period, alternative A does more to address the threats and risks when assessing movement toward DC, followed by alternative D, then B, and lastly C. However, by the end of the 15-year planning period, alternative B does more to address the threats and risks when assessing movement toward HRV, followed by alternative A,

then D, and lastly C. by the end of the 50-year modeling period, alternative A does more to address the threats and risks when assessing movement toward DC, followed by alternative D, then B, and lastly C. In addition, by the end of the 50-year modeling period, alternative A also does more to address the threats and risks when assessing movement toward HRV, but followed by the equally rated alternatives B and D, and lastly C.

For the proposed average acre treatment objectives, by the end of the 15-year planning period, alternative A does more to address the threats and risks when assessing movement toward DC, followed by alternative D, then B, and lastly C. However, by the end of the 15-year planning period, the equally rated alternatives A and B do more to address the threats and risks when assessing movement toward HRV, followed by alternative D, and lastly C. By the end of the 50-year modeling period, alternative A does more to address the threats and risks when assessing movement toward DC, followed by alternative D, then B, and lastly C. In addition, by the end of the 50-year modeling period, alternative A also does more to address the threats and risks when assessing movement toward HRV, but followed by the equally rated alternatives B and D, and lastly C.

For the proposed low acre treatment objectives, by the end of the 15-year planning period, alternative A does more to address the threats and risks when assessing movement toward DC followed by the equally rated alternatives B and D, and lastly C. However, by the end of the 15-year planning period, the equally rated alternatives A and D do more to address the threats and risks when assessing movement toward HRV, followed by the equally rated alternatives B and C. by the end of the 50-year modeling period, alternative A does more to address the threats and risks when assessing movement toward DC, followed by alternative D, then B, and lastly C. In addition, by the end of the 50-year modeling period, alternative A also does more to address the threats and risks when assessing movement toward HRV, but followed by alternative D, and lastly, the equally rated alternatives B and C.

Large Trees/Old Trees, Snags and Coarse Woody Debris

Large/Old Trees: By the end of the 15-year planning period, none of the alternatives would achieve the DCs for number of acres of large/old tree retention (table 54). However, the proposed high acre treatment objectives under alternatives D would provide the greatest movement toward DCs. This is followed by alternative C proposed high acre treatment objectives, alternative B proposed high acre treatment objectives, alternative D proposed average acre treatment objectives, alternative C proposed average acre treatment objectives, alternative B proposed average acre treatment objectives, alternative A, alternative D proposed low acre treatment objectives, alternative C proposed low acre treatment objectives, and lastly, alternative B proposed low acre treatment objectives. By the end of the 50-year modeling period, none of the alternatives would achieve the DCs for number of acres of large/old tree retention. However, the proposed high acre treatment objectives under alternatives D would provide the greatest movement toward DCs. This is followed by alternative D proposed average acre treatment objectives, alternative B proposed high acre treatment objectives, alternative C proposed high acre treatment objectives, alternative B proposed average acre treatment objectives, alternative C proposed average acre treatment objectives, alternative A, alternative D proposed low acre treatment objectives, alternative B proposed low acre treatment objectives, and lastly, alternative C proposed low acre treatment objectives.

Snags (18 inches or larger DBH): By the end of the 15-year planning period, none of the alternatives would achieve the DCs for the number of snags 18 inches or greater DBH per acre (table 54). However, the low acre treatment objectives proposed under both alternatives B and C provide the greatest movement toward DCs. This is followed by alternative A, alternative B proposed high acre treatment objectives, alternative C proposed high acre treatment objectives, alternative B proposed average acre treatment objectives, alternative D proposed low acre treatment objectives, alternative C proposed average acre treatment objectives, and then alternative D proposed high acre treatment objectives, and

lastly, alternative D proposed average acre treatment objectives. By the end of the 50-year modeling period, all alternatives are even further departed from DCs than they were at the end of the 15-year planning period.

Coarse Woody Debris: By the end of the 15-year planning period, five alternatives' proposed acre treatment objectives would achieve the DCs for the amount of coarse woody debris per acre (table 54). They are: alternative C proposed high, average, and low acre treatment objectives, alternative B proposed low acre treatment objectives, and lastly, alternative D proposed low acre treatment objectives. Those alternatives not meeting DCs for the amount of coarse woody debris per acre are: alternative A, alternative B proposed high and average acre treatment objectives, and lastly, alternative D proposed high, and average acre treatment objectives. By the end of the 50-year modeling period, all alternatives are even further departed from DCs than they were at the end of the 15-year planning period.

Table 54. Acres of large/old trees, number of snags greater than 18 inch diameter at breast height (DBH) per acre, and tons of the three size classes of coarse woody debris per acre by the end of the 15-year planning period and the 50-year modeling period within the wet mixed conifer forest PNVF for the proposed high, low and average treatment objectives for alters B, C and D, and alternative A

Alternative	Acres of Large/Old Trees wet mixed conifer forest vegetation structural states E, F, I, J, N, O, R, S	Across All Wet Mixed Conifer Forest Vegetation Structural States					
		number of snags/acre		tons of coarse woody debris/acre			total
		DBH		DBH			
		5" - 17.9"	≥ 18"	≤ 3"	> 3" & ≤ 12"	> 12"	
Desired Condition	80,543	≥ 20 ¹	average 1 - 5		range from 5 - 40		
Current Condition	20,058	25.4	9.8	4.4	6.5	2.9	13.8
15-year Planning Period							
Alternative A	36,004	23.0	10.0	9.5	18.6	12.7	40.7
B High Treatment	39,080	23.9	10.4	9.6	18.5	12.7	40.8
B Average Treatment	36,238	23.3	10.0	9.5	18.4	12.6	40.5
B Low Treatment	33,396	22.7	9.7	9.4	18.3	12.5	40.2
C High Treatment	39,966	23.7	10.7	9.2	17.7	12.3	39.3
C Average Treatment	36,729	23.3	10.2	9.3	18.0	12.3	39.2
C Low Treatment	33,492	22.8	9.7	9.4	18.2	12.5	40.1
D High Treatment	41,950	24.3	11.0	9.7	19.2	13.3	42.2
D Average Treatment	37,689	23.6	10.4	9.6	18.7	12.9	41.2
D Low Treatment	33,428	22.9	9.8	9.4	18.3	12.6	40.3
50-year Modeling Period							
Alternative A	45,522	25.0	11.4	10.1	19.5	13.5	43.0
B High Treatment	51,037	25.5	12.0	10.2	19.3	13.9	43.4
B Average Treatment	46,288	24.6	11.4	10.0	19.1	13.7	42.8
B Low Treatment	41,540	23.8	10.8	9.8	18.8	13.5	42.1
C High Treatment	46,305	24.6	11.7	9.6	18.3	13.2	41.1
C Average Treatment	43,819	24.1	11.2	9.7	18.5	13.2	41.4
C Low Treatment	41,333	23.7	10.8	9.7	18.6	13.3	41.6
D High Treatment	58,547	26.6	13.2	10.6	20.5	14.7	45.7
D Average Treatment	51,279	25.5	12.1	10.2	19.8	14.1	44.1
D Low Treatment	44,012	24.3	11.1	9.9	19.0	13.6	42.5

¹ Proposed Forest Plan mid-scale DCs (100 to 1,000 acres) for wet mixed conifer forest are for 20 or more snags > 8" in DBH per acre. Available data ranges from "small" (> 5" and ≤ 10" DBH), "large" (> 10" and ≤ 18" DBH), and "extra-large" (> 18" DBH): so there is no way to examine exactly how many 8" or greater diameter snags per acre there are currently, or would be under the proposed high, low and average acre treatments objectives by the end of the 15-year planning period or the 50-year modeling period). Data is provide for additional information only

In summary, for a complete display of the tabular summations of the 15-year planning period and 50-year modeling period comparisons of the environmental consequences to the vegetation indicators between the proposed high, average, and low acre treatment objectives for alternatives B, C, and D, and alternative A see Appendix G tables 1 through 6, for the proposed high acre treatment objectives, by the end of the 15-year planning period, alternative D does more when assessing movement toward DC for acres of large/old

trees per acre, followed by alternative C, then B, and lastly A. In addition, by the end of the 50-year modeling period, alternative D also does more when assessing movement toward DC for acres of large/old trees per acre, followed by alternative B, then C, and lastly A. By the end of the 15-year planning period, alternative A does more when assessing movement toward DC for number of large snags per acre, followed by alternative B, then C, and lastly D. In addition, by the end of the 50-year modeling period alternative A also does more when assessing movement toward DC for number of large snags per acre, followed by alternative C, then B, and lastly D. By the end of the 15-year planning period, alternative C does more when assessing movement toward DC for tons of coarse woody debris per acre, followed by the equally rated alternatives A and B, and lastly D. However, by the end of the 50-year modeling period, alternative C does more when assessing movement toward DC for tons of coarse woody debris per acre, followed by alternative A, then B, and lastly D.

For the proposed average acre treatment objectives, by the end of the 15-year planning period, alternative D does more when assessing movement toward DC for acres of large/old trees per acre, followed by alternative C, then B, and lastly A. In addition, by the end of the 50-year modeling period, alternative D also does more when assessing movement toward DC for acres of large/old trees per acre, but followed by alternative B, then C, and lastly A. By the end of the 15-year planning period, alternative A does more when assessing movement toward DC for number of large snags per acre, followed by alternative B, then C, and lastly D. However, by the end of the 50-year modeling period, alternative C does more when assessing movement toward DC for number of large snags per acre, followed by the equally rated alternatives A and B, and lastly D. By the end of the 15-year planning period and the 50-year modeling period, alternative C does more when assessing movement toward DC for tons of coarse woody debris per acre, followed by alternative B, then A, and lastly D.

For the proposed low acre treatment objectives, by the end of the 15-year planning period, alternative A does more when assessing movement toward DC for acres of large/old trees per acre, followed by alternative D, then C, and lastly B. In, addition, by the end of the 50-year modeling period, alternative A also does more when assessing movement toward DC for acres of large/old trees per acre, but followed by alternative D, then B, and lastly C. By the end of the 15-year planning period, the equally rated alternatives B and C do more when assessing movement toward DC for number of large snags per acre, followed by alternative A, and lastly D. In addition, by the end of the 50-year modeling period, the equally rated alternatives B and C also do more when assessing movement toward DC for number of large snags per acre, but followed by alternative D, and lastly A. By the end of the 15-year planning period and the 50-year modeling period, alternative C does more when assessing movement toward DC for tons of coarse woody debris per acre, followed by alternative B, then D, and lastly A.

Dry mixed conifer forest:

Table 55 presents the proposed treatment objectives within the dry mixed conifer forest PNVT by alternative.

Table 55. Proposed annual vegetation overstory treatment objectives within the dry mixed conifer forest PNVT(see Appendix F tables 1 through 8 for a more complete description of the individual treatments and the annual acres of each proposed treatment objective by PNVT for alternatives B, C and D, and alternative A)

Alternative	High Acre Treatment Objectives		Low Acre Treatment Objectives		Average Acre Treatment Objectives		Alternative A Treatment Acres	
	mechanical	prescribed fire	mechanical	prescribed fire	mechanical	prescribed fire	mechanical	prescribed fire
A	-	-	-	-	-	-	1,808	800
B	2,772	2,910	396	416	1,584	1,663	-	-
C	6,160	2,772	616	277	3,388	1,525	-	-
D	2,400	5,880	360	881	1,380	3,381	-	-

Vegetation Outcome

After one planning period (15 years), the proposed high acre treatment objectives under alternative C produces the greatest movement toward DC, from the current rating of 67 to 49 (table 56). This is a change of one departure class, from high to moderate. Under this alternative there is the greatest overall reduction in the representation of all size and age trees, single or multi-storied with closed canopy cover (combined values of vegetation structural states G, H, I, L, M). And the greatest overall increase in representation of medium to very large size, single or multi-storied trees with open canopy cover (combined values of vegetation structural states D, E, J, and K). Reduction in overstory canopy cover will favor shade intolerant and very shade intolerant species, including the herbaceous understory vegetation.

Table 56. Fifteen-year planning period dry mixed conifer forest PNVT overstory departure from DC and HRV comparisons by alternative (B, C and D) for the proposed high, low and average acre treatment objectives, and alternative A; alternatives are arranged in the order of departure from DC (lowest to highest)

Alternative and Percent Acres Treated Annually (arranged from least to most departed from DC)	Percent Within Each Dry Mixed Conifer Forest Vegetation Structural State														Overall Departure ¹	
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	DC	HRV
<i>Desired Condition</i>	0	5	3	4	15	4	3	2	6	11	30	4	13	0	0 ^N	-
<i>Current Condition</i>	3	1	2	3	1	3	14	8	2	3	1	26	9	25	67 ^H	77 ^H
C High Treatment (6.4)	3	1	1	3	2	30	11	5	3	6	14	10	6	5	49 ^M	44 ^M
B High Treatment (4.1)	3	1	1	3	4	28	10	8	4	5	9	13	7	5	53 ^M	48 ^M
C Average (3.6)	3	1	1	3	2	29	11	8	4	5	9	14	7	5	54 ^M	51 ^M
B Average (2.4)	3	1	1	3	4	28	11	8	4	4	6	14	7	5	56 ^M	52 ^M
D High Treatment (3.9)	3	2	1	5	3	24	9	8	11	4	4	13	7	6	56 ^M	52 ^M
A Average (1.8)	2	1	1	3	5	27	11	9	4	3	4	16	7	6	57 ^M	54 ^M
D Average (2.2)	3	1	1	4	3	26	10	10	8	4	3	15	7	6	58 ^M	54 ^M
C Low Treatment (0.8)	2	1	1	2	1	28	12	10	5	3	4	17	8	5	59 ^M	58 ^M
D Low Treatment (0.6)	2	1	1	3	2	27	11	11	5	3	3	18	8	6	59 ^M	56 ^M
B Low Treatment (0.7)	2	0	1	2	4	28	12	9	5	3	3	16	8	6	60 ^M	57 ^M

¹ Departure from DC and HRV Ratings: (0-20% = no departure^N); (21-40% = low departure^L); (41-60% = moderate departure^M); (61-80% = high departure^H); and (81-100% = severe departure^S)

The proposed high acre treatment objectives under alternative B produce the second greatest movement toward DC, from the current rating of 67 to 53. This is a change of one departure class, from high to moderate. The proposed average acre treatment objectives under alternative C produce the third greatest movement toward DC, from the current rating of 67 to 54. This is also a change of one departure class, from high to moderate. The low acre treatment objectives proposed under each of the action alternatives, and the average acre treatment objectives proposed under alternative D provide less movement towards DC than alternative A. For more information regarding dry mixed conifer vegetation structural state model run outcomes see Appendix D tables 21 through 30.

Figure 6 displays the long-term trend toward DC for all dry mixed conifer forest alternatives, based on their proposed average acre treatments. All alternatives produce reductions in departure from DC immediately, and continue to trend in movement toward DC through all modeling periods. They all move from a high to moderate departure. Overall, alternative A produces the greatest movement towards DC over the other alternatives. This is followed equally by alternatives B and C, and lastly by alternative D.

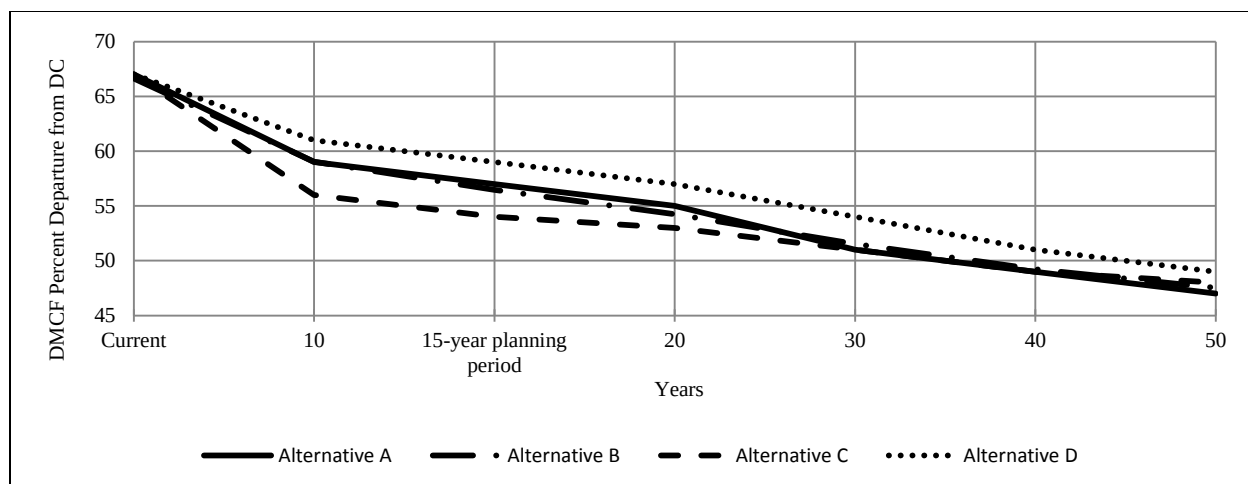


Figure 6. Overstory departure from DC trend comparisons for dry mixed conifer forest PNVT by alternative over a 50-year time period for alternative A and the average of the proposed high and low acre treatment objectives for alternatives B, C, and D

After one planning period (15 years), the proposed high acre treatment objectives under alternative C also produces the greatest movement toward HRV, from the current rating of 77 to 44 (table 56). This is a change of one departure class, from high moderate. The proposed high acre treatment objectives under alternative B produce the second greatest movement toward HRV, from the current rating of 77 to 49. This is also a change of one departure class, from high to moderate. The proposed average acre treatment objectives under alternative C produce the third greatest movement toward HRV, from the current rating of 77 to 51. This also lowers its high departure rating. The low acre treatment objectives proposed under each of the action alternatives, and the average acre treatment objectives proposed under alternative D provide less movement towards HRV than alternative A.

Figure 7 displays the long-term trend toward HRV for all dry mixed conifer forest alternatives, based on their proposed average acre treatments. All alternatives produce reductions in departure from HRV immediately, and continue to trend in movement toward HRV through all modeling periods. They all move from a high to moderate departure rating. Overall, alternative B produces the greatest movement towards HRV over the other alternatives.

In summary, for a complete display of the tabular summations of the 15-year planning period and the 50-year modeling period comparisons of the environmental consequences to the vegetation indicators between the proposed high, average, and low acre treatment objectives for alternatives B, C, and D, and alternative A see Appendix G tables 1 through 6, and Appendix H tables 1 through 6, for comparisons of the percent departures from DC and HRV by the end of the 15-year planning period and the 50-year modeling period, by alternative proposed high, average, and low acre treatment objectives and alternative A), for the proposed high acre treatment objectives, by the end of the 15-year planning period, alternative C does more to address the threats and risks when assessing movement towards both DC and HRV, followed by alternative B, then D, and lastly A. However, by the end of the 50-year modeling period, alternative B does more to address the threats and risks when assessing movement toward DC and HRV, followed by alternative A, then D, and lastly C.

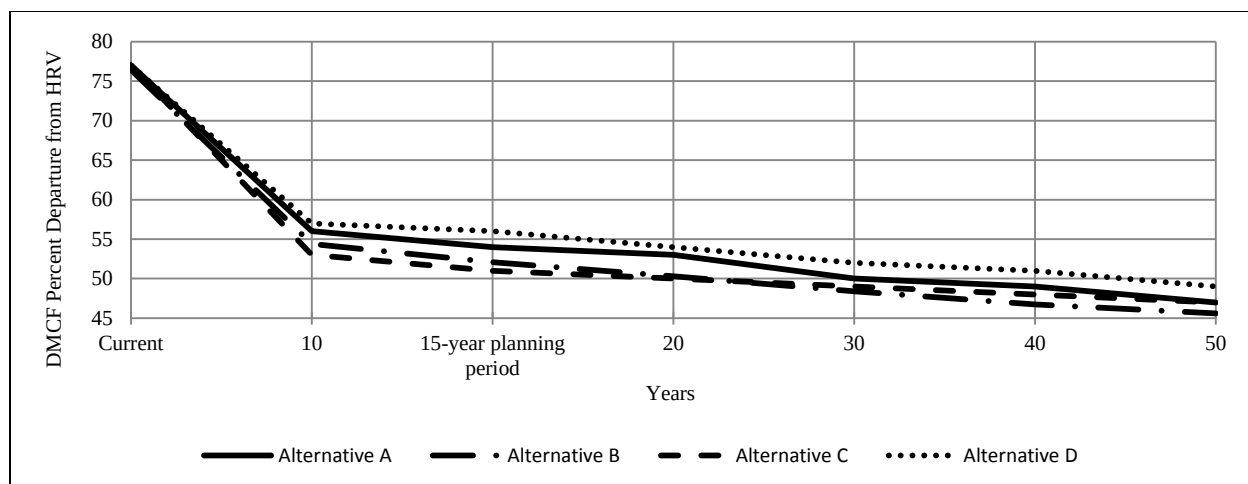


Figure 7. Overstory departure from HRV trend comparisons for dry mixed conifer forest PNVT by alternative over a 50-year time period for alternative A and the average of the proposed high and low acre treatment objectives for alternatives B, C, and D

For the proposed average acre treatment objectives, by the end of the 15-year planning period, alternative C does more to address the threats and risks when assessing movement towards both DC and HRV, followed by alternative B, then A, and lastly D. However, by the end of the 50-year modeling period, alternative A does more to address the threats and risks when assessing movement toward DC followed by alternative B, then C, and lastly D. In addition, by the end of the 50-year modeling period, alternative A also does more to address the threats and risks when assessing movement toward HRV, but followed by the equally rated alternatives B and D, and lastly C.

For the proposed low acre treatment objectives, by the end of the 15-year planning period, alternative A does more to address the threats and risks when assessing movement toward DC followed by the equally rated alternatives C and D, and lastly B. In addition, by the end of the 15-year planning period, alternative A also does more to address the threats and risks but when assessing movement toward HRV, but followed by alternative D, then B, and lastly C. Furthermore, by the end of the 50-year modeling period, alternative A also does more to address the threats and risks when assessing movement towards both DC and HRV, followed by alternative B, then C, and lastly D.

Large/Old Trees, Snags and Coarse Woody Debris

Large/Old Trees: By the end of the 15-year planning period, none of the alternatives would achieve the DCs for number of acres of large/old tree retention (table 57). However, the proposed high acre treatment objectives under alternatives D would provide the greatest movement toward DCs. This is followed by alternative C proposed high acre treatment objectives, alternative B proposed high acre treatment objectives, alternative B proposed average acre treatment objectives, alternative C proposed average acre treatment objectives, alternative D proposed average acre treatment objectives, alternative A, alternative B proposed low acre treatment objectives, alternative C proposed low acre treatment objectives, and lastly, alternative D proposed low acre treatment objectives. By the end of the 50-year modeling period, none of the alternatives would achieve the DCs for number of acres of large/old tree retention. However, the proposed high acre treatment objectives under alternatives B would provide the greatest movement toward DCs. This is followed by alternative D proposed high acre treatment objectives, alternative C proposed high acre treatment objectives, alternative B proposed average acre treatment objectives, alternative D proposed average acre treatment objectives, alternative C proposed average acre treatment objectives, alternative B proposed low acre treatment objectives, alternative A, alternative C proposed low acre treatment objectives, and lastly, alternative D proposed low acre treatment objectives.

Snags (18 inches or larger DBH): By the end of the 15-year planning period, none of the alternatives would achieve the DCs for the number of snags 18 inches or greater DBH per acre (table 57). However, the low acre treatment objectives proposed under alternatives D would provide the greatest movement toward DCs. This is followed by alternative C proposed low acre treatment objectives, alternative D proposed average acre treatment objectives and alternative B proposed low acre treatment objectives, alternative C proposed average acre treatment objectives, alternative A, alternative B proposed average acre treatment objectives, alternative D proposed high acre treatment objectives, and lastly, alternative B proposed high acre treatment objectives. By the end of the 50-year modeling period, all alternatives are even further departed from DCs than they were at the end of the 15-year planning period.

Table 57. Acres of large/old trees, number of snags greater than 18 inch diameter at breast height (DBH) per acre, and tons of the three size classes of coarse woody debris per acre by the end of the 15-year planning period and the 50-year modeling period within the dry mixed conifer forest PNVF for the proposed high, low and average treatment objectives for alters B, C and D, and alternative A

Alternative	Acres of Large/Old Trees dry mixed conifer forest vegetation structural states E, I, K, M	Across All Dry Mixed Conifer Forest Vegetation Structural States					
		number of snags/acre		tons of coarse woody debris/acre			total
		DBH		DBH			
		5" - 17.9"	≥ 18"	≤ 3"	> 3" & ≤ 12"	> 12"	
<i>Desired Condition</i>	84,295	<i>non-defined¹</i>	<i>average 3</i>	<i>range from 5 - 15</i>			
<i>Current Condition</i>	17,618	19.9	4.9	10.1	10.5	5.4	26.0
15- year Planning Period							
Alternative A	30,071	21.9	7.9	7.3	11.5	6.3	25.2
B High Treatment	34,905	21.5	8.3	7.0	10.9	6.0	23.9
B Average Treatment	32,618	21.7	8.1	7.3	11.3	6.3	24.9
B Low Treatment	29,606	21.9	7.9	7.5	11.8	6.6	25.9
C High Treatment	36,116	20.4	8.4	6.8	10.4	5.7	22.9
C Average Treatment	31,648	20.9	8.0	7.2	11.2	6.2	24.6
C Low Treatment	27,179	21.5	7.5	7.6	12.0	6.7	26.3
D High Treatment	36,995	20.2	8.2	7.2	11.6	6.6	25.4
D Average Treatment	31,598	20.8	7.7	7.4	11.8	6.6	25.9
D Low Treatment	26,201	21.4	7.3	7.6	12.0	6.7	26.3
50-year Modeling Period							
Alternative A	45,736	23.8	9.6	7.6	11.7	6.6	25.9
B High Treatment	55,479	23.9	10.5	7.4	11.3	6.3	25.1
B Average Treatment	50,623	23.8	10.1	7.7	11.8	6.6	26.0
B Low Treatment	45,767	23.7	9.7	7.9	12.2	7.0	27.0
C High Treatment	50,934	22.4	10.1	7.3	11.0	6.1	24.4
C Average Treatment	47,074	22.6	9.6	7.7	11.8	6.7	26.1
C Low Treatment	43,214	22.8	9.1	8.1	12.6	7.2	27.9
D High Treatment	54,132	23.1	10.0	7.5	12.0	6.8	26.4
D Average Treatment	47,985	23.0	9.5	7.8	12.4	7.1	27.3
D Low Treatment	41,838	22.9	9.0	8.1	12.8	7.4	28.3

¹ Proposed Forest Plan desired conditions for dry mixed conifer forest do not specify any DCs for this size class of snags; data is provide for additional information only

Coarse Woody Debris: By the end of the 15-year planning period, none of the alternatives would achieve the DCs for the amount of coarse woody debris per acre (table 57). However, the proposed high acre treatment objectives under alternatives B would provide the greatest movement toward DCs. This is followed by alternative C proposed high acre treatment objectives, alternative C proposed average acre treatment objectives, alternative B proposed average acre treatment objectives, alternative A, alternative D proposed high acre treatment objectives, equally by alternative B proposed low acre treatment objectives and alternative D proposed average acre treatment objectives, and lastly, equally by alternative C proposed low acre treatment objectives and alternative D proposed low acre treatment objectives. By the end of the 50-year modeling period, all alternatives are even further departed from DCs than they

were at the end of the 15-year planning period.

In summary, for a complete display of the tabular summations of the 15-year planning period and 50-year modeling period comparisons of the environmental consequences to the vegetation indicators between the proposed high, average, and low acre treatment objectives for alternatives B, C, and D, and alternative A see Appendix G tables 1 through 6, for the proposed high acre treatment objectives, by the end of the 15-year planning period, alternative D does more, when assessing movement toward DC for acres of large/old trees per acre, followed by alternative C, then B, and lastly A. However, by the end of the 50-year modeling period, alternative B does more, when assessing movement toward DC for acres of large/old trees per acre, followed by alternative D, then C, and lastly A. By the end of the 15-year planning period and the 50-year modeling period, alternative A does more, when assessing movement toward DC for number of large snags per acre, followed by alternative D, then C, and lastly B. By the end of the 15-year planning period, alternative B does more, when assessing movement toward DC for tons of coarse woody debris per acre, followed by alternative C, then A, and lastly D. However, by the end of the 50-year modeling period, alternative C does more, when assessing movement toward DC for tons of coarse woody debris per acre, followed by alternative B, then A, and lastly D.

For the proposed average acre treatment objectives, by the end of the 15-year planning period, alternative B does more, when assessing movement toward DC for acres of large/old trees per acre, followed by alternative C, then D, and lastly A. In addition, by the end of the 50-year modeling period, alternative B also does more, when assessing movement toward DC for acres of large/old trees per acre, but followed by alternative D, then C, and lastly A. By the end of the 15-year planning period and the 50-year modeling period, alternative D does more, when assessing movement toward DC, for number of large snags per acre, followed by the equally rated alternatives A and C, and lastly B. By the end of the 15-year planning period, alternative C does more, when assessing movement toward DC for tons of coarse woody debris per acre, followed by alternative B, then A, and lastly D. However, by the end of the 50-year modeling period, alternative A does more, when assessing movement toward DC for tons of coarse woody debris per acre, followed by alternative B, then C, and lastly D.

For the proposed low acre treatment objectives, by the end of the 15-year planning period, alternative A does more, when assessing movement toward DC for acres of large/old trees per acre, followed by alternative B, then C, and lastly D. However, by the end of the 50-year modeling period, alternative B does more, when assessing movement toward DC for acres of large/old trees per acre, followed by alternative A, then C, and lastly D. By the end of the 15-year planning period, alternative D does more, when assessing movement toward DC for number of large snags per acre, followed by alternative C, then B, and lastly D. In addition, by the end of the 50-year modeling period, alternative D also does more, when assessing movement toward DC for number of large snags per acre, but followed by alternative C, then A, and lastly B. By the end of the 15-year planning period, alternative A does more, when assessing movement toward DC for tons of coarse woody debris per acre, followed by alternative B, and lastly by the equally rated alternatives C and D. In addition, by the end of the 50-year modeling period, alternative A also does more, when assessing movement toward DC for tons of coarse woody debris per acre, but followed by alternative B, then C, and lastly D.

Spruce-fir forest:

Table 58 presents the proposed treatment objectives within the spruce-fir forest PNVt by alternative.

After one planning period (15 years), all four alternatives produce trends moving away from DC and change one departure class, from moderate to high (table 59). Within the planning cycle no alternative produces a reduction in the representation of vegetation structural states that are lacking aspen

regeneration (combined values of vegetation structural states K, L, M, N, O, and Q), or an increase in representation of medium to very large size, single or multi-storied trees with open canopy cover (combined values of vegetation structural states E and F). In addition, there is no reduction in overstory canopy cover to favor aspen and mixed-shade tolerant species, including the herbaceous understory vegetation; however, this is inappropriate for later seral states of this PNV. This forest type is supposed to be dense with closed canopy. Aspen is only dominant following high severity disturbances in the early seral conditions.

Table 58. Proposed annual vegetation overstory treatment objectives within the spruce-fir forest PNV (see Appendix F tables 1 through 8 for a more complete description of the individual treatments and the annual acres of each proposed treatment objective by PNV for alternatives B, C and D, and alternative A)

Alternative	High Acre Treatment Objectives		Low Acre Treatment Objectives		Average Acre Treatment Objectives		Alternative A Treatment Acres	
	mechanical	prescribed fire	mechanical	prescribed fire	mechanical	prescribed fire	mechanical	prescribed fire
A	-	-	-	-			108	100
B	95	606	14	87	55	347	-	-
C	208	892	16	93	112	493	-	-
D	36	964	6	145	21	555	-	-

Vegetation Outcome

However, of all of the alternatives, the proposed high acre treatment objectives under alternative C produce the smallest increase in departure, from the current rating of 59 to 63. The proposed high acre treatment objectives under alternatives B and D produce the next smallest increase, from the current rating of 59 to 64. The average acre treatment objectives under alternatives A and the proposed low acre treatment objectives in alternative B produce the greatest departure, from the current rating of 59 to 68. As mentioned earlier, these are all changes of one departure class, from moderate to high. For more information regarding spruce-fir vegetation structural state model run outcomes see Appendix D tables 31 through 40.

Table 59. Fifteen-year planning period spruce-fir forest PNV overstory departure from DC and HRV comparisons by alternative (B, C and D) for the proposed high, low and average acre treatment objectives, and alternative A; alternatives are arranged in the order of departure from DC (lowest to highest)

Alternative and Percent Acres Treated Annually (arranged from least to most departed from DC)	Percent Within Each Spruce-Fir Forest Vegetation Structural State																			Overall Departure ¹	
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	DC	HRV
<i>Desired Condition</i>	9	13	10	7	22	22	10	7	0	0	0	0	0	0	0	0	0	0	0	0 ^N	-
<i>Current Conditions</i>	14	33	15	6	1	1	0	3	0	0	14	4	6	1	0	1	3	0	0	59 ^M	62 ^H
C High Treatment (7.4)	0	31	5	9	2	2	3	5	6	4	1	14	5	1	1	3	6	2	1	63 ^H	54 ^M
B High Treatment (4.2)	0	33	6	8	1	1	3	4	4	3	0	16	5	1	1	3	6	3	2	64 ^H	54 ^M
D High Treatment (4.0)	0	31	5	9	1	2	3	5	6	3	0	13	5	1	1	3	7	3	1	64 ^H	53 ^M
C Average (4.1)	0	32	6	7	1	1	3	4	4	3	0	18	5	1	1	3	6	2	1	65 ^H	55 ^M
D Average (2.2)	0	33	6	7	1	1	3	4	4	2	0	17	5	0	1	3	7	2	1	65 ^H	55 ^M
B Average (2.1)	0	34	6	6	1	1	3	4	4	2	0	19	5	1	1	3	6	3	1	66 ^H	55 ^M
C Low Treatment (0.7)	0	34	7	5	1	1	2	3	3	2	0	22	6	0	1	3	6	2	1	67 ^H	57 ^M
D Low Treatment (0.4)	0	35	7	5	1	1	2	3	3	2	0	21	5	0	1	2	6	2	1	67 ^H	56 ^M
Alternative A (1.2)	0	40	12	6	2	1	4	1	1	0	1	13	5	2	2	7	3	2	0	68 ^H	58 ^M
B Low Treatment (2.5)	0	35	7	5	1	1	2	3	3	2	0	22	5	1	1	3	6	3	1	68 ^H	56 ^M

¹ Departure from DC and HRV Ratings: (0-20% = no departure^N); (21-40% = low departure^L); (41-60% = moderate departure^M); (61-80% = high departure^H); and (81-100% = severe departure^S)

Figure 8 displays the long-term trend in relation to DC for all spruce-fir forest alternatives, based on their proposed average acre treatments. At first, all alternatives produce increases in departure from DC immediately; however, at year 10 the trend reverses and all alternatives begin trending toward DC

throughout all modeling periods. At the end of the modeling period (50 years), Alternative D produces the greatest movement toward DC. By the end of the modeling period all alternatives have move from a moderate to a high departure rating.

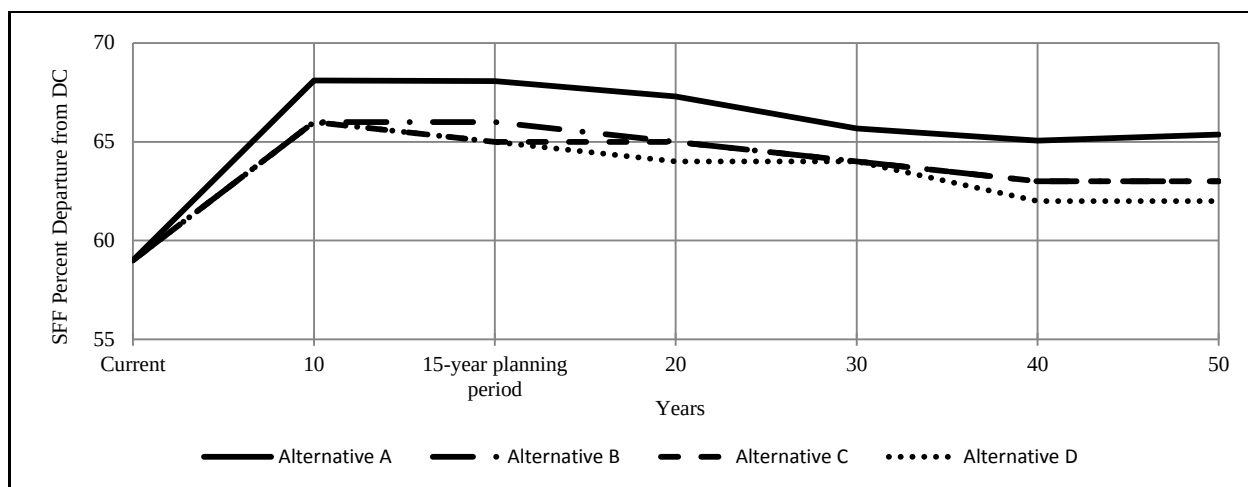


Figure 8. Overstory departure from DC trend comparisons for spruce-fir forest PNVT by alternative over a 50-year time period for alternative A and the average of the proposed high and low acre treatment objectives for alternatives B, C, and D

After one planning period (15 years), the proposed high acre treatment objectives under alternative D produces the greatest movement toward HRV, from the current rating of 62 to 53 (table 59). This is a change of one departure class, from high moderate. The proposed high acre treatment objectives under alternatives B and C produce the second greatest movement toward HRV, from their current rating of 77 to 54. This is also a change of one departure class, from high to moderate. The proposed low acre treatment objectives under alternative C and the treatment objectives in alternative A produce the least movement toward HRV, from the current rating of 62 to 57 and 58, respectively. However, this lowers their high departure ratings to moderate.

Figure 9 displays the long-term trend toward HRV for all spruce-fir forest alternatives, based on their proposed average acre treatments. All alternatives produce reductions in departure from HRV immediately, and continue to trend in movement toward HRV through all modeling periods. They all move from a high to moderate departure. Overall, alternatives B, C, and D produce the greatest movement towards HRV over alternative A, however all the action alternatives differ by only one percentage point.

In summary, for a complete display of the tabular summations of the 15-year planning period and the 50-year modeling period comparisons of the environmental consequences to the vegetation indicators between the proposed high, average, and low acre treatment objectives for alternatives B, C, and D, and alternative A see Appendix G tables 1 through 6, and Appendix H tables 1 through 6, for comparisons of the percent departures from DC and HRV by the end of the 15-year planning period and the 50-year modeling period, by alternative proposed high, average, and low acre treatment objectives and alternative A), for the proposed high acre treatment objectives, by the end of the 15-year planning period, alternative C does more to address the threats and risks when assessing movement toward DC, followed by the equally rated alternatives B and D, and lastly A. However, by the end of the 15-year planning period, alternative D does more to address the threats and risks when assessing movement toward HRV, followed by the equally rated alternatives B and C, and lastly A. By the end of the 50-year modeling period, the equally rated alternatives C and D do more to address the threats and risks when assessing movement toward DC, followed by alternative B, and lastly A. However, by the end of the 50-year modeling period,

alternative C does more to address the threats and risks when assessing movement toward HRV, followed by the equally rated alternatives B and D, lastly A.

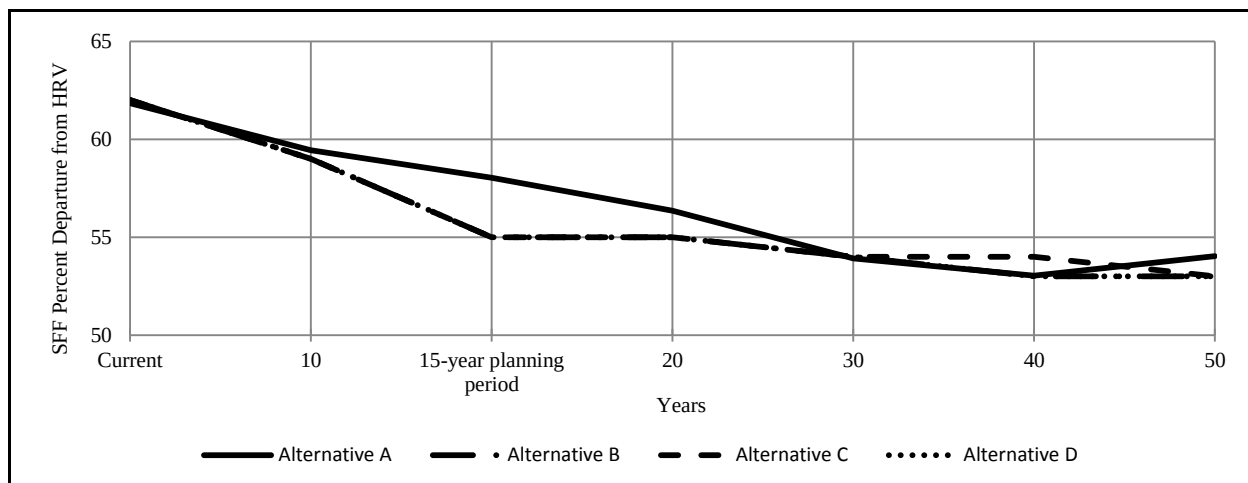


Figure 9. Overstory departure from HRV trend comparisons for spruce-fir forest PNVT by alternative over a 50-year time period for alternative A and the average of the proposed high and low acre treatment objectives for alternatives B, C, and D

For the proposed average acre treatment objectives, by the end of the 15-year planning period, the equally rated alternatives C and D do more to address the threats and risks when assessing movement toward DC, followed by alternative B, and lastly A. However, by the end of the 15-year planning period, the equally rated alternatives B, C, and D equally do more to address the threats and risks when assessing movement toward HRV, followed by alternative A. By the end of the 50-year modeling period, alternative D does more to address the threats and risks when assessing movement toward DC, followed by the equally rated alternatives B and C, and lastly A. However, by the end of the 50-year modeling period, the equally rated alternatives B, C, and D do more to address the threats and risks when assessing movement toward HRV, followed by alternative A.

For the proposed low acre treatment objectives, by the end of the 15-year planning period, the equally rated alternatives C and D do more to address the threats and risks when assessing movement toward DC, followed by alternative A, and lastly B. However, by the end of the 15-year planning period, the equally rated alternatives B and D do more to address the threats and risks when assessing movement toward HRV, followed by alternative C, and lastly A. By the end of the 50-year modeling period, alternative D does more to address the threats and risks when assessing movement toward DC, followed by the equally rated alternatives A and B, and lastly C. However, by the end of the 50-year modeling period, the equally rated alternatives B and C do more to address the threats and risks when assessing movement toward HRV, followed by the equally rated alternatives A and D.

Large/Old Trees, Snags and Coarse Woody Debris

Large/Old Trees: By the end of the 15-year planning period, none of the alternatives would achieve the DCs for number of acres of large/old tree retention (table 60). However, the proposed high acre treatment objectives under alternatives D would provide the greatest movement toward DCs. This is followed by alternative C proposed high acre treatment objectives, alternative B proposed high acre treatment objectives, alternative D proposed average acre treatment objectives, alternative C proposed average acre treatment objectives, alternative B proposed average acre treatment objectives, alternative A, alternative D proposed low acre treatment objectives, alternative B proposed low acre treatment objectives, and lastly, alternative C proposed low acre treatment objectives. By the end of the 50-year modeling period,

four alternatives' proposed acre treatment objectives would achieve the DCs. They are: alternatives B, C, and D high acre treatment objectives, and alternative D average acre treatment objectives. These are followed by alternative C proposed average acre treatment objectives, alternative B proposed average acre treatment objectives, alternative D proposed low acre treatment objectives, alternative C proposed low acre treatment objectives, alternative A, and lastly, alternative D proposed low acre treatment objectives.

Table 60. Acres of large/old trees, number of snags greater than 18 inch diameter at breast height (DBH) per acre, and tons of the three size classes of coarse woody debris per acre by the end of the 15-year planning period and the 50-year modeling period within the spruce-fir forest PNVF for the proposed high, low and average treatment objectives for alters B, C and D, and alternative A

Alternative	Acres of Large/Old Trees spruce-fir forest vegetation structural states E, F, I, J, N, O, R, S	Across All Spruce-Fir Forest Vegetation Structural States					total
		number of snags/acre		tons of coarse woody debris/acre			
		DBH		DBH			
		5" - 17.9"	≥ 18"	≤ 3"	> 3" & ≤ 12"	> 12"	
<i>Desired Condition</i>	7,067	13 - 30 ¹	1 - 3	<i>range from 5 - 40</i>			
<i>Current Condition</i>	1,829	24.7	8.4	10.1	20.7	7.4	38.2
15-year Planning Period							
Alternative A	3,660	32.6	13.1	12.8	25.4	11.4	49.7
B High Treatment	4,344	32.9	14.6	13.2	26.5	12.4	52.1
B Average Treatment	3,970	32.7	13.8	13.0	25.9	11.9	50.7
B Low Treatment	3,596	32.6	12.9	12.8	25.3	11.3	49.5
C High Treatment	4,525	32.9	15.1	13.2	26.7	12.8	52.6
C Average Treatment	4,029	32.7	14.1	13.0	26.0	12.0	51.0
C Low Treatment	3,533	32.6	13.0	12.7	25.3	11.3	49.4
D High Treatment	4,587	32.7	15.2	13.3	26.9	12.8	53.0
D Average Treatment	4,090	32.5	14.1	13.0	26.1	12.1	51.2
D Low Treatment	3,593	32.3	13.1	12.7	25.4	11.4	49.5
50-year modeling Period							
Alternative A	5,723	30.7	17.4	14.2	28.5	14.4	57.1
B High Treatment	7,599	29.3	21.1	15.5	31.2	17.1	63.8
B Average Treatment	6,655	30.0	19.3	14.8	29.9	15.7	60.4
B Low Treatment	5,712	30.6	17.4	14.2	28.5	14.3	57.0
C High Treatment	8,133	29.0	22.4	15.9	32.1	18.0	66.0
C Average Treatment	6,928	29.8	19.9	15.0	30.3	16.2	61.5
C Low Treatment	5,724	30.5	17.5	14.2	28.5	14.4	57.1
D High Treatment	8,619	28.4	23.1	16.1	32.6	18.6	67.3
D Average Treatment	7,316	29.4	20.5	15.2	30.7	16.6	62.6
D Low Treatment	6,017	30.4	17.8	14.4	28.8	14.6	57.8

¹ Proposed Forest Plan mid-scale DCs (100 to 1,000 acres) for spruce-fir forest are for 13 - 30 snags > 8" in DBH per acre. Available data ranges from "small" (> 5" and ≤ 10" DBH), "large" (> 10" and ≤ 18" DBH), and "extra-large" (> 18" DBH): so there is no way to examine exactly how many 8" or greater diameter snags per acre there are currently, or would be under the proposed high, low and average acre treatments objectives by the end of the 15-year planning period or the 50-year modeling period). Data is provide for additional information only

Snags (18 inches or larger DBH): By the end of the 15-year planning period, none of the alternatives would achieve the DCs for number of snags 18 inches or greater DBH per acre (table 60). However, the low acre treatment objectives proposed under alternative B provides the greatest movement toward DCs. This is followed by alternative C proposed low acre treatment objectives, alternative A and alternative D proposed low acre treatment objectives, alternative B proposed average acre treatment objectives, alternative C proposed average acre treatment objectives, alternative D proposed average acre treatment objectives, alternative B proposed high acre treatment objectives, alternative C proposed high acre treatment objectives, and lastly alternative D proposed high acre treatment objectives. By the end of the 50-year modeling period, all alternatives are even further departed from DCs than they were at the end of the 15-year planning period.

Coarse Woody Debris: By the end of the 15-year planning period, only the proposed high acre treatment objectives under alternatives D would achieve DCs for the amount of coarse woody debris per acre (table 60). This is followed by alternative C proposed low acre treatment objectives, alternative B proposed low acre treatment objectives, alternative D proposed low acre treatment objectives, alternative A, alternative B proposed acreage acre treatment objectives, alternative C proposed acreage acre treatment objectives, alternative D proposed acreage acre treatment objectives, alternative B proposed high acre treatment objectives, and lastly, alternative C proposed high acre treatment objectives. By the end of the 50-year modeling period, all alternatives are even further departed from DCs for the amount of coarse woody debris per acre than they were at the end of the 15-year planning period.

In summary, for a complete display of the tabular summations of the 15-year planning period and 50-year modeling period comparisons of the environmental consequences to the vegetation indicators between the proposed high, average, and low acre treatment objectives for alternatives B, C, and D, and alternative A see Appendix G tables 1 through 6, for the proposed high acre treatment objectives, by the end of the 15-year planning period, alternative D does more, when assessing movement toward DC for acres of large/old trees per acre, followed by alternative C, then B, and lastly A. However, by the end of the 50-year modeling period, the equally rated alternatives B, C and D do more, when assessing movement toward DC for acres of large/old trees per acre, followed by alternative A. By the end of the 15-year planning period and 50-year modeling period, alternative A does more, when assessing movement toward DC for number of large snags per acre, followed by alternative B, then C, and lastly D. By the end of the 15-year planning period, alternative D does more, when assessing movement toward DC for tons of coarse woody debris per acre, followed by alternative A, then B, and lastly C. However, by the end of the 50-year modeling period, alternative A does more, when assessing movement toward DC for tons of coarse woody debris per acre, followed by alternative B, then C, and lastly D.

For the proposed average acre treatment objectives, by the end of the 15-year planning period and 50-year modeling period, alternative D does more, when assessing movement toward DC for acres of large/old trees per acre, followed by alternative C, then B, and lastly A. By the end of the 15-year planning period and 50-year modeling period, alternative A does more, when assessing movement toward DC for number of large snags per acre, followed by alternative B, then C, and lastly A. By the end of the 15-year planning period and 50-year modeling period, alternative A does more, when assessing movement toward DC for tons of coarse woody debris per acre, followed by alternative B, then C, and lastly D.

For the proposed low acre treatment objectives, by the end of the 15-year planning period, alternative A does more, when assessing movement toward DC for acres of large/old trees per acre, followed by alternative B, then D, and lastly C. However, by the end of the 50-year modeling period, alternative D does more, when assessing movement toward DC for acres of large/old trees per acre, followed by alternative C, then A, and lastly B. By the end of the 15-year planning period, alternative B does more, when assessing movement toward DC for number of large snags per acre, followed by alternative C, and lastly, by the equally rated alternatives A and D. However, by the end of the 50-year modeling period, the equally rated alternatives A and B do more, when assessing movement toward DC for the number of large snags per acre, but followed by alternative C, and lastly D. By the end of the 15-year planning period, alternative C does more, when assessing movement toward DC for tons of coarse woody debris per acre, followed by alternative B, then D, and lastly A. However, by the end of the 50-year modeling period, alternative B does more, when assessing movement toward DC, for tons of coarse woody debris per acre, followed by the equally rated alternatives A and C, and lastly D.

Forested PNVs: Figure 10 displays the summary of long-term trends in relation to DC for the collective forested PNVs under all alternatives, modeled in VDDT, based on their proposed average acre treatments. All action alternatives produce reductions in departure from DC immediately and continue across all modeling periods. Alternative C produces the greatest movement towards DC by the end of the

planning period. However, by the end of the 50 year modeling period, alternatives A produce the greatest movement towards DC; however, all alternatives are within four percentage points of one another.

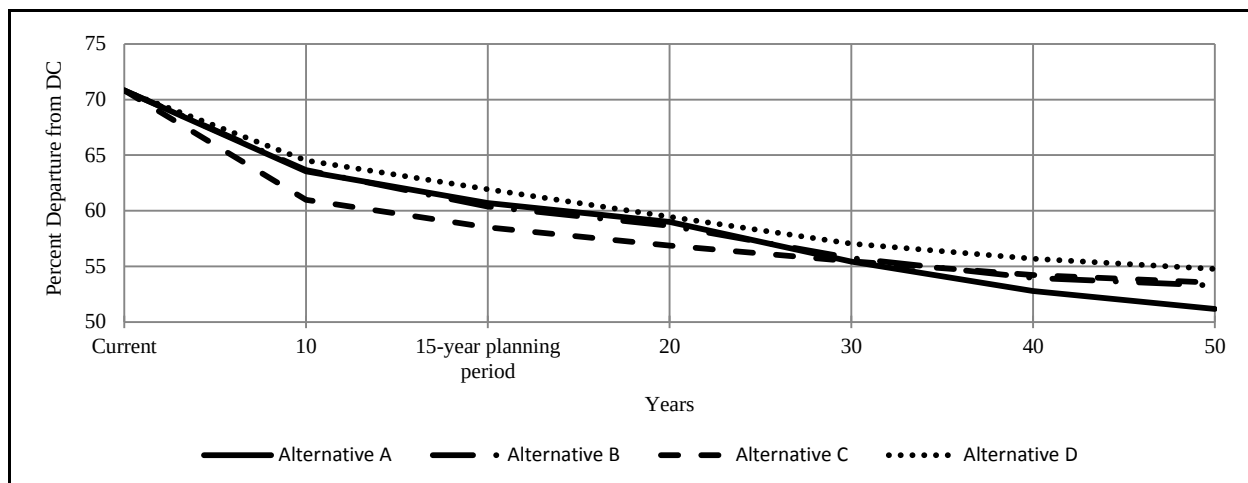


Figure 10. Overstory departure from DC trend comparisons for all forested PNVs by alternative over a 50-year time period for alternative A and the average of the proposed high and low acre treatment objectives for alternatives B, C, and D

Figure 11 displays the summary of long-term trends in relation to HRV for the collective forest PNVs under all alternatives, modeled in VDDT, based on their proposed average acre treatments. All alternatives produce reductions in departure from HRV immediately and continue across all modeling periods. Alternative C produces the greatest movement towards HRV by the end of the planning period. By the end of the 50-year modeling period, alternative D produces the greatest movement towards HRV.

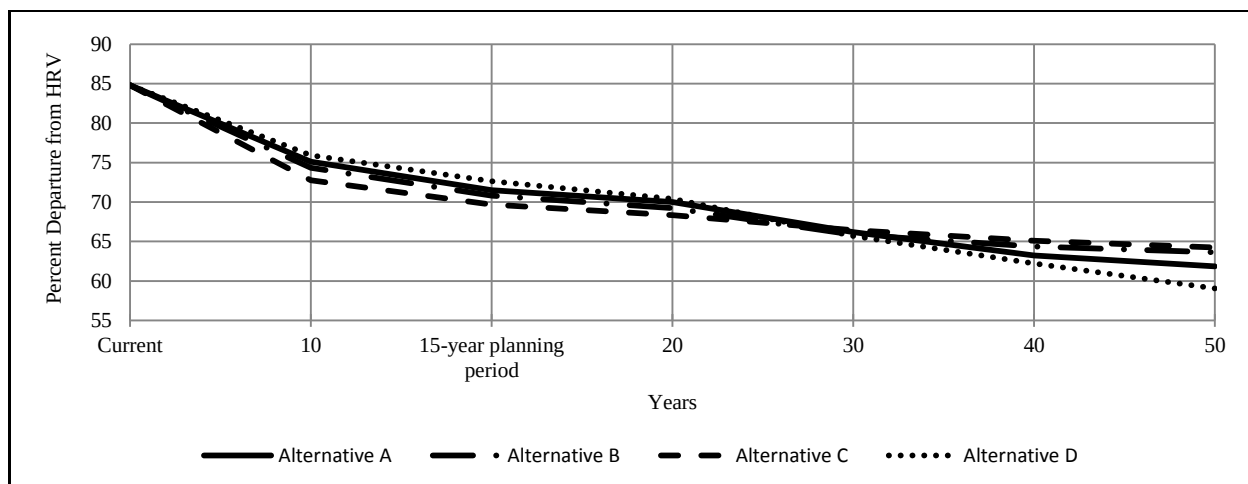


Figure 11. Overstory departure from HRV trend comparisons for all forest PNVs by alternative over a 50-year time period for alternative A and the average of the proposed high and low acre treatment objectives for alternatives B, C, and D

In summary, for a complete display of the tabular summations of the 15-year planning period and the 50-year modeling period comparisons of the environmental consequences to the vegetation indicators between the proposed high, average, and low acre treatment objectives for alternatives B, C, and D, and alternative A see Appendix G tables 1 through 6, and Appendix H tables 1 through 6, for comparisons of the percent departures from DC and HRV by the end of the 15-year planning period and the 50-year modeling period, by alternative proposed high, average, and low acre treatment objectives and alternative

A), for the proposed high acre treatment objectives, by the end of the 15-year planning period, alternative C does more to address the threats and risks when assessing movement toward DC, followed by alternative B, then A, and lastly D. In addition, by the end of the 15-year planning period, alternative C does more to address the threats and risks when assessing movement toward HRV, but followed by the equally rated alternatives A and B, and lastly D. By the end of the 50-year modeling period, alternative A does more to address the threats and risks when assessing movement toward DC, followed by alternative B, then C, and lastly D. However, by the end of the 50-year modeling period, alternative D does more to address the threats and risks when assessing movement toward HRV, followed by alternative A, and lastly, by the equally rated alternatives B and C.

For the proposed average acre treatment objectives, by the end of the 15-year planning period, alternative C does more to address the threats and risks when assessing movement toward DC, followed by alternative B, then A, and lastly D. In addition, by the end of the 15-year planning period, alternative C also does more to address the threats and risks when assessing movement toward HRV, but followed by the equally rated alternatives A and B, and lastly D. By the end of the 50-year modeling period, alternative A does more to address the threats and risks when assessing movement toward DC, followed by alternative B, then C, and lastly D. However, by the end of the 50-year modeling period, alternative D does more to address the threats and risks when assessing movement toward HRV, followed by alternative A, and lastly by the equally rated alternatives B and C.

For the proposed low acre treatment objectives, by the end of the 15-year planning period, alternatives C does more to address the threats and risks when assessing movement toward DC, followed by alternative B, then A, and lastly D. In addition, by the end of the 15-year planning period, alternatives C also does more to address the threats and risks when assessing movement toward HRV, but followed by the equally rated alternatives A and B, and lastly D. By the end of the 50-year modeling period, alternative A does more to address the threats and risks when assessing movement toward DC, followed by alternative B, then C, and lastly D. By the end of the 50-year modeling period, alternatives D does more to address the threats and risks when assessing movement toward HRV, followed by alternative A, and lastly, by the equally rated alternatives B and C.

Woodland PNVTs

Madrean pine-oak woodland:

Table 61 presents the proposed treatment objectives within the Madrean pine-oak woodland PNVT by alternative.

Table 61. Proposed annual vegetation overstory treatment objectives within the Madrean pine-oak woodland PNVT(see Appendix F tables 9 through 16 for a more complete description of the individual treatments and the annual acres of each proposed treatment objective by PNVT for alternatives B, C and D, and alternative A)

Alternative	High Acre Treatment Objectives		Low Acre Treatment Objectives		Average Acre Treatment Objectives		Alternative A Treatment Acres	
	mechanical	prescribed fire	mechanical	prescribed fire	mechanical	prescribed fire	mechanical	prescribed fire
A	-	-	-	-	-	-	0	1,063
B	0	11,143	0	3,714	0	7,429	-	-
C	0	5,000	0	1,250	0	3,125	-	-
D	0	22,335	0	3,722	0	13,029	-	-

Vegetation Outcome

After one planning cycle, the proposed high acre treatment objectives under alternative D produce the greatest movement toward DC, from the current rating of 61 to 28 (table 62). This is a change of two departure classes, from high to low. Under this alternative there is the greatest overall increase in the representation of seedling, saplings, small, and medium to very large size, single or multi-storied trees with open canopy cover (vegetation structural states B, C, and D). And the greatest reduction in closed canopy structural states (vegetation structural states F and G). Reduction in overstory canopy cover will favor shade intolerant and very shade intolerant species, including the herbaceous understory vegetation.

Table 62. Fifteen-year planning period Madrean pine-oak woodland PNV overstory departure from DC and HRV comparisons by alternative (B, C and D) for the proposed high, low and average acre treatment objectives, and alternative A; alternatives are arranged in the order of departure from DC (lowest to highest)

Alternative and Percent Acres Treated Annually (arranged from least to most departed from DC)	Percent Within Each Madrean Pine-Oak Woodland Vegetation Structural State							Overall Departure ¹	
	A	B	C	D	E	F	G	DC	HRV
<i>Desired Condition</i>	4	3	13	60	3	3	15	0 ^N	-
<i>Current Conditions</i>	5	0	9	7	1	44	33	61 ^H	72 ^H
D High Treatment (5.6)	6	2	14	34	1	17	26	28 ^L	38 ^L
B High Treatment (2.8)	5	2	10	25	1	23	35	41 ^M	52 ^M
D Average (3.3)	5	2	10	25	1	23	35	41 ^M	51 ^M
B Average (1.9)	5	1	8	20	1	26	39	47 ^M	58 ^M
C High Treatment (1.3)	8	1	7	18	1	27	37	50 ^M	61 ^H
B Low Treatment (0.9)	4	1	6	15	1	28	44	54 ^M	65 ^H
D Low Treatment (0.9)	4	1	6	17	1	28	44	54 ^M	65 ^H
C Average (0.8)	6	1	6	16	1	29	41	55 ^M	66 ^H
Alternative A (0.3)	6	1	4	12	1	31	44	59 ^M	70 ^H
C Low Treatment (0.3)	4	1	5	13	1	31	46	59 ^M	70 ^H

¹ Departure from DC and HRV Ratings: (0-20% = no departure^N); (21-40% = low departure^L); (41-60% = moderate departure^M); (61-80% = high departure^H); and (81-100% = severe departure^S)

The proposed high acre treatment objectives under alternative B and the average acre treatment objectives under alternative D produce the second greatest movement toward DC, from their current ratings of 61 to 41. This is a change of one departure classes, from high to moderate. The treatment objectives under alternative A and the proposed low acre treatment objectives under alternative C produce the least movement toward DC, from the current rating of 61 to 59. However this does provide a change in their departure class, from high to moderate. For more information regarding Madrean pine-oak vegetation structural state model run outcomes see Appendix D tables 41 through 50.

Figure 12 displays the long-term trend in relation to DC for all Madrean pine-oak woodland alternatives, based on their average acre treatments. All action alternatives produce reductions in departure from DC immediately; however, alternative D has the greatest movement during the planning cycle and across all modeling periods (at which point it has dropped two departure classes). Alternatives B, C, and A lag behind, respectively, however, alternative B also decreases two departure classes while alternatives A and C each decrease by one departure class.

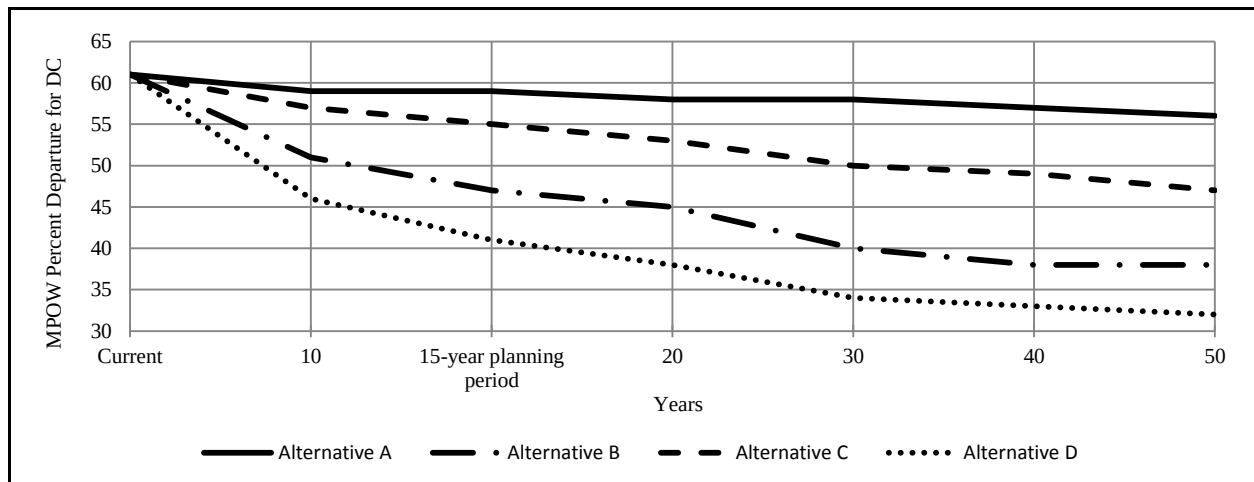


Figure 12. Overstory departure from DC trend comparisons for Madrean pine-oak woodland PNVT by alternative over a 50-year time period for alternative A and the average of the proposed high and low acre treatment objectives for alternatives B, C, and D

Figure 13 displays the long-term trend in relation to HRV for all Madrean pine-oak woodland alternatives, based on their average acre treatments. All alternatives produce reductions in departure from HRV immediately; however, alternative D has the greatest movement during the planning cycle and across all modeling periods (at which point it has dropped one departure classes. Alternatives B, C, and A lag behind, respectively, however, alternative B and C also decrease one departure classes while alternatives A remains highly departed.

In summary, for a complete display of the tabular summations of the 15-year planning period and the 50-year modeling period comparisons of the environmental consequences to the vegetation indicators between the proposed high, average, and low acre treatment objectives for alternatives B, C, and D, and alternative A see Appendix G tables 1 through 6, and Appendix H tables 1 through 6, for comparisons of the percent departures from DC and HRV by the end of the 15-year planning period and the 50-year modeling period, by alternative proposed high, average, and low acre treatment objectives and alternative A), for the proposed high acre treatment objectives, by the end of the 15-year planning period and the 50-year modeling period, alternative D does more to address the threats and risks when assessing movement towards both DC and HRV, followed by alternative B, then C, and lastly A.

For the proposed average acre treatment objectives, by the end of the 15-year planning period and the 50-year modeling period, alternative D does more to address the threats and risks when assessing movement towards both DC and HRV, followed by alternative B, then C, and lastly A.

For the proposed low acre treatment objectives, by the end of the 15-year planning period, the equally rated alternatives B and D do more to address the threats and risks when assessing movement towards both DC and HRV, followed by the equally rated alternatives A and C. In addition, by the end of the 50-year modeling period, the equally rated alternatives B and D also do more to address the threats and risks when assessing movement towards both DC and HRV, but followed by alternative C, and lastly A.

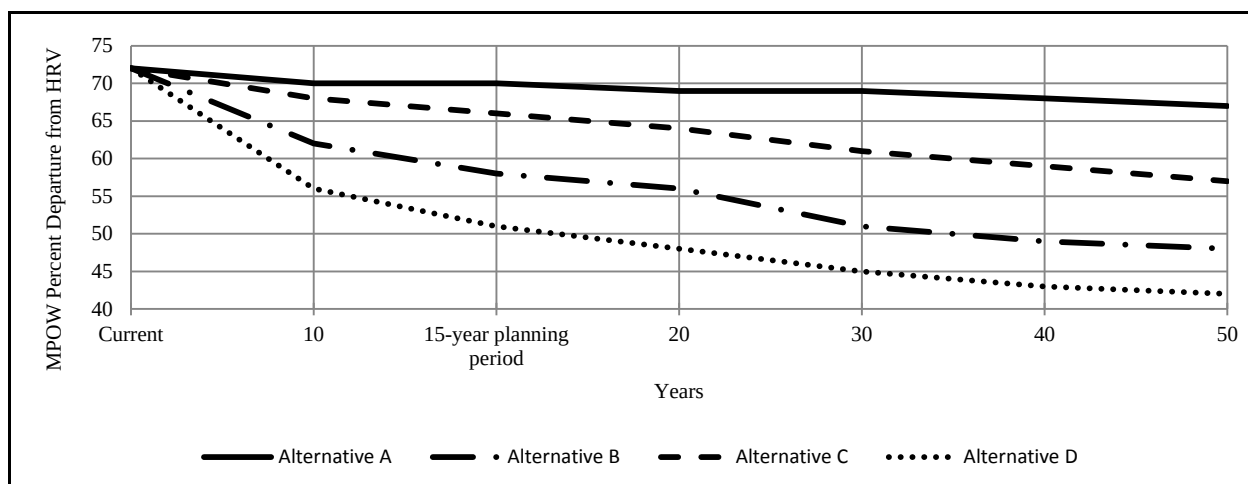


Figure 13. Overstory departure from HRV trend comparisons for Madrean pine-oak woodland PNVt by alternative over a 50-year time period for alternative A and the average of the proposed high and low acre treatment objectives for alternatives B, C, and D

Large/Old Trees, Snags and Coarse Woody Debris

Large/Old Trees: By the end of the 15-year planning period, none of the alternatives would achieve the DCs for number of acres of large/old tree retention (table 63). However, the proposed high acre treatment objectives under alternatives D would provide the greatest movement toward DCs. This is followed by alternative D proposed average acre treatment objectives, alternative D proposed low acre treatment objectives, alternative B proposed high acre treatment objectives, alternative B proposed average acre treatment objectives, alternative B proposed low acre treatment objectives, alternative C proposed low acre treatment objectives, alternative C proposed average acre treatment objectives, alternative A, and lastly, alternative C proposed high acre treatment objectives. By the end of the 50-year modeling period, none of the alternatives would achieve the DCs for number of acres of large/old tree retention (table 63). However, the proposed low acre treatment objectives under alternatives C would provide the greatest movement toward DCs. This is followed by alternative D proposed low acre treatment objectives, alternative B proposed low acre treatment objectives, alternative A, alternative B proposed average acre treatment objectives, alternative D proposed average acre treatment objectives, alternative B proposed high acre treatment objectives, alternative D proposed high acre treatment objectives, alternative C proposed average acre treatment objectives, and lastly, alternative C proposed high acre treatment objectives.

Snags (18 inches or larger DBH): By the end of the 15-year planning period, all of the alternatives would achieve the DCs for number of snags 18 inches or greater DBH per acre (table 63). By the end of the 50-year modeling period, all alternatives would continue to maintain DCs for number of snags 18 inches or greater DBH per acre.

Coarse Woody Debris: By the end of the 15-year planning period, none of the alternatives would achieve the DCs for the amount of coarse woody debris per acre (table 63). However, the proposed high acre treatment objectives under alternatives D would provide the greatest movement toward DCs. This is followed by alternative B proposed average acre treatment objectives and alternative D proposed average acre treatment objectives, alternative C proposed average acre treatment objectives, alternative B proposed high acre treatment objectives, alternative C proposed high acre treatment objectives, alternative D proposed low acre treatment objectives, alternative B proposed low acre treatment objectives, alternative C proposed low acre treatment objectives, and lastly, alternative A. By the end of the 50-year modeling period, none of the alternatives would achieve the DCs for the amount of coarse woody debris

per acre (table 63). However, the proposed high acre treatment objectives under alternatives D would provide the greatest movement toward DCs. This is followed by alternative B proposed high acre treatment objectives, alternative C proposed high acre treatment objectives and alternative D proposed average acre treatment objectives, alternative B proposed average acre treatment objectives, alternative C proposed average acre treatment objectives and alternative B proposed low acre treatment objectives and alternative D proposed low acre treatment objectives, alternative C proposed low acre treatment objectives, and lastly, alternative A.

Table 63. Acres of large/old trees, number of snags greater than 18 inch diameter at breast height (DBH) per acre, and tons of the three size classes of coarse woody debris per acre by the end of the 15-year planning period and the 50 modeling period within the Madrean pine-oak woodland PNVT for the proposed high, low and average treatment objectives for alters B, C and D, and alternative A

Alternative	Acres of Large/Old Trees Madrean pine-oak woodland vegetation structural states D, G	Across All Madrean Pine-Oak Woodland Vegetation Structural States					
		number of snags/acre		tons of coarse woody debris/acre			total
		DBH		DBH			
		5" - 17.9"	≥ 18"	≤ 3"	> 3" & ≤ 12"	> 12"	
Desired Condition	222,147	non-defined ¹	1 - 2	range from 1 - 5			
Current Condition	119,259	3.7	0.9	0.3	1.3	0.8	2.4
15- year Planning Period							
Alternative A	167,913	11.5	1.4	3.4	3.6	2.1	9.0
B High Treatment	176,473	9.6	1.3	2.8	3.0	1.8	7.6
B Average Treatment	176,088	10.4	1.4	3.1	3.2	1.9	8.2
B Low Treatment	175,703	11.3	1.4	3.3	3.5	2.1	8.9
C High Treatment	162,582	10.1	1.3	3.0	3.1	1.9	8.0
C Average Treatment	171,142	10.9	1.3	3.2	3.4	2.0	8.6
C Low Treatment	174,370	11.7	1.4	3.4	3.6	2.1	9.2
D High Treatment	178,991	8.0	1.3	2.4	2.5	1.5	6.4
D Average Treatment	178,695	9.6	1.3	2.8	3.0	1.8	7.6
D Low Treatment	178,399	11.2	1.4	3.3	3.5	2.1	8.8
50-year Modeling Period							
Alternative A	211,099	11.8	1.4	3.4	3.9	2.2	9.4
B High Treatment	204,553	8.1	1.3	2.4	2.6	1.5	6.5
B Average Treatment	208,640	9.3	1.3	2.7	3.0	1.7	7.5
B Low Treatment	212,728	10.6	1.4	3.1	3.4	2.0	8.4
C High Treatment	181,775	8.4	1.2	2.5	2.7	1.6	6.8
C Average Treatment	197,666	10.0	1.3	2.9	3.2	1.9	8.0
C Low Treatment	213,557	11.6	1.4	3.3	3.8	2.1	9.2
D High Treatment	199,932	6.4	1.2	1.9	2.0	1.2	5.2
D Average Treatment	206,700	8.4	1.3	2.5	2.7	1.6	6.8
D Low Treatment	213,468	10.5	1.4	3.0	3.4	1.9	8.4

¹ Proposed Forest Plan desired conditions for dry mixed conifer forest do not specify any DCs for this size class of snags; data is provide for additional information only

In summary, for a complete display of the tabular summations of the 15-year planning period and 50-year modeling period comparisons of the environmental consequences to the vegetation indicators between the proposed high, average, and low acre treatment objectives for alternatives B, C, and D, and alternative A see Appendix G tables 1 through 6, for the proposed high acre treatment objectives, by the end of the 15-year planning period, alternative D does more, when assessing movement toward DC for acres of large/old trees per acre, followed by alternative B, then A, and lastly C. However, by the end of the 50-year modeling period, alternative A does more, when assessing movement toward DC for acres of large/old trees per acre, followed by alternative B, then D, and lastly C. By the end of the 15-year planning period and the 50-year modeling period, all of the alternatives are rated as equal, when assessing movement toward DC for number of large snags per acre. By the end of the 15-year planning period and the 50-year modeling period, alternative D does more, when assessing movement toward DC for tons of coarse woody debris per acre, followed by alternative B, then C, and lastly A.

For the proposed average acre treatment objectives, by the end of the 15-year planning period, alternative D does more, when assessing movement toward DC for acres of large/old trees per acre, followed by alternative B, then C, and lastly A. However, by the end of the 50-year modeling period, alternative A does more, when assessing movement toward DC for acres of large/old trees per acre, followed by alternative B, then D, and lastly C. By the end of the 15-year planning period and by the end of the 50-year modeling period, all of the alternatives are rated as equal, when assessing movement toward DC for number of large snags per acre. By the end of the 15-year planning period and the 50-year modeling period, alternative D does more, when assessing movement toward DC for tons of coarse woody debris per acre, followed by alternative B, then C, and lastly A.

For the proposed low acre treatment objectives, by the end of the 15-year planning period, alternative D does more, when assessing movement toward DC for acres of large/old trees per acre, followed by alternative C, then B, and lastly A. However, by the end of the 50-year modeling period, alternative C does more, when assessing movement toward DC for acres of large/old trees per acre, followed by alternative D, then B, and lastly A. By the end of the 15-year planning period and the 50-year modeling period, all of the alternatives are rated as equal, when assessing movement toward DC for number of large snags per acre. By the end of the 15-year planning period, alternative D does more, when assessing movement toward DC for tons of coarse woody debris per acre, followed by alternative B, and lastly, by the equally rated alternatives A and C. However, by the end of the 50-year modeling period, the equally rated alternatives B and D do more, when assessing movement toward DC for tons of coarse woody debris per acre, followed by alternative C, and lastly A.

Piñon-juniper woodland:

Table 64 presents the proposed treatment objectives within the piñon-juniper woodland PNVT by alternative.

Table 64. Proposed annual vegetation overstory treatment objectives within the piñon-juniper woodland PNVT(see Appendix F tables 9 through 16 for a more complete description of the individual treatments and the annual acres of each proposed treatment objective by PNVT for alternatives B, C and D, and alternative A)

Alternative	High Acre Treatment Objectives		Low Acre Treatment Objectives		Average Acre Treatment Objectives		Alternative A Treatment Acres	
	mechanical	prescribed fire	mechanical	prescribed fire	mechanical	prescribed fire	mechanical	prescribed fire
A	-	-	-	-	-	-	500	713
B	2,341	1,412	780	470	1,561	941	-	-
C	4,213	600	1,053	150	2,633	375	-	-
D	4,042	3,443	673	575	2,358	2,009	-	-

Vegetation Outcome

After one planning period, the proposed high acre treatment objectives under alternative C produce the greatest movement toward DC, from the current rating of 26 to 18 (table 65). There is a change in departure class from low to no departure. Under this alternative there is the greatest overall increase in the representation of seedling, saplings, small, and medium to very large size, single or multi-storied trees with open canopy cover (vegetation structural states B, C, and D), and the greatest reduction in closed canopy vegetation structural state G. Reduction in overstory canopy cover will favor shade intolerant and very shade intolerant species, including the herbaceous understory vegetation.

All proposed acre treatments under alternatives B and D, and the proposed average acre treatment objectives under alternative and C produce movement toward DC, from the current rating of 26 to 19s and 20s. These are all changes in departure class from low to no departure. The treatment objectives under alternative A and the proposed low acre treatment objectives under alternative C do not change departure class.

Table 65. Fifteen-year planning period piñon-juniper woodland PNVT overstory departure from DC and HRV comparisons by alternative (B, C and D) for the proposed high, low and average acre treatment objectives, and alternative A; alternatives are arranged in the order of departure from DC (lowest to highest)

Alternative and Percent Acres Treated Annually (arranged from least to most departed from DC)	Percent Within Each Piñon-Juniper Woodland Vegetation Structural State							Overall Departure ¹	
	A	B	C	D	E	F	G	DC	HRV
<i>Desired Condition</i>	5	8	8	50	8	10	10	0 ^N	-
<i>Current Conditions</i>	7	1	1	69	1	6	15	26 ^L	26 ^L
C High Treatment (2.2)	7	5	4	54	3	6	22	18 ^N	18 ^N
B High Treatment (1.7)	5	5	4	56	4	6	21	19 ^N	19 ^N
C Average (1.4)	6	4	3	52	3	7	25	19 ^N	19 ^N
D High Treatment (3.4)	9	5	4	60	4	4	14	19 ^N	19 ^N
D Average (2.0)	7	5	3	56	3	5	20	19 ^N	19 ^N
B Low Treatment (0.6)	5	4	2	52	3	7	26	20 ^N	20 ^N
B Average (1.2)	5	4	3	54	4	6	24	20 ^N	20 ^N
D Low Treatment (0.6)	6	4	2	51	3	7	26	20 ^N	20 ^N
Alternative A (0.2)	6	4	2	48	3	8	29	21 ^L	21 ^L
C Low Treatment (0.5)	5	4	2	49	3	8	28	21 ^L	21 ^L

¹Departure from DC and HRV Ratings: (0-20% = no departure^N); (21-40% = low departure^L); (41-60% = moderate departure^M); (61-80% = high departure^H); and (81-100% = severe departure^S)

Figure 14 displays the long-term trend in relation to DC and HRV for all piñon-juniper woodland alternatives, based on their average acre treatments. All alternatives produce reductions in departure from DC and HRV immediately; however, around 15 to 20 years all alternatives start trending away from DC and HRV. Alternative D maintains a lower departure trend than the other alternatives, while alternative A maintains a higher departure trend than alternatives B and C. Alternative D maintains the lowest departure rating across all modeling periods, followed by alternatives B, C and then A. Alternatives D, and B end in a low departure class while alternative C, and alternative A end in a moderate departure class. However, it appears that around 15 years trend changes in all alternatives and management changes would be needed to reset movement toward DCs within this PNV. For more information regarding piñon-juniper vegetation structural state model run outcomes see Appendix D tables 51 through 60.

In summary, for a complete display of the tabular summations of the 15-year planning period and the 50-year modeling period comparisons of the environmental consequences to the vegetation indicators between the proposed high, average, and low acre treatment objectives for alternatives B, C, and D, and alternative A see Appendix G tables 1 through 6, and Appendix H tables 1 through 6, for comparisons of the percent departures from DC and HRV by the end of the 15-year planning period and the 50-year modeling period, by alternative proposed high, average, and low acre treatment objectives and alternative A), for the proposed high acre treatment objectives, by the end of the 15-year planning period, alternative C does more to address the threats and risks when assessing movement towards both DC and HRV, followed by the equally rated alternatives B and D, and lastly A. However, by the end of the 50-year modeling period, alternative D does more to address the threats and risks when assessing movement towards both DC and HRV, followed by alternative B, then C, and lastly A.

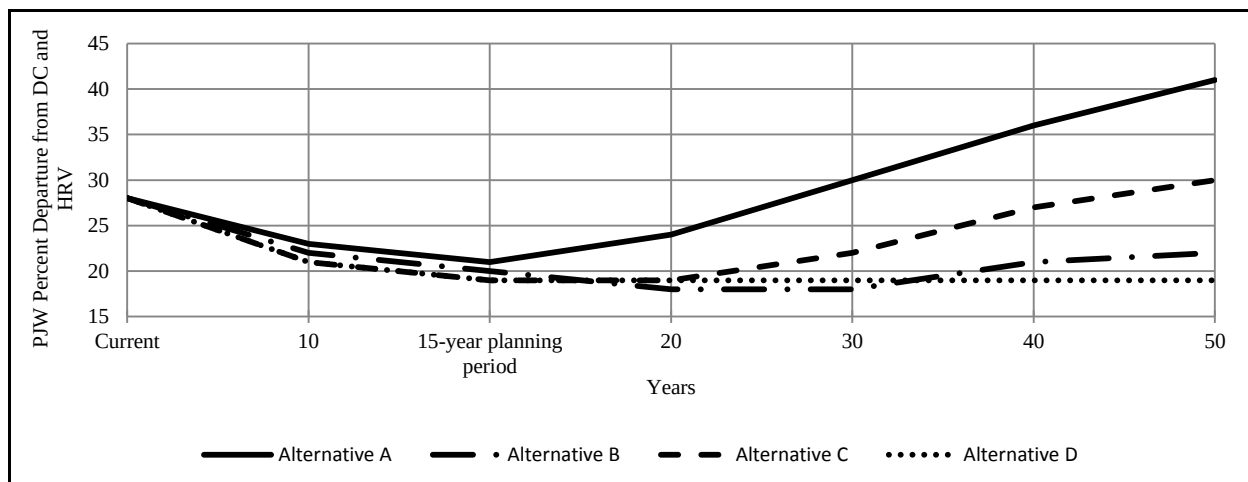


Figure 14. Overstory departure from DC and HRV trend comparisons for piñon-juniper woodland PNVT by alternative over a 50-year time period for alternative A and the average of the proposed high and low acre treatment objectives for alternatives B, C, and D

For the proposed average acre treatment objectives, by the end of the 15-year planning period, the equally rated alternatives C and D do more to address the threats and risks when assessing movement towards both DC and HRV, followed by alternative B, and lastly A. However, risks by the end of the 50-year modeling period, alternative D does more to address the threats and risks when assessing movement towards both DC and HRV, and followed by alternative B, then C, and lastly A.

For the proposed low acre treatment objectives, by the end of the 15-year planning period, the equally rated alternatives B and D do more to address the threats and risks when assessing movement towards both DC and HRV, followed by the equally rated alternatives A and C. However, by the end of the 50-year modeling period, alternative D does more to address the threats and risks when assessing movement towards both DC and HRV, followed by alternative B, then C, and lastly A.

Large/Old Trees, Snags and Coarse Woody Debris

Large/Old Trees: By the end of the 15-year planning period, none of the alternatives would achieve the DCs for number of acres of large/old tree retention (table 66). However, the proposed high acre treatment objectives under alternatives D would provide the greatest movement toward DCs. This is followed by alternative C proposed high acre treatment objectives, alternative B proposed high acre treatment objectives, alternative D proposed average acre treatment objectives, alternative C proposed average acre treatment objectives, alternative D proposed low acre treatment objectives, alternative A, alternative C proposed low acre treatment objectives, alternative B proposed average acre treatment objectives, and lastly, alternative B proposed low acre treatment objectives. By the end of the 50-year modeling period, none of the alternatives would achieve the DCs for number of acres of large/old tree retention. However, the proposed high acre treatment objectives under alternatives D would provide the greatest movement toward DCs. This is followed by alternative C proposed high acre treatment objectives, alternative D proposed average acre treatment objectives, alternative C proposed average acre treatment objectives, alternative B proposed high acre treatment objectives, alternative B proposed average acre treatment objectives, alternative D proposed low acre treatment objectives, alternative B proposed low acre treatment objectives, alternative A, and lastly, alternative C proposed low acre treatment objectives.

Snags (18 inches or larger DBH): By the end of the 15-year planning period, all of the alternatives would achieve the DC for number of snags 18 inches or greater DBH per acre (table 66). By the end of the 50-

year modeling period, all alternatives would continue to maintain DCs for number of snags 18 inches or greater DBH per acre.

Table 66. Acres of large/old trees, number of snags greater than 18 inch diameter at breast height (DBH) per acre, and tons of the three size classes of coarse woody debris per acre by the end of the 15-year planning period and the 50-year modeling period within the piñon-juniper woodland PNVt for the proposed high, low and average treatment objectives for alters B, C and D, and alternative A

Alternative	Acres of Large/Old Trees piñon-juniper woodland vegetation structural states D, G	Across All Piñon-Juniper Woodland Vegetation Structural States					total
		number of snags/acre		tons of coarse woody debris/acre			
		DBH		DBH			
		5" - 17.9"	≥ 18"	≤ 3"	> 3" & ≤ 12"	> 12"	
<i>Desired Condition</i>	99,971	<i>non-defined¹</i>	1 - 2	<i>range from 2 - 5</i>			
<i>Current Condition</i>	139,845	6.6	1.5	0.6	2.2	1.4	4.2
15-year Planning Period							
Alternative A	128,541	8.7	1.4	0.7	2.9	1.4	5.0
B High Treatment	128,307	7.2	1.4	0.7	2.4	1.3	4.4
B Average Treatment	129,806	7.7	1.4	0.7	2.6	1.4	4.6
B Low Treatment	129,844	8.2	1.4	0.7	2.7	1.4	4.8
C High Treatment	125,196	7.6	1.4	0.7	2.5	1.3	4.5
C Average Treatment	128,408	8.1	1.4	0.7	2.8	1.4	5.0
C Low Treatment	129,768	8.6	1.4	0.7	2.8	1.4	4.9
D High Treatment	124,493	6.0	1.4	0.6	2.1	1.2	3.9
D Average Treatment	128,357	7.1	1.4	0.6	2.4	1.3	4.3
D Low Treatment	128,508	8.2	1.4	0.7	2.7	1.4	4.8
50-year Modeling Period							
Alternative A	121,558	12.0	1.3	0.9	3.8	1.6	6.3
B High Treatment	118,483	8.1	1.3	0.7	2.7	1.3	4.7
B Average Treatment	119,829	9.3	1.3	0.8	3.0	1.4	5.2
B Low Treatment	121,175	10.5	1.3	0.8	3.3	1.5	5.7
C High Treatment	113,981	9.3	1.3	0.8	3.0	1.4	5.1
C Average Treatment	117,971	10.3	1.3	0.8	3.3	1.4	5.6
C Low Treatment	121,961	11.3	1.3	0.9	3.6	1.5	6.0
D High Treatment	109,376	5.8	1.3	0.6	1.9	1.1	3.7
D Average Treatment	114,984	7.9	1.3	0.7	2.6	1.3	4.6
D Low Treatment	120,593	10.1	1.3	0.8	3.2	1.5	5.5

¹ Proposed Forest Plan desired conditions for dry mixed conifer forest do not specify any DCs for this size class of snags; data is provide for additional information only

Coarse Woody Debris: By the end of the 15-year planning period, all of the alternatives would achieve the DC for the amount of coarse woody debris per acre (table 66). By the end of the 50-year modeling period, only the following alternatives would maintain DC for the amount of coarse woody debris per acre: alternative D proposed high acre treatment objectives, alternative D proposed average acre treatment objectives, alternative B proposed high acre treatment objectives, and alternative C proposed high acre treatment objectives.

In summary, for a complete display of the tabular summations of the 15-year planning period and 50-year modeling period comparisons of the environmental consequences to the vegetation indicators between the proposed high, average, and low acre treatment objectives for alternatives B, C, and D, and alternative A see Appendix G tables 1 through 6, for the proposed high acre treatment objectives, by the end of the 15-year planning period and the 50-year modeling period, alternative D does more, when assessing movement toward DC for acres of large/old trees per acre, followed by alternative C, then B, and lastly A. by the end of the 15-year planning period and by the end of the 50-year modeling period, all of the alternatives are rated as equal, when assessing movement toward DC for number of large snags per acre. By the end of the 15-year planning period, all of the alternatives are rated as equal, when assessing movement toward DC for tons of coarse woody debris per acre. However, by the end of the 50-year

modeling period, the equally rated alternatives B and D do more, when assessing movement toward DC for tons of coarse woody debris per acre, followed by alternative C, and lastly A.

For the proposed average acre treatment objectives, by the end of the 15-year planning period, alternative D does more, when assessing movement toward DC for acres of large/old trees per acre, followed by alternative C, then A, and lastly B. In addition, by the end of the 50-year modeling period, alternative D also does more, when assessing movement toward DC for acres of large/old trees per acre, but followed by alternative C, then B, and lastly A. By the end of the 15-year planning period and the 50-year modeling period, all of the alternatives are rated as equal, when assessing movement toward DC for number of large snags per acre. By the end of the 15-year planning period, all of the alternatives are rated as equal, when assessing movement toward DC for tons of coarse woody debris per acre. However, by the end of the 50-year modeling period, alternative D does more, when assessing movement toward DC for tons of coarse woody debris per acre, followed by alternative C, then B, and lastly A.

For the proposed low acre treatment objectives, by the end of the 15-year planning period, alternative D does more, when assessing movement toward DC for acres of large/old trees per acre, followed by alternative A, then C, and lastly B. In addition, by the end of the 50-year modeling period, alternative D also does more, when assessing movement toward DC for acres of large/old trees per acre, but followed by alternative B, then A, and lastly C. By the end of the 15-year planning period and by the end of the 50-year modeling period, all of the alternatives are rated as equal, when assessing movement toward DC for number of large snags per acre. By the end of the 15-year planning period, all of the alternatives are rated as equal, when assessing movement toward DC for tons of coarse woody debris per acre. However, by the end of the 50-year modeling period alternative D does more, when assessing movement toward DC for tons of coarse woody debris per acre, followed by alternative B, then C, and lastly A.

Woodland PNVTs: Figure 15 displays the summary of long-term trends in relation to DC for the collective woodland PNVTs under all alternatives, modeled in VDDT, based on their proposed average acre treatment objectives. All alternatives produce reductions in departure from DC immediately. Alternative D produces the greatest movement towards DC by the end of the planning period going from a moderate to low departure rating, followed by alternative B (going from a moderate to low, as well), and then alternative C. Alternative A provides no movement toward DC after the 15-year planning period. Both alternatives C and A remain moderately departed by the end of the 50-year modeling period.

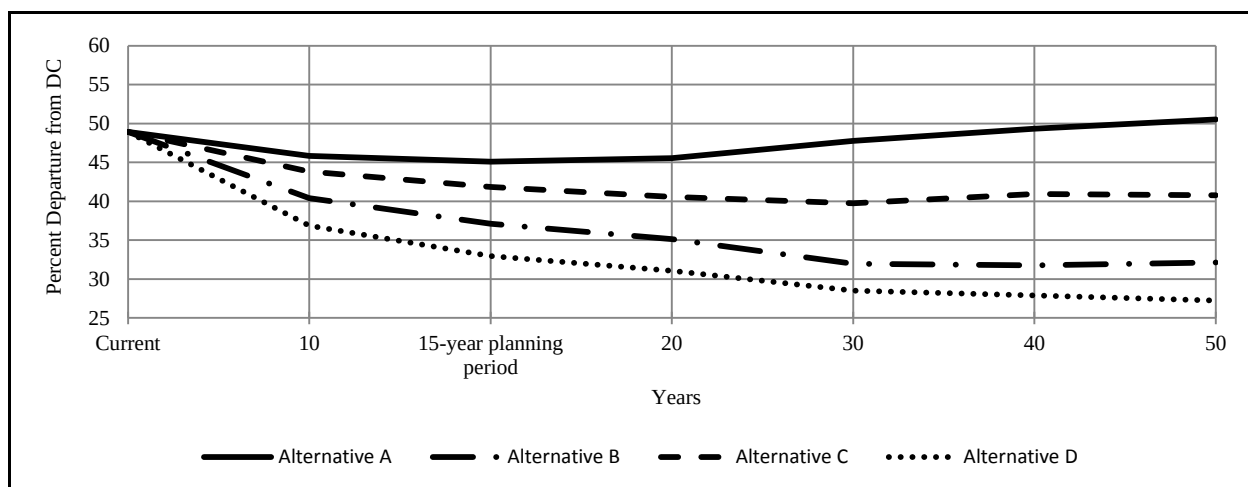


Figure 15. Overstory departure from DC trend comparisons for all woodland PNVTs by alternative over a 50-year time period for alternative A and the average of the proposed high and low acre treatment objectives for alternatives B, C, and D

Figure 16 displays the summary of long-term trends in relation to HRV for the collective woodland PNVTs under all alternatives, modeled in VDDT, based on their average acre treatments. All alternatives produce reductions in departure from HRV immediately. Alternative D produces the greatest movement towards DC by the end of the planning period going from a moderate to low departure rating, followed by alternative B (going from a moderate to low, as well), and then alternative C. Alternative A provides no movement toward HRV by the end of the 15-year planning period. Both alternatives C and A remain moderately departed by the end of the 50-year modeling period.

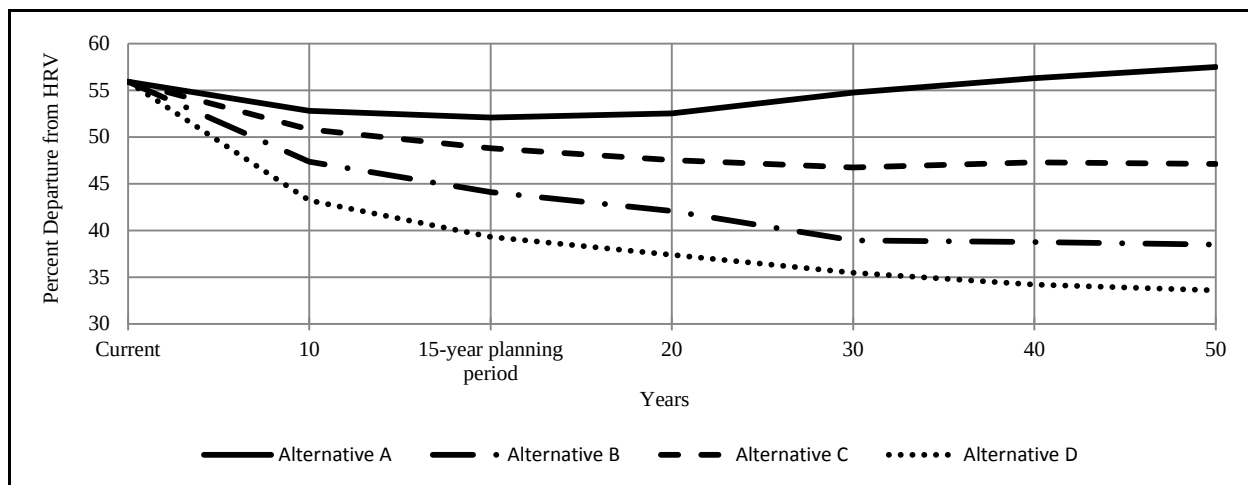


Figure 16. Overstory departure from HRV trend comparisons for all woodland PNVTs by alternative over a 50-year time period for alternative A and the average of the proposed high and low acre treatment objectives for alternatives B, C, and D

In summary, for a complete display of the tabular summations of the 15-year planning period and the 50-year modeling period comparisons of the environmental consequences to the vegetation indicators between the proposed high, average, and low acre treatment objectives for alternatives B, C, and D, and alternative A see Appendix G tables 1 through 6, and Appendix H tables 1 through 6, for comparisons of the percent departures from DC and HRV by the end of the 15-year planning period and the 50-year modeling period, by alternative proposed high, average, and low acre treatment objectives and alternative A), for the proposed high acre treatment objectives, by the end of the 15-year planning period and by the end of the 50-year modeling period, alternative D does more to address the threats and risks when assessing movement towards both DC and HRV, followed by alternative B, then C, and lastly A.

For the proposed average acre treatment objectives, by the end of the 15-year planning period and by the end of the 50-year modeling period, alternative D does more to address the threats and risks when assessing movement towards both DC and HRV, followed by alternative B, then C, and lastly A.

For the proposed low acre treatment objectives, by the end of the 15-year planning period, the equally rated alternatives B and D do more to address the threats and risks when assessing movement towards both DC and HRV, followed by the equally rated alternatives A and C. By the end of the 50-year modeling period, alternative D does more to address the threats and risks when assessing movement toward DC, followed by alternative B, then C, and lastly A. However, by the end of the 50-year modeling period, the equally rated alternatives B and D do more to address the threats and risks when assessing movement toward HRV, followed by alternative C, and lastly A.

Grassland PNVTs

Great Basin grassland:

Table 67 presents the proposed treatment objectives within the Great Basin grassland PNVt by alternative.

Table 67. Proposed annual vegetation overstory treatment objectives within the Great Basin grassland PNVt(see Appendix F tables 17 through 24 for a more complete description of the individual treatments and the annual acres of each proposed treatment objective by PNVt for alternatives B, C and D, and alternative A)

Alternative	High Acre Treatment Objectives		Low Acre Treatment Objectives		Average Acre Treatment Objectives		Alternative A Treatment Acres	
	mechanical	prescribed fire	mechanical	prescribed fire	mechanical	prescribed fire	mechanical	prescribed fire
A	-	-	-	-	-	-	500	41
B	10,269	10,000	5,135	5,000	7,702	7,500	-	-
C	0	0	0	0	0	0	-	-
D	6,161	14,000	3,081	7,000	4,621	10,500	-	-

Vegetation Outcome

After one planning period (15 years), the proposed high acre treatment objectives under alternative D produce the greatest movement toward DC, from the current rating of 67 to 8 (table 68). This is a change of four departure classes, from high to no departure. Under this alternative there is the greatest overall reduction in woody vegetation encroachment²⁴ (vegetation structural states C and D) and a return to historic grassland conditions, dense stands of perennial grasses and forbs with less than ten percent woody canopy cover (vegetation structural state B). Reduction in overstory canopy cover will favor shade intolerant and very shade intolerant herbaceous species.

The proposed high acre treatment objectives under alternative B produce the second greatest movement toward DC, from the current rating of 67 to 9. This is also a change of four departure classes, from high to no departure. The proposed average acre treatment objectives under alternative B produce the third greatest movement toward DC, from the current rating of 67 to 17. This is a change of three departure classes, from high to low. Alternatives A and C stay highly departed from DC and HRV. For more information regarding Great Basin vegetation structural state model run outcomes see Appendix D tables 61 through 68.

Figure 17 displays the long-term trend in relation to DC and HRV for all Great Basin grassland alternatives, based on their average acre treatments. Both alternatives B and D produce reductions in departure from DC and HRV immediately, from high to no departure and remain there throughout the 50-year modeling period. Both alternatives A and C produce movement away from DC and HRV.

²⁴ The term encroachment and not invasion is used because woody species that have been increasing in density are native species and have been present in these communities for thousands of years. These indigenous or native woody species have increased in density, cover and biomass because of changes in one or more abiotic or biotic factors or conditions. Woody species that have increased in density and cover are not the cause of the encroachment, but the result of changes in the abiotic or biotic factors or conditions (Van Auken, 2009).

Table 68. Fifteen-year planning period Great Basin grassland PNVT overstory departure from DC and HRV comparisons by alternative (B, C and D) for the proposed high, low and average acre treatment objectives; alternatives are arranged in the order of departure from DC (lowest to highest)

Alternative and Percent Acres Treated Annually (arranged from least to most departed from DC)	Percent Within Each Great Basin Grassland Vegetation Structural State					Overall Departure ¹	
	A	B	C	D	E	DC	HRV
<i>Desired Condition</i>	5	73	20	2	0	0 ^N	
<i>Current Conditions</i>	1	10	69	18	2	67 ^H	67 ^H
D High Treatment (10.9)	0	70	19	8	2	8 ^N	8 ^N
B High Treatment (11.0)	0	75	15	7	2	9 ^N	9 ^N
B Average (8.3)	0	65	21	12	2	17 ^N	17 ^N
D Average (8.2)	0	60	25	13	2	19 ^N	19 ^N
B Low Treatment (5.5)	0	54	26	18	2	24 ^L	24 ^L
D Low Treatment (5.4)	0	49	31	18	2	29 ^L	29 ^L
Alternative A (0.2)	0	15	43	40	2	63 ^H	63 ^H
Alternative C (0.2)	0	15	43	40	2	63 ^H	63 ^H

¹ Departure from DC Ratings: (0-20% = no departure^N); (21-40% = low departure^L); (41-60% = moderate departure^M); (61-80% = high departure^H); and (81-100% = severe departure^S)

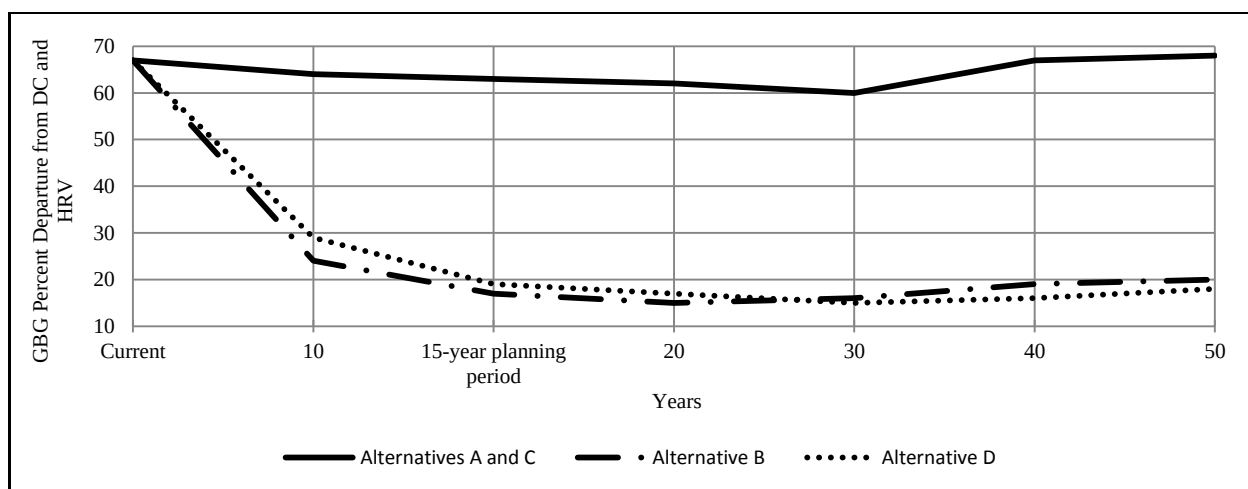


Figure 17. Overstory departure from DC and HRV trend comparisons for Great Basin grassland PNVT by alternative over a 50-year time period for alternative A and the average of the proposed high and low acre treatment objectives for alternatives B, C, and D

In summary, for a complete display of the tabular summations of the 15-year planning period and the 50-year modeling period comparisons of the environmental consequences to the vegetation indicators between the proposed high, average, and low acre treatment objectives for alternatives B, C, and D, and alternative A see Appendix G tables 1 through 6, and Appendix H tables 1 through 6, for comparisons of the percent departures from DC and HRV by the end of the 15-year planning period and the 50-year modeling period, by alternative proposed high, average, and low acre treatment objectives and alternative A), for the proposed high acre treatment objectives, by the end of the 15-year planning period and the 50-year modeling period, alternative D does more to address the threats and risks when assessing movement towards both DC and HRV, followed by alternative B, and lastly, the equally rated alternatives A and C.

For the proposed average acre treatment objectives, by the end of the 15-year planning period, alternative B does more to address the threats and risks when assessing movement towards both DC and HRV, followed by alternative D, and lastly, the equally rated alternatives A and C. However, by the end of the 50-year modeling period, alternative D does more to address the threats and risks when assessing

movement towards both DC and HRV, followed by alternative B, and lastly, the equally rated alternatives A and C.

For the proposed low acre treatment objectives, when assessing movement towards both DC and HRV, alternative B does more to address the threats and risks by the end of the 15-year planning period and by the end of the 50-year modeling period followed by alternative D, then equally by alternatives A and C.

Semi-desert grassland:

Table 69 presents the proposed treatment objectives within the semi-desert grassland PNVT by alternative.

Table 69. Proposed annual vegetation overstory treatment objectives within the semi-desert grassland PNVT(see Appendix F tables 17 through 24 for a more complete description of the individual treatments and the annual acres of each proposed treatment objective by PNVT for alternatives B, C and D, and alternative A)

Alternative	High Acre Treatment Objectives		Low Acre Treatment Objectives		Average Acre Treatment Objectives		Alternative A Treatment Acres	
	mechanical	prescribed fire	mechanical	prescribed fire	mechanical	prescribed fire	mechanical	prescribed fire
A	-	-	-	-	-	-	0	27
B	0	3,000	0	2,000	0	2,500	-	-
C	0	0	0	0	0	0	-	-
D	0	3,000	0	2,000	0	2,500	-	-

Vegetation Outcome

After one planning period, the proposed high acre treatment objectives under both Alternatives B and D produce the greatest movement toward DC and HRV, from the current rating of 78 to 66 (table 70). However, there is no change in departure class, and the grassland remains highly departed. Under these alternatives there is the greatest overall reduction in woody vegetation encroachment (vegetation structural states C and D) and some movement to historic grassland conditions, dense stands of perennial grasses and forbs with less than ten percent woody canopy cover (vegetation structural state B). Reduction in overstory canopy cover will favor shade intolerant and very shade intolerant herbaceous species.

The proposed average acre treatment objectives under alternatives B and D produce the second greatest movement toward DC and HRV, from the current rating of 78 to 68. Again, there is no change in departure class, and the grassland remains highly departed. Alternatives A and C continue to trend away from DC and HRV For more information regarding semi-desert vegetation structural state model run outcomes see Appendix D tables 69 through 76.

Table 70. Fifteen-year planning cycle semi-desert grassland PNVT overstory departure from DC and HRV comparisons by alternative (B, C and D) for the proposed high, low and average acre treatment objectives, and alternative A; alternatives are arranged in the order of departure from DC (lowest to highest)

Alternative and Percent Acres Treated Annually (arranged from least to most departed from DC)	Percent Within Each Semi-desert Grassland Vegetation Structural State					Overall Departure ¹	
	A	B	C	D	E	DC	HRV
<i>Desired Condition</i>	24	76	0	0	0	0 ^N	-
<i>Current Conditions</i>	4	15	22	57	2	79 ^H	79 ^H
B High Treatment (2.8)	1	34	25	39	2	66 ^H	66 ^H
D High Treatment (2.8)	1	34	25	39	2	66 ^H	66 ^H
B Average (2.3)	1	30	24	44	2	68 ^H	68 ^H
D Average (2.3)	1	30	24	44	2	68 ^H	68 ^H
B Low Treatment (1.8)	0	29	23	45	2	70 ^H	70 ^H
D Low Treatment (1.8)	0	29	23	45	2	70 ^H	70 ^H
Alternative A (0.0)	0	16	21	61	2	84 ^S	84 ^S
Alternative C (0.0)	0	16	21	61	2	84 ^S	84 ^S

¹ Departure from DC Ratings: (0-20% = no departure^N); (21-40% = low departure^L); (41-60% = moderate departure^M); (61-80% = high departure^H); and (81-100% = severe departure^S)

Figure 18 displays the long-term trend in relation to DC and HRV for all semi-desert grassland alternatives, based on their average acre treatments. Both alternatives B and D produce reductions in departure from DC and HRV from high to moderate by year 30, and the departure class remains the same throughout the modeling period. Alternatives A and C produce movement away from DC and transition from highly to severely departed.

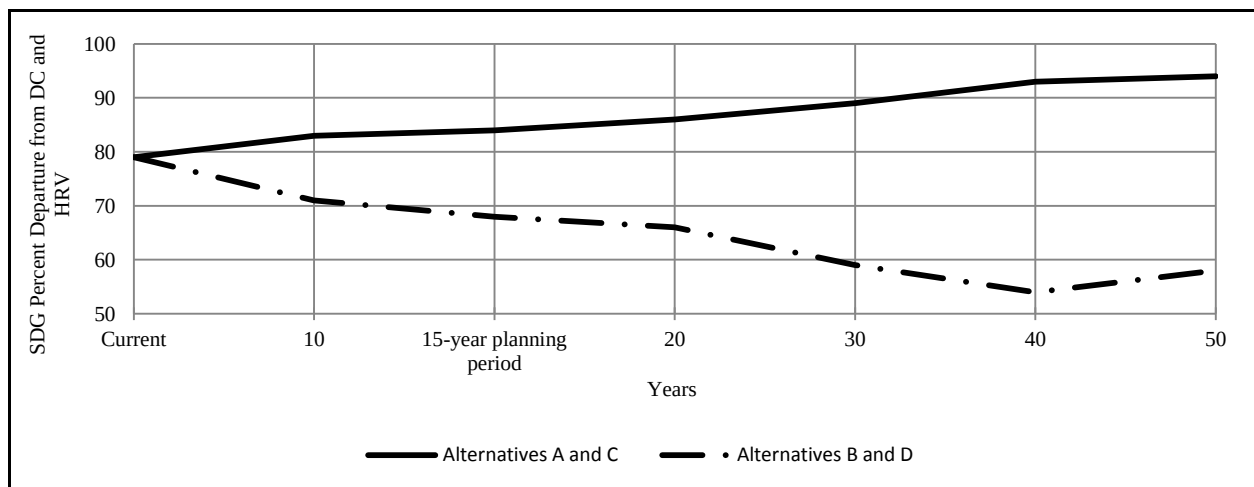


Figure 18. Overstory departure from DC and HRV trend comparisons for semi-desert grassland PNVT by alternative over a 50-year time period for alternative A and the average of the proposed high and low acre treatment objectives for alternatives B, C, and D

In summary, for a complete display of the tabular summations of the 15-year planning period and the 50-year modeling period comparisons of the environmental consequences to the vegetation indicators between the proposed high, average, and low acre treatment objectives for alternatives B, C, and D, and alternative A see Appendix G tables 1 through 6, and Appendix H tables 1 through 6, for comparisons of the percent departures from DC and HRV by the end of the 15-year planning period and the 50-year modeling period, by alternative proposed high, average, and low acre treatment objectives and alternative A), for the proposed high, average, and low acre treatment objectives, by the end of the 15-year planning period and the 50-year modeling period, the equally rated alternatives B and D do more to address the threats and risks when assessing movement towards both DC and HRV, followed by the equally rated alternatives A and C.

Grassland PNTs: Figure 19 displays the summary of long-term trends in relation to DC and HRV for the collective grassland PNTs under all alternatives, modeled in VDDT, based on their average acre treatments. Both Alternatives B and D produce reductions in departure from DC and HRV immediately, from high to no departure and remain in this departure class out to 50 years. This trend reflects the greater influence of the trends and conditions within the Great Basin grassland as opposed to the semi-desert grasslands. Both Alternatives A and C produce movement away from DC and HRV and transition from highly to severely departed.

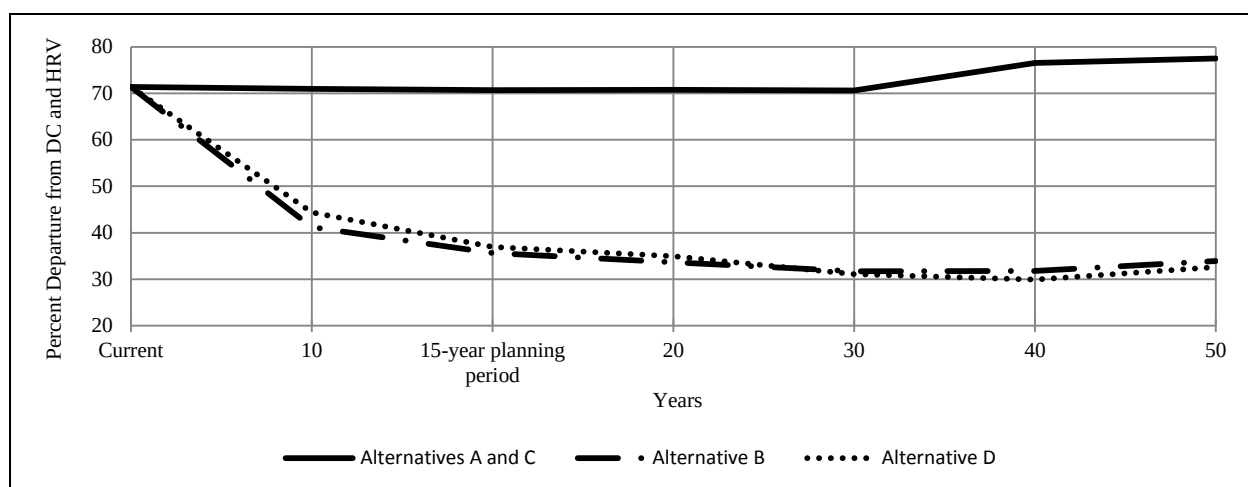


Figure 19. Overstory departure from DC and HRV trend comparisons for all grassland PNTs by alternative over a 50-year time period for alternative A and the average of the proposed high and low acre treatment objectives for alternatives B, C, and D

In summary, for a complete display of the tabular summations of the 15-year planning period and the 50-year modeling period comparisons of the environmental consequences to the vegetation indicators between the proposed high, average, and low acre treatment objectives for alternatives B, C, and D, and alternative A see Appendix G tables 1 through 6, and Appendix H tables 1 through 6, for comparisons of the percent departures from DC and HRV by the end of the 15-year planning period and the 50-year modeling period, by alternative proposed high, average, and low acre treatment objectives and alternative A), for the proposed high, average, and low acre treatment objectives, by the end of the 15-year planning period and the 50-year modeling period, alternative D does more to address the threats and risks when assessing movement towards both DC and HRV, followed by alternative B, and lastly, the equally rated alternatives A and C.

Summary of Modeling Results Relative to Desired Conditions and Historic Range of Variability

All Modeled PNTs: When comparing the alternative proposed average acre treatment objectives, after one planning cycle, across all modeled PNTs (this includes the four forest, two woodland, and two grassland PNTs), all four alternatives display a reduction in departure from DC; from a high to moderate departure (table 71). In relation to HRV, alternatives B and D display a reduction from a high to moderate departure. Both alternatives A and C remain highly departed. See Appendix H tables 1 through 6 for comparisons of the percent departures from DC and HRV by the end of the 15-year planning period and 50-year modeling period, by alternative proposed high, average, and low acre treatment objectives and alternative A.

Table 71. Comparisons of the overstory departures from DC and HRV at the end of the 15-year planning period, by alternative (B, C and D) proposed average¹ acre treatment objectives and alternative A (the lower the departure² value the closer to DC and HRV)

Alter- native	Forested PNV Group										Woodland PNV Group						Grassland PNV Group						All A-SNFs Modeled PNVTs	
	ponderosa pine forest		wet mixed conifer forest		dry mixed conifer forest		spruce-fir forest		all A-SNFs modeled forested PNVTs		Madrean pine-oak woodland		piñon- juniper woodland		all A-SNFs modeled woodland PNVTs		Great Basin grassland		semi- desert grassland		all A-SNFs modeled grassland PNVTs			
	DC	HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV		DC
Current Condition	77 ^H	94 ^S	54 ^M	61 ^H	67 ^H	77 ^H	59 ^M	62 ^H	71 ^H	85 ^S	61 ^H	72 ^H	28 ^L	28 ^L	49 ^M	56 ^M	67 ^H	67 ^H	79 ^H	79 ^H	71 ^H	71 ^H	64 ^H	73 ^H
A	65 ^H	84 ^S	49 ^M	46 ^M	57 ^M	54 ^M	68 ^H	58 ^M	61 ^H	71 ^H	59 ^M	70 ^H	21 ^L	21 ^L	45 ^M	52 ^M	63 ^H	63 ^H	84 ^S	84 ^S	71 ^H	71 ^H	57 ^M	65 ^H
B Average	63 ^H	83 ^S	53 ^M	46 ^M	56 ^M	52 ^M	66 ^H	55 ^M	60 ^M	71 ^H	47 ^M	58 ^M	20 ^N	20 ^N	37 ^L	44 ^M	17 ^N	17 ^N	68 ^H	68 ^H	36 ^L	36 ^L	49 ^M	56 ^M
C Average	60 ^M	81 ^S	56 ^M	49 ^M	54 ^M	51 ^M	65 ^H	55 ^M	58 ^M	70 ^H	55 ^M	66 ^H	19 ^N	19 ^N	42 ^M	49 ^M	63 ^H	63 ^H	84 ^S	84 ^S	71 ^H	71 ^H	55 ^M	63 ^H
D Average	66 ^H	85 ^S	52 ^M	47 ^M	59 ^M	56 ^M	65 ^H	55 ^M	62 ^H	73 ^H	41 ^M	51 ^M	19 ^N	19 ^N	33 ^L	39 ^L	19 ^N	19 ^N	68 ^H	68 ^H	37 ^L	37 ^L	48 ^M	56 ^M

¹ See Appendix H tables 1 and 3 for comparisons of the departures from DC and HRV by the end of the 15-year planning period, by alternative proposed high and low acre treatment objectives and alternative A

² Departure Ratings: (0-20% = no departure^N); (21-40% = low departure^L); (41-60% = moderate departure^M); (61-80% = high departure^H); and (81-100% = severe departure^S)

Numerically, all of the alternatives produce some movement toward DC/HRV by the end of the 15-year planning period. However, alternative D produces the greatest movement in the direction toward DC/HRV (from 64% DC-73% HRV (existing condition) to 48% DC-56% HRV), when considering the modeling results across all eight PNVs. Alternative B produces the second greatest movement in the direction toward DC/HRV from existing conditions to 49% DC-56% HRV, when considering the modeling results across all eight PNVs; however, the only difference between alternatives D and B is one percentage point for movement toward DC; they are equal in movement toward HRV. Qualitatively, these are both movements from high departure to moderate departure in relation to both DC and HRV.

By the end of the 15-year planning period, alternative C produces the third greatest movement in the direction toward DC/HRV from existing conditions to 55% DC-63% HRV, when considering the modeling results across all eight PNVs. Alternative A produces the least movement in the direction toward DC/HRV from existing conditions to 57% DC-65% HRV; however, the only difference between alternatives C and A is two percentage points for both DC and HRV. Qualitatively, there is no change in departure class in relation to both DC and HRV for either alternative C or alternative A, when considering the modeling results across all eight PNVs.

When comparing the alternative proposed average acre treatments, by the end of the 50-year modeling period, for all modeled PNVs, all four alternatives display a reduction in departure from DC; from a high to moderate departure rating (table 72). In relation to HRV, Alternatives B and D display a reduction from a high to moderate departure rating. Both Alternatives A and C remain highly departed; alternative A slightly more than alternative C.

Numerically, all of the alternatives produce some movement toward DC/HRV by the end of the 50-year modeling period. However, alternative D produces the greatest movement in the direction toward DC/HRV (from 64% DC-73% HRV (existing condition) to 42% DC-46% HRV). Alternative B produces the second greatest movement in the direction toward DC/HRV from existing conditions to 43% DC-51% HRV; however, the difference between alternatives D and B is one and five percentage point for DC and

HRV, respectively. Qualitatively, these are movements from high departure to moderate departure in relation to both DC and HRV for both alternatives D and B.

Table 72. Comparisons of the overstory departures from DC and HRV at the end of the 50-year modeling period, by alternative (B, C and D) proposed average¹ acre treatment objectives and alternative A (the lower the departure² value the closer to DC and HRV)

Alter- native	Forested PNVT Group										Woodland PNVT Group						Grassland PNVT Group								All A-SNFs Modeled PNVTs
	ponderosa pine forest		wet mixed conifer forest		dry mixed conifer forest		spruce-fir forest		all A-SNFs modeled forested PNVTs		Madrean pine-oak woodland		piñon- juniper woodland		all A-SNFs modeled woodland PNVTs		Great Basin grassland		semi- desert grassland		all A-SNFs modeled grassland PNVTs				
	DC	HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV	
Current Condition	77 ^H	94 ^S	54 ^M	61 ^H	67 ^H	77 ^H	59 ^M	62 ^H	71 ^H	85 ^S	61 ^H	72 ^H	28 ^L	28 ^L	49 ^M	56 ^M	67 ^H	67 ^H	79 ^H	79 ^H	71 ^H	71 ^H	64 ^H	73 ^H	
A	54 ^M	71 ^H	45 ^M	43 ^M	47 ^M	47 ^M	65 ^H	54 ^M	51 ^M	62 ^H	56 ^M	67 ^H	41 ^M	41 ^M	51 ^M	57 ^M	68 ^H	68 ^H	94 ^S	94 ^S	78 ^H	78 ^H	55 ^M	63 ^H	
B Average	54 ^M	74 ^H	53 ^M	45 ^M	48 ^M	46 ^M	63 ^H	53 ^M	53 ^M	64 ^H	38 ^L	48 ^M	22 ^L	22 ^L	32 ^L	38 ^L	20 ^N	20 ^N	58 ^M	58 ^M	34 ^L	34 ^L	43 ^M	51 ^M	
C Average	54 ^M	74 ^H	57 ^M	48 ^M	48 ^M	47 ^M	63 ^H	53 ^M	54 ^M	64 ^H	47 ^M	57 ^M	30 ^L	30 ^L	41 ^M	47 ^M	68 ^H	68 ^H	94 ^S	94 ^S	78 ^H	78 ^H	53 ^M	61 ^H	
D Average	57 ^M	66 ^H	51 ^M	45 ^M	49 ^M	49 ^M	62 ^H	53 ^M	55 ^M	59 ^M	32 ^L	42 ^M	19 ^N	19 ^N	27 ^L	34 ^L	18 ^N	18 ^N	58 ^M	58 ^M	33 ^L	33 ^L	42 ^M	46 ^M	

¹ See Appendix H tables 2 and 4 for comparisons of the departures from DC and HRV by the end of the 50-year modeling period, by alternative proposed high and low acre treatment objectives and alternative A

² Departure Ratings: (0-20% = no departure^N); (21-40% = low departure^L); (41-60% = moderate departure^M); (61-80% = high departure^H); and (81-100% = severe departure^S)

By the end of the 50-year modeling period, alternative C produces the third greatest movement in the direction toward DC/HRV from existing conditions to 53% DC-61% HRV. Alternative A produces the least movement in the direction toward DC/HRV from existing conditions to 55% DC-63% HRV; however, the only difference between alternatives C and A is two percentage points for DC and HRV. Qualitatively, these are movements from high departure to moderate departure in relation to both DC. Qualitatively, there is no change in departure class in relation to HRV for either alternative C or alternative A; they remain highly departed.

The greater movements toward DC and HRV for alternatives D and B than those produced by alternatives C and A can be primarily attributed to two factors: 1) the proposed 2.4- to 4.2-fold increase in acre treatments within the Madrean pine-oak woodland not included in alternative C, and the 7.0- to 12.3-fold increase in acre treatments not included in alternative A; and 2) the proposed 19,682 to 19,803 acre treatments in the Great Basin and semi-desert grasslands that are not included in alternative C or alternative A. The amount and extent of the proposed treatments within these three highly departed PNVts has a substantial influence on the overall rate and extent of progress in movement in relation to DC/HRV among the action alternatives, as well as the no-action alternative.

Figure 20 displays the summary of long-term trends in relation to DC for the collective A-SNFs modeled PNVts under all alternatives, modeled in VDDT, based on their proposed average acre treatments. All alternatives produce reductions in departure from DC immediately (by the end of the 15-year planning period), from high to moderate departure. Alternatives A and C “plateau-out” about 30 years and remain moderately departed across the remaining modeling periods. Alternatives B and D level out about 40 years out and remain moderately departed by the end of the 50-year modeling period.

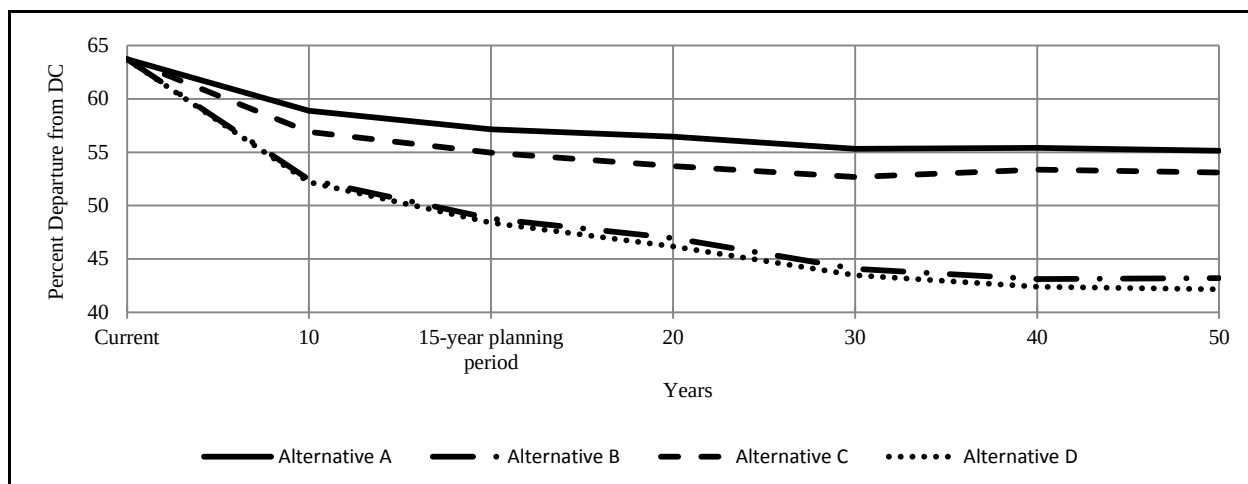


Figure 20. Overstory departure from DC trend comparisons for all A-SNFs PNVTs modeled by alternative over a 50-year time period for alternative A and the average of the proposed high and low acre treatment objectives for alternatives B, C, and D

Figure 21 displays the summary of long-term trends in relation to HRV for the collective A-SNFs modeled PNVTs under all alternatives, modeled in VDDT, based on their proposed average acre treatments. All alternatives produce reductions in departure from HRV immediately (by the end of the 15-year planning period). Alternatives B and D transition from high to moderate departure at year ten; while alternatives A and C remain highly departed to the end of the 50-year modeling period.

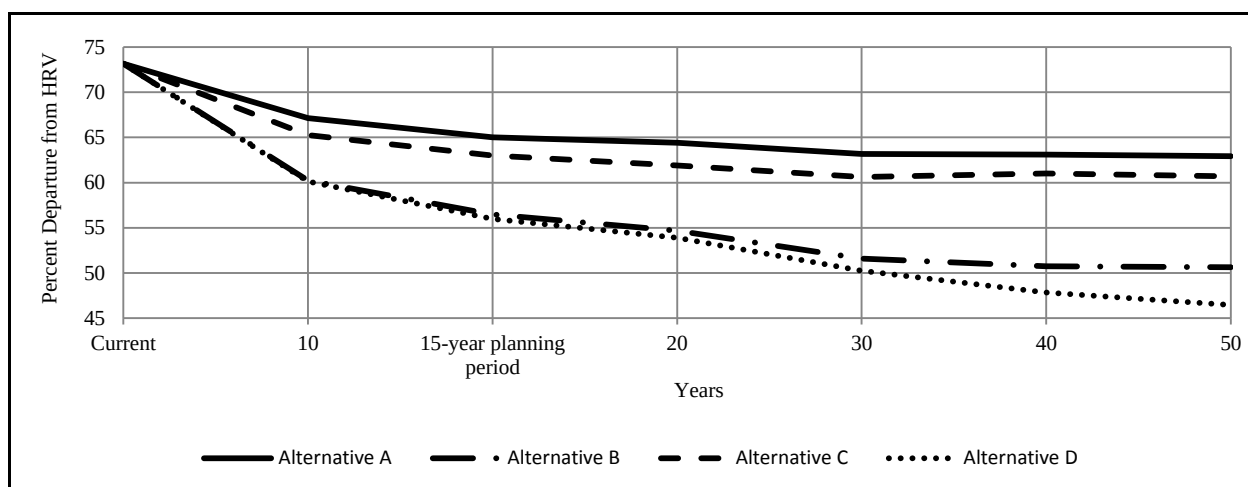


Figure 21. Overstory departure from HRV trend comparisons for all A-SNFs PNVTs modeled by alternative over a 50-year time period for alternative A and the average of the proposed high and low acre treatment objectives for alternatives B, C, and D

In summary, for a complete display of the tabular summations of the 15-year planning period and the 50-year modeling period comparisons of the environmental consequences to the vegetation indicators between the proposed high, average, and low acre treatment objectives for alternatives B, C, and D, and alternative A see Appendix G tables 1 through 6, and Appendix H tables 1 through 4, for comparisons of the departures from DC and HRV by the end of the 15-year planning period and the 50-year modeling period, by alternative proposed high and low acre treatment objectives and alternative A, for the proposed high acre treatment objectives, by the end of the 15-year planning period, alternative C does more to address the threats and risks when assessing movement toward DC, followed by alternative A, then B, and

lastly D. However, by the end of the 15-year planning period, alternative A does more to address the threats and risks when assessing movement toward HRV followed by alternative C, then B, and lastly D. By the end of the 50-year modeling period, alternative D does more to address the threats and risks when assessing movement toward DC, followed by alternative B, then C, and lastly A. However, by the end of the 50-year modeling period, alternative B does more to address the threats and risks when assessing movement toward HRV, followed by alternative D, then C, and lastly A.

For the proposed average acre treatment objectives, by the end of the 15-year planning period and the 50-year modeling period, alternative D does more to address the threats and risks when assessing movement towards both DC and HRV, followed by alternative B, then C, and lastly A. However, by the end of the 15-year planning period, the equally rated alternatives B and D do more to address the threats and risks when assessing movement toward HRV, followed by alternative C, and lastly A. Furthermore, by the end of the 50-year modeling period, alternative B does more to address the threats and risks when assessing movement toward HRV, followed by alternative D, then C, and lastly A.

For the proposed low acre treatment objectives, by the end of the 15-year planning period, alternative B does more to address the threats and risks when assessing movement toward DC, followed by alternative D, then C, and lastly A. However, by the end of the 15-year planning period, the equally rated alternatives B and D do more to address the threats and risks when assessing movement toward HRV, followed by alternative C, and lastly A. In addition, by the end of the 15-year planning period and the 50-year modeling period, the equally rated alternatives B and D also do more to address the threats and risks when assessing movement towards both DC and HRV, followed by alternative C, and lastly A.

PNVTs Not Modeled with VDDT

Grassland PNVT

Montane/subalpine grasslands:

Annual Vegetation Treatment Objectives

There are no specific objectives regarding this PNVT in alternative A other than a general statement on eliminating tree encroachment to maintain grasslands as suitable range. The action alternatives would treat approximately 500 acres per year to restore grassland conditions (table 73).

Table 73. General proposed annual vegetation overstory treatment objectives within the montane/subalpine grassland PNVT for alternatives B, C and D, and alternative A

Alternative	Annual Average Acre Treatment Objectives		Alternative A Treatment Acre Objectives	
	mechanical	prescribed fire	mechanical	prescribed fire
A	-	-	0	0
B	500	0	-	-
C	500	0	-	-
D	500	0	-	-

Vegetation Outcome

Alternatives B, C and D would provide equal benefit to the montane/subalpine grasslands. These alternatives have a proposed 500 acre annual treatment objective through the planning period; specifically, under alternative C for commercial tree removal where encroachment in the grasslands has occurred and under alternatives B and D for grassland restoration. Although not quantified, burning

(planned and unplanned) would also be emphasized under alternatives C and D. At this treatment rate, treating the 10 percent tree encroached area of this PNVN will take roughly 11 years to complete. Alternative B primarily emphasizes restoration treatments within the Great Basin and semi-desert grasslands and would provide some restoration benefits on an opportunity basis. Since alternative A does not have any proposed treatment objectives, it provides less benefit to these grasslands than alternatives B, C, and D.

The departure from DC within these grasslands is rated at moderate and trending away. While removal of encroaching trees would be beneficial, they are a minor contributor to overall departure. In a study conducted on the A-SNFs, White (2002) found significant changes had occurred in these grasslands between 1913 and 1998 in soil surface cover, exposed soil, herbaceous vegetation composition and cover, and dominant species composition that were not related to woody species encroachment. White determined that ungulate grazing (both livestock and wildlife) were the principle causal factors responsible for these changes; followed by fire suppression. The proposed treatment objectives under all action alternatives would not change this PNVN's departure classification.

Changes in the structure and function of grassland systems have been noted as the primary cause of the loss of native diversity within grasslands (Stacey, 1995, Gori and Enquist, 2003). Finch (2004) identified and summarized the major threats to grassland biological diversity as the loss of natural fire cycles, overgrazing by livestock (Fleischner et al., 1994), prairie dog eradication, and introduction of non-native vegetation, woody species encroachment, erosion, and habitat fragmentation.

In summary, for a complete display of the tabular summations of the 15-year planning period and 50-year modeling period comparisons of the environmental consequences to the vegetation indicators between the proposed high, average, and low acre treatment objectives for alternatives B, C, and D, and alternative A see Appendix G tables 1 through 6, for the proposed high, average, and low acre treatment objectives, by the end of the 15-year planning period, the equally rated alternatives B, C and D do more to address the threats and risks when assessing movement towards both DC and HRV, followed by alternative A.

Chaparral PNVN

Interior chaparral:

Annual Vegetation Treatment Objectives

There are no specific objectives regarding this PNVN in alternative A or the action alternatives and the overstory and understory structure and function of the interior chaparral ecosystem would not change during the course of the planning period.

Vegetation Outcome

Since chaparral is rated at not being departed from DC/HRV, the management approach under all alternatives is to maintain this condition into the future, primarily by fire (planned and unplanned ignitions).

In summary, for a complete display of the tabular summations of the 15-year planning period and 50-year modeling period comparisons of the environmental consequences to the vegetation indicators between the proposed high, average, and low acre treatment objectives for alternatives B, C, and D, and alternative A see Appendix G tables 1 through 6, for the proposed high, average, and low acre treatment objectives, by

the end of the 15-year planning period, alternatives A, B, C and D equally address the threats and risks when assessing movement towards both DC and HRV.

Riparian Areas/Riparian Forest PNVTs (see the Riparian Specialist Report for a description of riparian conditions)

Wetland/cienegas riparian areas, mixed broadleaf deciduous, montane willow, and cottonwood-willow riparian forests:

Annual vegetation treatment objectives are displayed in table

Table 74. General proposed average annual vegetation overstory treatment objectives within the wetland/cienega riparian areas, and mixed broadleaf deciduous, montane willow, and cottonwood-willow riparian forests PNVTs for alternatives B, C and D, and alternative A

Alternative	Treatment Objectives		
	mechanical treatment acres	prescribed fire treatment acres	number of wetland/cienegas restored
A	0	0	0
B Average	0	350	15
C Average	0	0	0
D Average	0	450	15

Vegetation Outcome

As mentioned earlier, these riparian PNVTs are rated as no departure (CWRF) to low departure MWRF, MBDRF, and WCRA). There are no specific objectives regarding treating the vegetation structure and compositions of these PNVTs in alternatives A or C. Alternatives B and D propose to restore 200 to 500, and 300 to 600 acres annually (B and D, respectively). Alternatives B and D also have an objective to restore 5 to 25 wetland/cienegas riparian areas during the planning period, and would therefore, have a greater benefit.

If proposed treatments include removal of non-riparian woody and herbaceous species, alternatives B and D would provide the greater benefit to all of the riparian PNVTs. All action alternatives also propose to reduce animal damage on five miles of riparian area annually. This should reduce ungulate damage to willows and other riparian woody species.

Changes in the structure and function of wetland/cienega systems have been noted as the primary cause of the loss of biological diversity within these systems. The causes of adverse change in the ecological character of wetland/cienegas can be grouped in five broad categories:

- Changes to the water regime
- Water pollution
- Physical modification
- Exploitation of biological products
- Introduction of invasive species

Again, alternatives B and D have an objective to restore 5 to 25 wetland/cienegas riparian areas during the planning period, and would therefore, have a greater benefit than either alternative A or C.

The riparian areas and riparian forest PNVTs have some of the highest road and motorized trail densities on the forests; ranging from 1.4 (MBDRF), 1.9 (CWRF), 2.5 (WCRA) to 3.4 (MWRF) linear miles of

road and motorized trails per square mile. Rehabilitating land that has been roaded is difficult at best. However, all action alternatives proposed to remove roads and unauthorized routes during the planning period.

Treatment Objectives

Objective Description	Alternative			
	A	B	C	D
Minimum amount of NFS roads or trails that negatively impact streams or riparian areas to be relocated, repaired, improved, or decommissioned	0	4	0	4
Average amount of unauthorized roads or trails that negatively impact streams or riparian areas to be removed	0	2	3	3

In this regard, alternative D would produce the greatest benefit by removing the most roads, followed by Alternatives B and C. Alternative A does not contain specific objectives to remove roads for the benefit of riparian areas.

In summary, for a complete display of the tabular summations of the 15-year planning period and 50-year modeling period comparisons of the environmental consequences to the vegetation indicators between the proposed high, average, and low acre treatment objectives for alternatives B, C, and D, and alternative A see Appendix G tables 1 through 6, for the proposed high, average, and low acre treatment objectives, by the end of the 15-year planning period, the equally rated alternatives B and D do more to address the threats and risks when assessing movement towards both DC and HRV, followed by the equally rated alternatives A and C.

Overall Evaluation of PNVT Overstory Vegetation Movement towards Desired Conditions and Historic Range of Variability (see Appendix G for further information)

Desired Conditions: The overall evaluation of the alternatives regarding all A-SNFs PNVTs for the proposed high acre treatment objectives, by the end of the 15-year planning period and the 50-year modeling period, alternative D does more to address the threats and risks when assessing movement toward DC, followed by alternative B, then C, and lastly A.

The overall evaluation of the alternatives regarding all A-SNFs PNVTs for the proposed average acre treatment objectives, by the end of the 15-year planning period, alternative B does more to address the threats and risks when assessing movement toward DC, followed by alternative D, then C, and lastly A. However, by the end of the 50-year modeling period, alternative D does more to address the threats and risks when assessing movement toward DC, followed by alternative B, and lastly, the equally rated alternatives A and C.

The overall evaluation of the alternatives regarding all A-SNFs PNVTs for the proposed low acre treatment objectives, by the end of the 15-year planning period and the 50-year modeling period, alternative B does more to address the threats and risks when assessing movement toward DC, followed by alternative D, then C, and lastly A.

Historic Range of Variability: The overall evaluation of the alternatives regarding all A-SNFs PNVTs for the proposed high acre treatment objectives, by the end of the 15-year planning period, the equally rated alternatives B and D do more to address the threats and risks when assessing movement toward HRV, followed by alternative C, and lastly A. However, by the end of the 50-year modeling period, alternative D does more to address the threats and risks when assessing movement toward HRV, followed by alternative B, then C, and lastly A.

The overall evaluation of the alternatives regarding all A-SNFs PNVTs for the proposed average acre treatment objectives, by the end of the 15-year planning period, alternative B does more to address the threats and risks when assessing movement toward HRV, followed by alternative D, then C, and lastly A. However, by the end of the 50-year modeling period, alternative D does more to address the threats and risks when assessing movement toward HRV, followed by alternative B, then C, and lastly, A.

The overall evaluation of the alternatives regarding all A-SNFs PNVTs for the proposed low acre treatment objectives, by the end of the 15-year planning period, alternative B does more to address the threats and risks when assessing movement toward HRV, followed by alternative D, then C, and lastly A. However, by the end of the 50-year modeling period, alternative D does more to address the threats and risks when assessing movement toward HRV, followed by the equally rated alternatives A and C.

Quaking Aspen

Maintain and Regenerate

All alternatives have the objective to retain aspen on the landscape. This would entail actions to maintain and regenerate aspen at the DC level of 50,200 acres or more during the planning period. Aspen readily regenerates with disturbance like fire. Actions to maintain aspen include fencing and removal of conifer succession within aspen clones.

Table 75 shows that aspen is maintained at a level above DC under all alternatives during the planning cycle (15 years). Alternative A maintains the greatest amount of aspen with 71,076 acres at the end of the planning period, followed by the proposed low acre treatment objectives under alternative B with 70,711 acres. The proposed high acre treatment objectives under alternative C produce the greatest reduction, 20.2 percent at the end of the planning cycle, followed by the proposed high acre treatment objectives under alternative D with 19.2 percent at the end of the planning cycle. However, all alternatives have aspen levels above DC ranging from a low of 121.6 percent to a high of 141.6 percent for the proposed high acre treatment acres under alternative C and the average acre treatment objectives in alternative A, respectively.

It is recognized that the level of aspen, as a consequence of forest management and activities, shown in table 75 will be further affected by non-federal actions. A primary example of aspen loss not related to forest management and activities, commonly occurring now, include ungulate browsing of aspen seedlings and saplings, insects and disease, and sudden aspen decline (SAD). SAD is distinct from age-induced dieback, as it is a sudden, landscape-scale event that can lead to loss of most of an aspen stand (Worrall et al., 2008; Korb, 2012). The average time frame for naturally occurring dieback for aspen is approximately 100 years while the average time frame for SAD induced dieback is between 3 to 6 years (Frey et al., 2004). Worrell et al. (2010 and 2013), found that an extremely warm drought was a major factor in an episode of SAD in southwestern Colorado. Ireland et al. (2014) found for some early successional species, like aspen, slow growth at various stages of the tree's life is associated with increased mortality risk. One of the principle dynamic forces for growth is available moisture (Hogg et al., 2008; Worrell et al., 2010; Huang and Anderegg, 2011). Results from Hanna and Kulakowski's (2012) study of aspen mortality throughout the western U.S. suggests that aspen die-off is strongly associated with recent climatic conditions.

At the end of the 50-year modeling period, all alternatives apart from the proposed high acre treatment acre objectives in both alternatives C and D maintain aspen at levels above DCs.

Table 75. Comparisons of the trend in aspen in relation to DC acres by alternative (B, C and D) for the proposed high, low and average acre treatment objectives, and alternative A, for the 15-year planning period and the 50-year modeling period; alternatives are arranged from the most to least aspen acres by the end of the 15-year planning period

Alternative (arranged from the most to least aspen acres at 15 years)	Aspen						
	acres	percent	15-year planning period			50-year modeling period	
			acres	% reduction from current acres	percent of minimum DC	acres	% reduction from current acres
<i>Desired Condition</i>			<i>50,200 acres or more</i>				
<i>Current Condition¹</i>	76,500	100					
Alternative A			71,076	7.1	141.6	58,870	23.1
B Low Treatment			70,711	7.6	140.9	57,946	24.3
C Low Treatment			70,542	7.8	140.5	56,966	25.5
D Low Treatment			69,241	9.5	137.9	56,597	26.0
B Average			68,204	10.9	135.9	54,333	29.0
C Average			65,796	14.0	131.1	51,532	32.6
B High Treatment			65,696	14.1	130.9	50,720	33.7
D Average			65,517	14.4	130.5	50,450	34.1
D High Treatment			61,793	19.2	123.1	44,304	42.1
C High Treatment			61,049	20.2	121.6	46,098	39.7

¹ Data is post-2011 Wallow Fire

Figure 22 illustrates the long-term trends in aspen acres under all alternative proposed average acre treatment acre objectives. Alternative A maintains the greatest number of aspen acres; however, this is roughly a 23 percent reduction from current levels. This is followed by alternatives B, C and D with reductions of 29.0, 32.6, and 34.1 percent, respectively. However, all alternative proposed average acre treatment acre objectives still provide for aspen acreage at levels above DC.

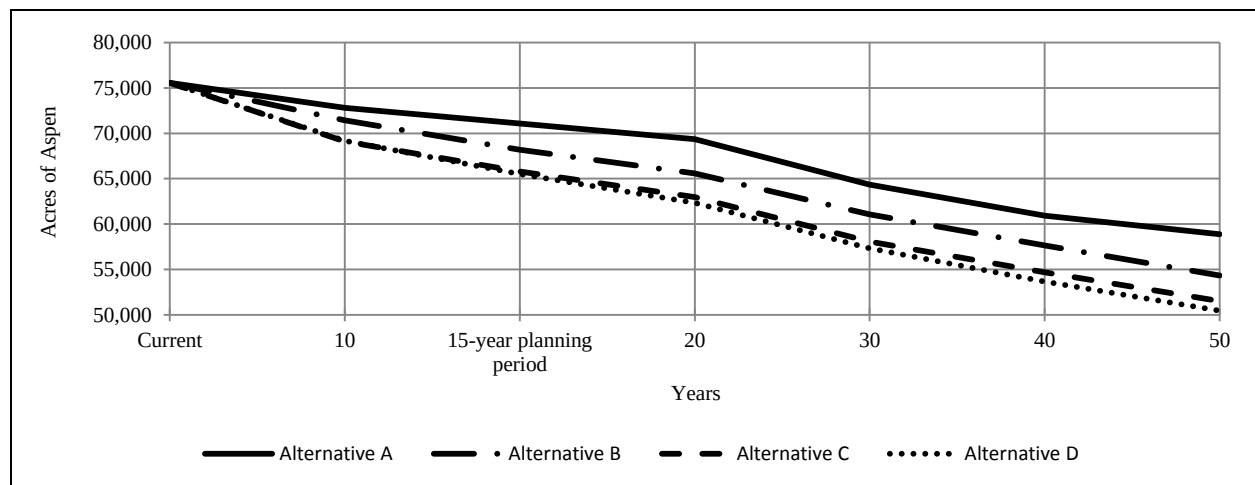


Figure 22. Comparisons of the trend in acres of aspen, between alternatives, across the 50-year modeling period, based on the proposed average acre treatment objectives for alternatives B, C and D, and alternative A

In summary, for a complete display of the tabular summations of the 15-year planning period and 50-year modeling period comparisons of the environmental consequences to the vegetation indicators between the proposed high, average, and low acre treatment objectives for alternatives B, C, and D, and alternative A see Appendix G tables 1 through 6, for the proposed high acre treatment objectives, by the end of the 15-year planning period, alternatives A, B, C and D equally address the maintenance of aspen within DC levels. However, by the end of the 50-year modeling period, alternatives A and B equally address the maintenance of aspen within DC levels, while alternatives C and D do not.

For the proposed average acre treatment objectives, by the end of the 15-year planning period, alternatives A, B, C and D equally address the maintenance of aspen within DC levels. However, by the end of the 50-year modeling period, alternatives A and B equally address the maintenance of aspen within DC levels, while alternatives C and D do not.

For the proposed low acre treatment objectives, by the end of the 15-year planning period and the 50-year modeling period, alternatives A, B, C and D equally address the maintenance of aspen within DC levels.

Woody Overstory/Herbaceous Understory Vegetation Cover Relationship

According to Copper (1960), the composition and quality of the herbaceous vegetation is governed by livestock grazing, fire and the density of the forest canopy. One of the most distinctive features of frequent-fire forests, woodlands, and grasslands of the A-SNFs is the major contribution that the herbaceous understory vegetation (grasses, forbs, shrubs) makes to ecosystem diversity and productivity (Smith, 2011). According to Laughlin and Grace (2006), in the absence of fire, the density of overstory trees increases, which can reduce the diversity of herbaceous understory vegetation 10-30 percent. Restoration efforts on the A-SNFs should focus on the enhancement and/or recovery of native herbaceous species.

The following discussion presents potential changes in the relations between overstory and herbaceous understory vegetation due to the different proposed alternative acre treatment levels. Jameson (1967) studying the overstory/understory relationships in ponderosa pine forests in northern Arizona found a greater than 2.3- to 3.4-fold increase in herbaceous understory vegetation production between open (30% or less) and closed (greater than 30%) canopy sites. Reduction in overstory canopy cover and burning the understory would increase understory species composition and diversity (Smith 2011).

Tree canopy closure in southwestern ponderosa pine old-growth stands ranges from 17 to 30 percent (Laughlin et al., 2006), which suggests that understory patches may have comprised greater than 70 percent of the forested landscape. Moore and Deiter (1992) reported that herbaceous understory vegetation response to the overstory reduction appeared to be dependent on understory plant type. They found that overstory density effects on understory production were most predictable for the herbaceous plants (i.e., grasses, sedges, and forbs) while shrubs showed only a slight response to changing overstory density. To what extent the herbaceous understory vegetation responds to overstory removal, also depends on the health and condition of the existing understory community and its ability to respond, as well as, available seed bank, and soil productivity. In a study conducted in a ponderosa pine forest in northern Arizona, Springer (1999) found that overstory canopy type has a significant influence on the species in the soil seed bank. In general, annual and biennial species were found in greater numbers in the soil seed bank as opposed to perennials. This is troubling for all of the PNVTs where long-term, established herbage production in response to overstory removal is of concern.

According to Heitschmidt and Stuth (1991), remaining grasslands and savannas may become increasingly susceptible to woody plant encroachment in response to anticipated global changes that may generate warmer, drier climates characterized by greater variability (Emanuel et al., 1985a and 1985b). The ecological ramifications of the loss of herbaceous understory vegetation are hard to quantify; however, there are relationships between composition, structure, and processes that continually act upon one another to keep these communities functioning in a healthy manner. Pellant et al. (2005) define the three attributes of community health that can be directly related to loss of vegetation composition and structure: 1) soil and site stability; 2) integrity of the biotic; and 3) hydrologic function of the community. According to the Jacoby (1989), the degree to which these three attributes, as well as the ecological

processes of the ecological system are in equilibrium and sustained is an indicator of overall health of the system.

If a goal of ecological restoration in these forests is increased cover of native perennial plants, and the potential for increased native perennial grass reproduction, then cattle grazing exclusion, or a change in cattle management, could provide critically important options in restoration plans (Kerns et al., 2011). Grazing-induced modifications in species composition have been documented in numerous grasslands throughout the world (Voigt and Weaver, 1951; Branson and Weaver, 1953; Ellison, 1960; Williams, 1969; Noy-Meir et al., 1989; Grover and Musick, 1990; among others). Compositional changes frequently involve the replacement of higher successional species by lower successional species (Canfield, 1957). The lower successional species are frequently mid- or short-grass species held in a subordinate position by competitive interaction with species possessing greater stature (Arnold, 1955; Belsky, 1986). The importance of this is, successional changes within plant communities are linked to soil fertility, where lower successional stages are associated with soil erosion and the loss of topsoil in which nutrients are concentrated (Humphreys, 1997). Successional changes are linked directly to the integrity of the biotic community.

Integrity of the biotic community is defined as the capacity of a site to support characteristic functional and structural communities within the context of normal variability to withstand and recover from disturbance events (Pellant et al., 2005). Ecological processes functioning within a normal range of variability will support specific plant communities, however, when the biotic integrity of a site has been impaired changes within the functional and structural community can take place (Pellant et al., 2005). According to Tilman (1997), species structural and functional diversity are the principle factors for plant productivity. Consistent with McLaren (2006), species composition very probably plays an important role in determining ecosystem function because species differ in their traits. The effect of the loss of a species on an ecosystem is the result of both the loss of the direct effects of the organism on ecosystem functioning, and the response of other organisms to that loss. These effects and responses occur through numerous mechanisms (e.g., species can directly affect soil nutrient and water content through varying root mass). In addition, specific species can alter plant community composition through varying competitive abilities and facilitative effects, which in turn may affect ecosystem function. Vegetation species compositional shifts have occurred within these PNVTs (White, 2002; Vander Lee et al., 2006).

As overstory canopy cover moves towards DCs; (reduction in overstory canopy cover), and with the reintroduction of periodic fire within the ponderosa pine and dry mixed conifer forests, Madrean pine-oak and piñon-juniper woodlands, and Great Basin and semi-desert grasslands there would be an expected increase in understory species diversity, cover, composition and production (Smith, 2011). Laughlin et al. (2005) found that, low-intensity surface fire is an important ecological process in lower montane and subalpine forests that maintains understory communities within the range of natural variability and appears to promote species diversity. According to several authors (Bailey and Copeland, 1961; Blackburn et al., 1986; Knight, 1993), species composition is a clear indicator of hydrologic function. Hydrologic function is defined as the capacity of a site to capture, store and release moisture and as the ability to withstand and recover from capacity reducing events (Pellant et al., 2005).

Shifts in compositions that change the vegetative structure from herbaceous species to woody species, has a direct effect on levels of surface runoff and soil loss (McGinty et al., 1995). As sediment production increases, total biomass decreases (Thurrow et al., 1986; Thurrow, 1991). Species compositional shifts have already occurred within these PNVTs and they exhibit moderate to high departure from DC/HRV. Functionally, the advantage of increased efficiency of water use is in conserving soil moisture and delaying the effects of drought (Long, 1999). A reduction in nutrient availability also occurs in dry soils (Chapin, 1991).

The significance of changes in vegetation composition and structure is the relation to ecosystem function and process-litter and root biomass of herbaceous vegetation builds and enriches soils at a far greater rate than within adjacent forested or woodland sites (Aber and Melillo, 1991) or areas that are now occupied by tree encroachment. Within southwestern ponderosa pine forests, Kaye and Hart (1998) reported that net rates of nitrogen (N) transformation beneath relict grassy openings were twice those beneath post-settlement pines. Other studies have identified some herbaceous understory vegetation components that may function as major community and ecosystem drivers (Nilsson and Wardle, 2005).

Forested PNVTs Woody Overstory/Herbaceous Understory Relationship

Ponderosa pine forest: Ponderosa pine is a naturally open canopied forest and DCs are to have 90 percent (541,985 acres) of this PNVT with open canopy cover. By the end of the 15 year planning period all alternatives proposed average acre treatment objectives produce a reduction in closed canopy acres (figure 23); however, alternative C reduces the closed canopy cover on the greatest number of acres, from 410,912 to 324,765 acres, a 21 percent reduction (table 76); alternatives B, A, and D follow with 13, 10, and 8 percent reductions, respectively. See Appendix I tables 1 and 3 for more information regarding changes in canopy cover for the proposed high and low acre treatment objectives by the end of the 15-year planning period and the 50-year modeling period for ponderosa pine.

At the end of 50 years all the alternatives have reduced closed canopy acres by 24, 21, 18, and 16 percent for alternatives C, D, B, and A, respectively. It would appear that under all alternatives, insufficient acres would be treated within this PNVT to achieve the DCs over time.

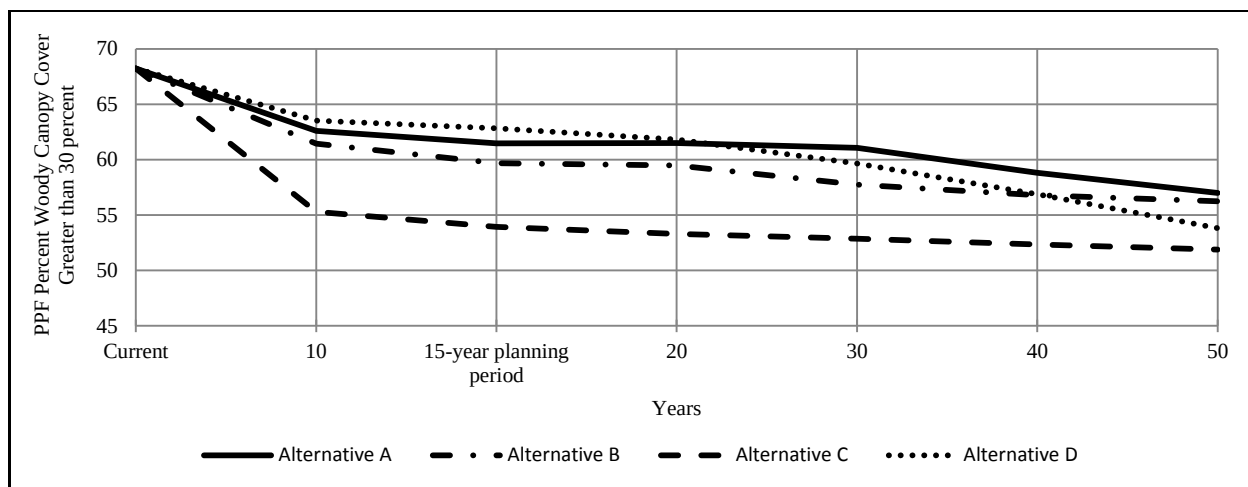


Figure 23. Percent of ponderosa pine forest PNVT acres with woody canopy cover greater than 30 percent over a 50-year timeframe, based on the proposed average acre treatment objectives for alternatives B, C and D, and alternative A

Herbaceous understory vegetation cover has been directly related to time since fire and ponderosa pine basal area (Laughlin et al., 2005). Results from Dodson and Peterson's (2010) study, suggest that restoration treatments designed primarily to reduce fire hazard and promote sustainable conditions in fire-adapted ecosystems (such as this PNVT) can also increase community heterogeneity and facilitate colonization by new understory species without significant local extirpation of current species. As a result of canopy cover reductions through mechanical thinning and introduction of periodic fire on a regular basis, within this PNVT there should be an increase in understory plant cover, richness, diversity, and heterogeneity.

Table 76. Comparisons, based on the proposed average acre treatment objectives for alternatives B, C and D, and alternative A, by the end of the 15-year planning period and the 50-year modeling period, of the percentage and acreage changes in closed woody canopy cover¹ within the historically open forest (ponderosa pine forest [PPF] and dry mixed conifer forest [DMCF]) PNVTs, and the historically closed forest (wet mixed conifer forest [WMCF] and spruce-fir forest [SFF]) PNVTs on the A-SNFs

Percent and Acreage Display the Amount of Change within Each PNVT that has Closed Woody Canopy Cover Greater than 30 Percent (arrows indicate direction of change in woody canopy cover; ↑ increase or ↓ decrease)				
Years	proposed average treatment objectives			
	alternative A	alternative B	alternative C	alternative D
Ponderosa pine forest PNVT current conditions: 602,206 acres of which 68% or 410,912 acres with woody canopy cover > 30%				
15	10%↓ (370,119 acres)	13%↓ (359,445 acres)	21%↓ (324,765 acres)	8%↓ (378,270 acres)
50	16%↓ (343,281 acres)	18%↓ (338,631 acres)	24%↓ (312,530 acres)	21%↓ (324,026 acres)
Dry mixed conifer forest PNVT current conditions: 147,885 acres of which 61% or 90,210 acres with woody canopy cover > 30%				
15	23%↑ (110,914 acres)	20%↑ (107,956 acres)	19%↑ (107,217 acres)	25%↑ (112,393 acres)
50	21%↑ (109,435 acres)	20%↑ (107,695 acres)	22%↑ (110,174 acres)	26%↑ (113,871 acres)
All A-SNFs Modeled Open canopy forest types (PPF+DMCF): 750,091 acres of which 67% or 501,122 acres with woody canopy cover > 30%				
15	4%↓ (481,033 acres)	7%↓ (467,401 acres)	14%↓ (431,982 acres)	2%↓ (490,662 acres)
50	10%↓ (452,716 acres)	11%↓ (447,327 acres)	16%↓ (422,704 acres)	13%↓ (437,897 acres)
Wet mixed conifer forest PNVT current conditions: 177,995 acres of which 61% or 101,457 acres with woody canopy cover > 30%				
15	12%↑ (113,917 acres)	12%↑ (113,917 acres)	5%↑ (106,797 acres)	12%↑ (113,917 acres)
50	18%↑ (119,257 acres)	19%↑ (121,037 acres)	14%↑ (115,697 acres)	18%↑ (120,147 acres)
Spruce-fir forest PNVT current conditions: 17,667 acres of which 61% or 10,777 acres with woody canopy cover > 30%				
15	11%↑ (12,014 acres)	11%↑ (11,925 acres)	9%↑ (11,749 acres)	10%↑ (11,837 acres)
50	2%↑ (10,954 acres)	3%↓ (10,424 acres)	4%↓ (10,335 acres)	7%↓ (9,982 acres)
All A-SNFs Modeled Closed canopy forest types (WMCF+SFF): 195,662 acres of which 57% or 112,234 acres with woody canopy cover > 30%				
15	12%↑ (125,930 acres)	12%↑ (125,842 acres)	6%↑ (118,546 acres)	12%↑ (125,754 acres)
50	16%↑ (130,210 acres)	17%↑ (131,460 acres)	12%↑ (126,032 acres)	16%↑ (130,128 acres)

¹Woody canopy closure classes are: 0 to < 10% is defined as very open canopy; 10 to ≤ 30% is defined as open canopy; and > 30% is defined as closed canopy. Under HRV and for DC ponderosa pine and dry mixed conifer forests should exhibit open canopies (10 to ≤ 30% woody canopy cover). Therefore, the lower the amounts of closed woody canopy cover, the closer these two PNVTs are to their HRV and forest plan DCs. Under HRV and for DC wet mixed conifer and spruce-fir forests should exhibit closed canopies (> 30% woody canopy cover). Therefore, the higher the amount of closed woody canopy cover, the closer these two PNVTs are to their HRV and forest plan DCs

With expected increases in herbaceous plant vigor through decreased competition for sunlight and moisture, and more rapid nutrient cycling by fire there could be greater herbage growth. Current average herbaceous cover ranging from 45-78 percent and average estimated production ranging from 255-390 pounds per acre have the potential to increase by as much as 27 and 39 percent for cover and production, respectively (table 48). Given the opportunity to respond to overstory canopy reductions, the existing understory state of affairs where low and moderately-low ecological conditions or very-poor and poor range conditions occur on more than 480,000 acres, should enable some movement to higher ecological levels and closer to DCs.

Wet mixed conifer forest: Wet mixed conifer is a naturally closed canopy forest and DCs are to have 79 percent (140,616 acres) of this PNVN with closed canopy cover. By the end of the 15-year planning period, all alternative proposed average acre treatment objectives would produce increases in closed canopy acres (figure 24). Alternatives A, B, and D would equally increase closed canopy acres from 101,457 to 113,917, a nearly 12 percent increase (table 76). Alternative C would increase closed canopy acres from 101,457 to 106,797, a five percent increase. At the end of 50 years all the alternatives have increased closed canopy acres by 19, 18, 18, and 14 percent for alternatives B, A, D, and C, respectively. It would appear that under all alternatives, too many acres would be treated within this PNVN to achieve DCs over time. See Appendix I tables 1 and 3 for more information regarding changes in canopy cover for the proposed high and low acre treatment objectives by the end of the 15-year planning period and the 50-year modeling period for wet mixed conifer.

As a result of canopy cover increases within this PNVN there is very little likelihood in a change occurring in understory plant cover, richness, diversity, and heterogeneity from current conditions. Current average herbaceous cover ranging from 73-94 percent and average estimated production ranging from 60-140 pounds per acre would not have the potential to increase by as much as 13 and 16 percent for cover and production, respectively (table 48). Overstory canopy increase would facilitate minimal, if any, movement of the existing understory situation where low and moderately-low ecological conditions occur on more than 60,000 acres, to higher ecological levels and closer to DCs; in fact, the opposite is more likely to occur.

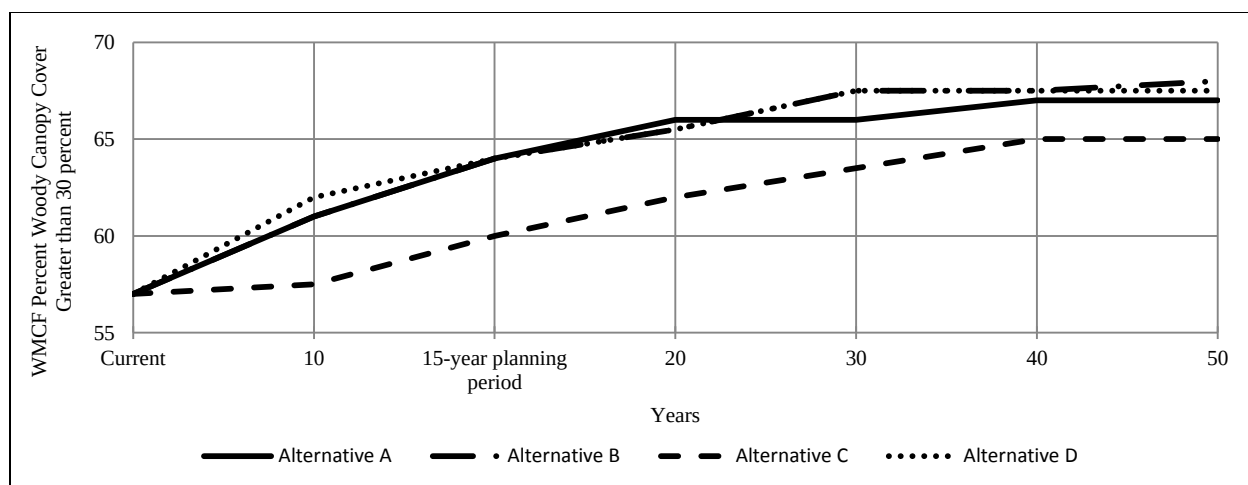


Figure 24. Percent of wet mixed conifer forest PNVN acres with woody canopy cover greater than 30 percent over a 50-year timeframe, based on the proposed average acre treatment objectives for alternatives B, C and D, and alternative A

Dry mixed conifer forest: Dry mixed conifer is a naturally open canopied forest and DCs are to have 68 percent (100,562 acres) of this PNVN with open canopy cover. However, within the planning period all

alternatives proposed average acre treatment objectives produce increases in closed canopy acres (figure 25). Alternatives C yield the smallest increase in closed canopy acres, from 90,210 to 107,217 acres, a 19 percent increase (table 76); alternatives B and A follow with 20 and 23 percent increases, respectively. At the end of 50 years all the alternatives have augmented closed canopy acres by 20, 21, 22, and 26 percent for alternatives B, A, C, and D, respectively, from current conditions. It would appear that under all alternatives, insufficient acres would be treated within this PNVN to achieve the DCs. See Appendix I tables 1 and 3 for more information regarding changes in canopy cover for the proposed high and low acre treatment objectives by the end of the 15-year planning period and the 50-year modeling period for dry mixed conifer.

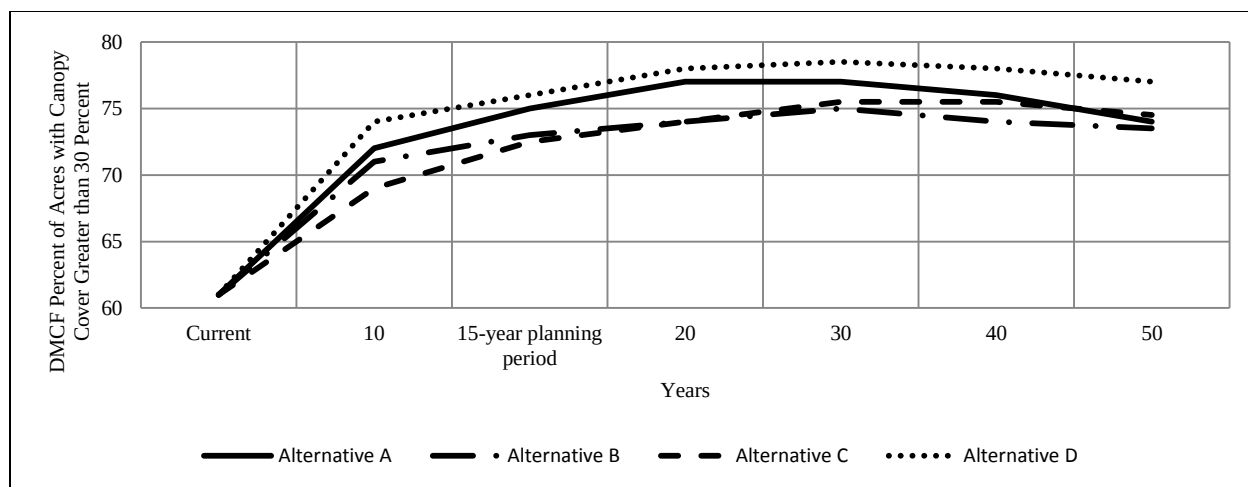


Figure 25. Percent of dry mixed conifer forest PNVN acres with woody canopy cover greater than 30 percent over a 50-year timeframe, based on the proposed average acre treatment objectives for alternatives B, C and D, and alternative A

As a result of canopy cover increases within this PNVN there is very little likelihood in a change occurring in understory plant cover, richness, diversity, and heterogeneity from current conditions. Current average herbaceous cover ranging from 57-89 percent and average estimated production ranging from 205-500 pounds per acre would not have the potential to increase by as much as 19 and 27 percent for cover and production, respectively (table 48). Overstory canopy increase would facilitate minimal, if any, movement of the existing understory situation where low and moderately-low ecological conditions occur on more than 81,000 acres, to higher ecological levels and closer to DCs; in fact, the opposite is more likely to occur.

When combining the two naturally open forested PNVNs' (ponderosa pine and dry mixed conifer forests) to assess canopy cover changes, alternative C results in the greatest overall reduction (14%) in closed canopy acres within the planning period; followed by alternatives B, A and D with seven, four and two percent, respectively. By the end of the 50 year modeling period Alternative C again results in the greatest overall reduction (16%) in closed canopy acres; followed by alternatives D, B, and A with 13, 11 and 10 percent, respectively.

Spruce-fir forest: Spruce-fir is a naturally closed canopy forest and DCs are to have no more than 19 percent (3,357 acres) of this PNVN with open canopy cover. By the end of the 15-year planning period, all alternative proposed average acre treatment objectives would produce an increase in closed canopy acres (figure 26). Alternative A would produce the greatest increase in closed canopy acres from 10,777 to 12,014 acres, an 11 percent increase (table 76). Alternative B would increase closed canopy acres to 11,925, a nearly 11 percent increase. Alternative B would increase closed canopy acres to 11,925, a nearly 11 percent increase. Alternative D would provide a roughly 10 percent increase in closed canopy acres

(from 10,777 to 11,837). Alternative C would increase closed canopy acres the least from 10,777 to 11,749 acres, a nine percent increase. Desired conditions for this PNVNT are to have roughly 81 percent or 14,310 acres with closed canopy cover. However, at the end of 50 years, only alternative A would result in an increase (2%) in closed canopy acres. Alternatives B, C, and D would produce further decreases in closed canopy by 3, 4, and 7 percent, respectively. It would appear that under all alternatives, too many acres would be treated within this PNVNT to achieve and maintain DCs over time. Reduction in canopy cover is likely the result of the number of years that it would require to treat this entire PNVNT under the various alternative proposed treatment objective acres; 83 years, 41 years, 28 years, and 33 years for A, B, C, and D, respectively. See Appendix I tables 1 and 3 for more information regarding changes in canopy cover for the proposed high and low acre treatment objectives by the end of the 15-year planning period and the 50-year modeling period for spruce-fir.

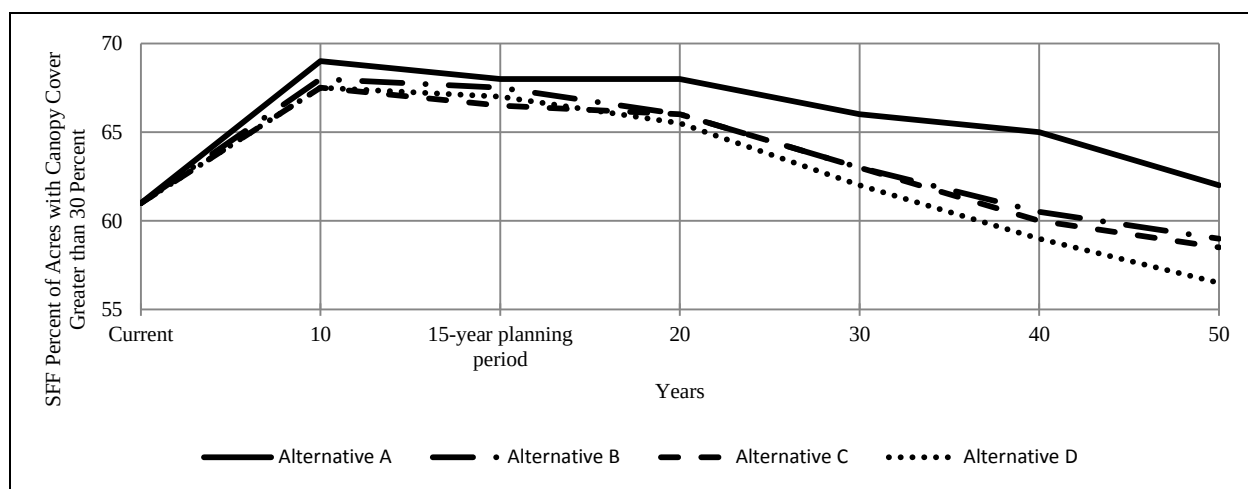


Figure 26. Percent of spruce-fir forest PNVNT acres with woody canopy cover greater than 30 percent over a 50-year timeframe, based on the proposed average acre treatment objectives for alternatives B, C and D, and alternative A

As a result of canopy cover increases through mechanical thinning and introduction of some underburning, within this PNVNT there should be a small increase (at least in the short-term) in understory plant cover, richness, diversity, and heterogeneity because of more rapid nutrient cycling by fire; there could be greater herbage growth. Current average herbaceous cover ranging from 90-95 percent and average estimated production ranging from 25-50 pounds per acre have the potential to increase by as much as 6 and 8 percent for cover and production, respectively (table 48). Overstory canopy decrease may facilitate minimal movement of the existing understory situation where low and moderately-low ecological conditions occur on more than 500 acres, to higher ecological levels and closer to potential.

When combining the two naturally closed forested PNVNTs' (wet mixed conifer and spruce-fir forests) to assess canopy cover changes, alternative C results in the smallest overall increase (6%) within the planning period; followed equally by alternatives A, B, and D with 12 percent increases. By the end of the 50-year modeling period alternative C again results in the smallest overall increase (12%) in closed canopy acres; followed equally by alternatives A and D with a 16 percent increase, and lastly by alternative B with a 17 percent increase in closed canopy acres.

Woodland PNVNTs Woody Overstory/Herbaceous Understory Relationship

Madrean pine-oak woodland: Madrean pine-oak is naturally open canopy woodland and DCs are to have less than 21 percent (82,935 acres) of this PNVNT with closed canopy cover. Within the planning period all

alternative proposed average acre treatment objectives produce reductions in closed canopy acres (figure 27). However, alternative D reduces the closed woody canopy cover on the greatest number of acres, from 308,927 to 231,032 acres, a 25 percent reduction (table 77), and alternatives B, C and A follow with 15, 8, and 3 percent reductions, respectively. At the end of 50 years all alternatives have reduced closed woody canopy acres by 42, 32, 24 and 6 percent for alternatives D, B, C, and A, respectively. Because this PNVT is predominately roadless (93%) and has no suitable lands for timber production or mechanical harvest treatments, fire is the only management tool available. It would appear that under all alternatives, insufficient acres would be treated or fire treatments are only partially effective within this PNVT to achieving the DCs. See Appendix I tables 4 and 6 for more information regarding changes in canopy cover for the proposed high and low acre treatment objectives by the end of the 15-year planning period and the 50-year modeling period for Madrean pine-oak.

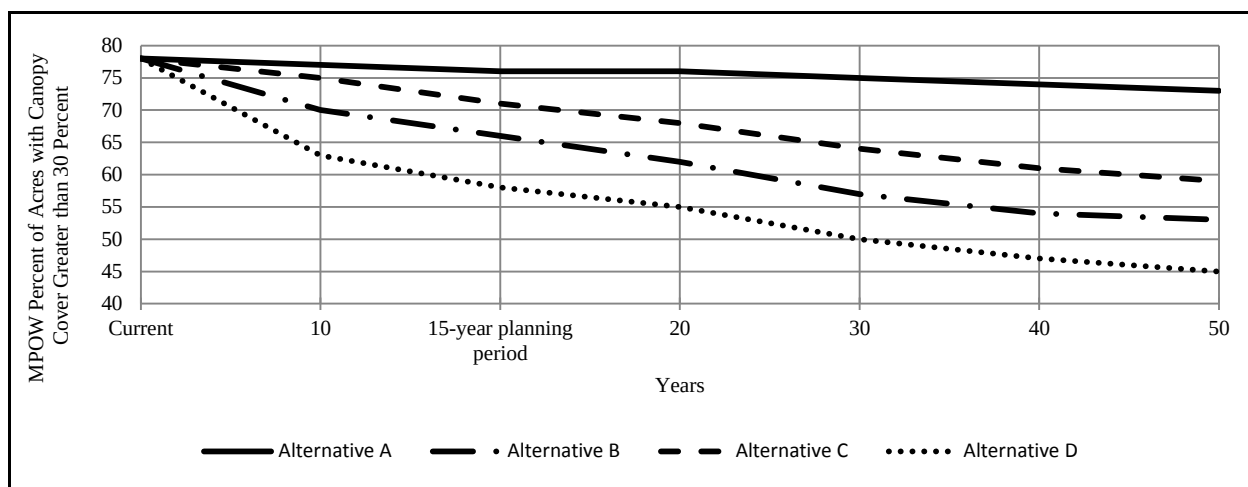


Figure 27. Percent of Madrean pine-oak woodland PNVT acres with woody canopy cover greater than 30 percent over a 50-year timeframe, based on the proposed average acre treatment objectives for alternatives B, C and D, and alternative A

As a result of canopy cover reductions through thinning with periodic fire on a regular basis, within this PNVT there should be some increase in understory plant cover, richness, diversity, and heterogeneity. With expected increases in herbaceous plant vigor through decreased competition for sunlight and moisture, and more rapid nutrient cycling by fire there could be greater herbage growth. Current average herbaceous cover ranging from 6-35 percent and average estimated production ranging from 100-155 pounds per acre have the potential to increase by as much as 43 and 79 percent for cover and production, respectively (table 48). Given the opportunity to respond to overstory canopy reduction, the existing understory state of affairs where low and moderately-low ecological conditions or very-poor and poor range conditions occur on more than 100,000 acres, should enable some movement to higher ecological levels and closer to DCs.

Table 77. Comparisons, based on the proposed average acre treatment objectives for alternatives B, C and D, and alternative A, by the end of the 15-year planning period and the 50-year modeling period, of the percentage and acreage changes in closed woody canopy cover¹ within the historically open woodland (Madrean pine-oak woodland [MPOW] and piñon-juniper woodland [PJW]) PNVTs, and very open grassland (Great Basin grassland [GBG] and semi-desert grassland [SDG]) PNVTs on the A-SNFs

Percent and Acreage Display the Amount of Change within Each PNVT that has Closed Woody Canopy Cover Greater than 30 Percent in Woodland and Greater than 10 Percent in Grassland				
Years	(arrows indicate direction of change in woody canopy cover; ↑ increase, ↓ decrease, or ↔ no change)			
	alternative A	proposed average treatment objectives		
		alternative B average	alternative C average	alternative D average
Madrean pine-oak woodland PNVT current conditions: 394,927 acres of which 78% or 308,043 acres with woody canopy cover > 30%				
15	3%↓ (300,145 acres)	15%↓ (260,652 acres)	8%↓ (282,373 acres)	25%↓ (231,032 acres)
50	6%↓ (288,297 acres)	33%↓ (207,337 acres)	24%↓ (233,007 acres)	42%↓ (177,717 acres)
Piñon-juniper woodland PNVT current conditions: 222,166 acres of which 22% or 48,877 acres with woody canopy cover > 30%				
15	82%↑ (88,866 acres)	52%↑ (74,426 acres)	61%↑ (78,869 acres)	32%↑ (64,428 acres)
50	191%↑ (142,186 acres)	116%↑ (105,529 acres)	145%↑ (119,970 acres)	70%↑ (83,312 acres)
Woodland total current conditions (MPOW+PJW): 617,093 acres of which 58% or 356,920 acres with woody canopy cover > 30%				
15	9%↑ (389,011 acres)	6%↓ (335,077 acres)	1%↑ (361,242 acres)	17%↓ (295,460 acres)
50	21%↑ (430,483 acres)	12%↓ (312,866 acres)	1%↓ (352,977 acres)	27%↓ (261,029 acres)
Great Basin grassland current conditions: 185,523 acres of which 89% or 165,190 acres with woody canopy cover > 10%				
15	5%↓ (157,757 acres)	63%↓ (61,223 acres)	7%↓ (153,984 acres)	57%↓ (70,499 acres)
50	2%↓ (162,647 acres)	56%↓ (73,282 acres)	8%↓ (152,129 acres)	58%↓ (69,571 acres)
Semi-desert grassland current conditions: 106,952 acres of which 79% or 84,492 acres with woody canopy cover > 10%				
15	6%↑ (89,840 acres)	16%↓ (70,588 acres)	4%↑ (87,701 acres)	16%↓ (70,588 acres)
50	19%↑ (100,535 acres)	30%↓ (59,358 acres)	16%↑ (98,398 acres)	30%↓ (59,358 acres)
Grassland total current conditions (GBG+SDG): 292,475 acres of which 85% or 249,682 acres with woody canopy cover > 10%				
15	1%↓ (246,597 acres)	47%↓ (131,811 acres)	3%↓ (241,685 acres)	43%↓ (141,087 acres)
50	5%↑ (263,182 acres)	47%↓ (132,640 acres)	0%↔ (250,525 acres)	48%↓ (128,929 acres)

¹ Woody canopy closure classes are: 0 to < 10% is defined as very open canopy; 10 to ≤ 30% is defined as open canopy; and > 30% is defined as closed canopy. Under HRV and for DC Madrean pine-oak and piñon-juniper woodlands should exhibit open canopies (10 to ≤ 30% woody canopy cover). Under HRV and for DC Great Basin and semi-desert grasslands should exhibit very open canopies (0 to ≤ 10% woody canopy cover); grasslands, by definition, should not be dominated by woody species canopy cover. Therefore, the lower the amounts of closed woody canopy cover, the closer these four PNVTs are to their HRV and forest plan DCs

Piñon-juniper woodland: The majority of the piñon-juniper on the A-SNFs is naturally open canopy woodland and DCs are to have less than 28 percent (62,204 acres) of this PNVNT with closed woody canopy cover. Unfortunately, within the planning period all alternative proposed average acre treatment objectives produce an increase in closed canopy acres (figure 28). However, alternative D yields the smallest increase in closed canopy acres, from 48,877 to 64,428 acres, a 32 percent increase (table 77), and alternatives B, C and A follow with 52, 61, and 82 percent increases in closed canopy acres, respectively. By the end of the 50 year modeling period all alternatives have augmented closed canopy acres by as much as 70, 116, 145, and 191 percent for alternatives D, B, C, and A, respectively, from current conditions. It would appear that under all alternatives, insufficient acres would be treated within this PNVNT to achieve the DCs over time. At the proposed treatment rates it would take roughly 377, 79, 74, and 53 years for alternative A, B, C, and D, respectively, to treat the entire PNVNT; natural regeneration and growth maybe occurring at a greater rate than treatment removal. See Appendix I tables 4 and 6 for more information regarding changes in canopy cover for the proposed high and low acre treatment objectives by the end of the 15-year planning period and the 50-year modeling period for piñon-juniper.

As a result of canopy cover increases within this PNVNT there should be a decrease in understory plant cover, richness, diversity, and heterogeneity. With expected decreases in herbaceous plant vigor through increased competition for sunlight and moisture, and slower nutrient cycling by fire there should be less herbage growth. Current average herbaceous cover ranging from 17-37 percent and average estimated production ranging from 100-225 pounds per acre have the potential to increase by as much as 60 and 73 percent for cover and production, respectively (table 48). Overstory canopy increase will not facilitate movement of the existing understory situation where low and moderately-low ecological conditions occur on more than 192,000 acres, to higher ecological levels and closer to DCs.

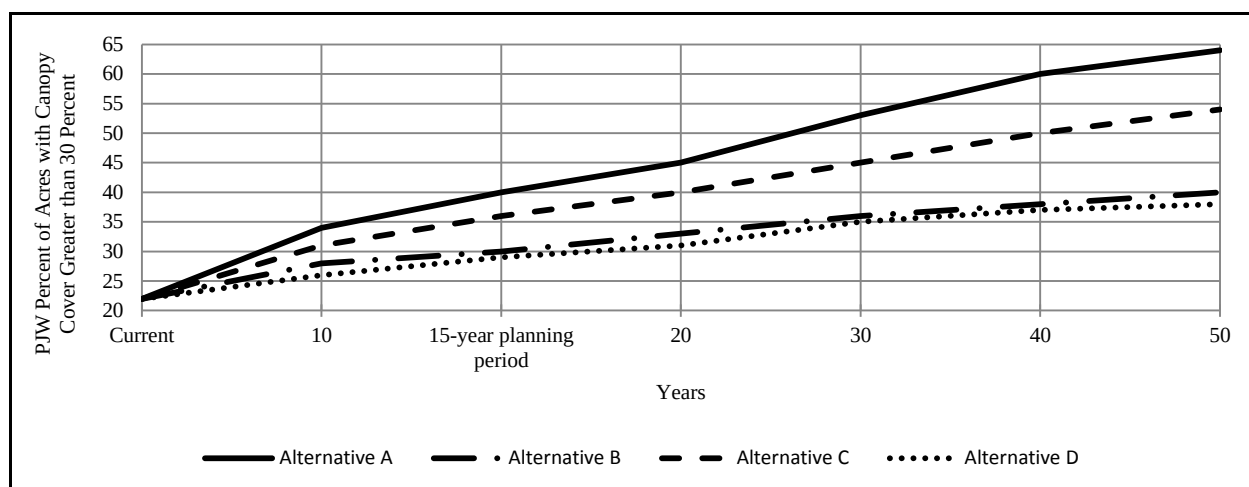


Figure 28. Percent of piñon-juniper woodland PNVNT acres with woody canopy cover greater than 30 percent over a 50-year timeframe, based on the proposed average acre treatment objectives for alternatives B, C and D, and alternative A

When combining Madrean pine-oak and piñon-juniper woodlands' canopy changes, alternative D results in the greatest overall reduction (17%) by the end of the 15-year planning period, and the 50-year modeling period (27%). Alternative B also results in a woody canopy cover reduction by 6% and 12% by the end of the 15-year planning period, and the 50-year modeling period, respectively. Alternative A would result in the greatest overall increases in woody canopy cover by the end of the 15-year planning period, and the 50-year modeling period; 9% and 21%, respectively. Alternative C also results in woody canopy cover increase (1%) by the end of the 15-year planning period, and a decrease (1%) by the end of the 50-year modeling period.

Grassland PNVTs Woody Overstory/Herbaceous Understory Relationship

Grasslands by definition are those areas on which the vegetation is dominated by grasses, grass-like plants and/or forbs (Anderson, 2012) and are maintained in this condition by natural successional processes, primarily driven by drought and fire. Grasslands should not have a woody species component that contributes greater than 10 percent of the overall canopy cover. Herbaceous vegetation provides critical soil cover as well as hiding cover and shelter for small wildlife. In addition, open grasslands have the potential to produce from 6 to 110 times the herbaceous biomass per acre as adjacent forested areas (Laing et al., 1989).

Great Basin grassland: Great Basin grassland is naturally an open herbaceous vegetation dominated PNVT and DCs are to have less than 22 percent (40,815 acres) of this PNVT with closed woody canopy cover. Within the planning period all alternative proposed average acre treatment objectives produce reductions in woody canopy acres (figure 28); however, alternative B reduces the woody canopy cover on the greatest number of acres, from 165,190 to 61,223 acres, a 63 percent reduction (table 77); alternative D follows with a 57 percent reduction in closed canopy cover. During the same period, under alternatives A and C closed woody canopy acres are reduced by five and seven percent, respectively. By the end of the 50-year modeling period all alternative proposed average acre treatment objectives produce reductions in woody canopy acres (figure 29); however, alternative D reduces the woody canopy cover on the greatest number of acres, from 165,190 to 69,571 acres, a 58 percent reduction (table 67); alternative B follows with a 56 percent reduction in closed canopy cover. During the same period, under alternatives A and C closed woody canopy acres are reduced by two and eight percent, respectively. It appears that under alternatives A and C insufficient acres would be treated within this PNVT to achieve the DCs over time. It also appear that around 40 years management actions under alternatives B and D would need to change in order to continue to reduce closed woody canopy acres. See Appendix I tables 4 and 6 for more information regarding changes in canopy cover for the proposed high and low acre treatment objectives by the end of the 15-year planning period and the 50-year modeling period for Great Basin.

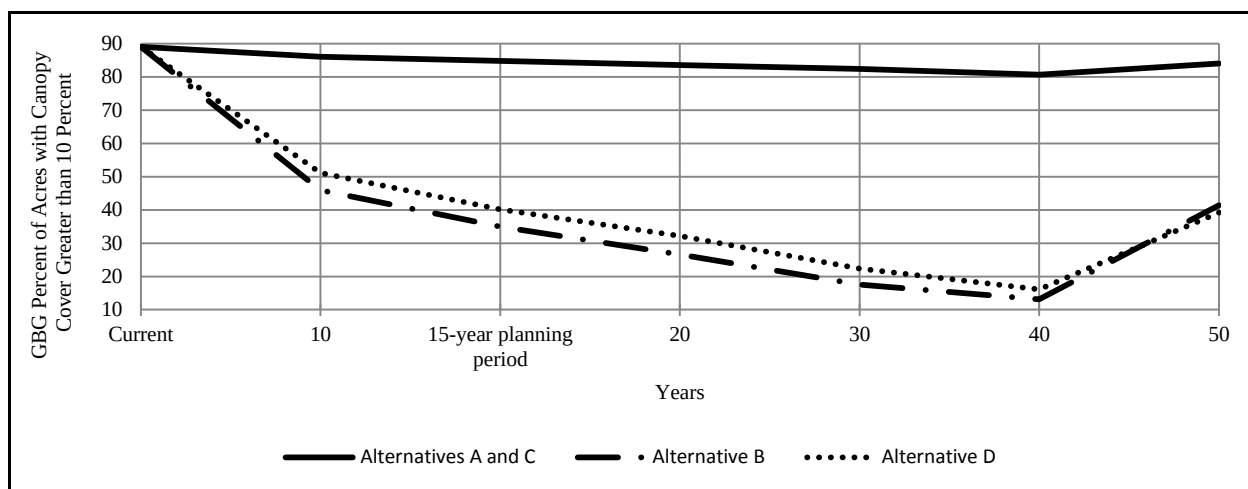


Figure 29. Percent of Great Basin grassland PNVT acres with woody canopy cover greater than 30 percent over a 50-year timeframe, based on the proposed average acre treatment objectives for alternatives B, C and D, and alternative A

As a result of woody canopy cover elimination through mechanical thinning and introduction of periodic fire on a regular basis, within this PNVT there should be an increase in understory plant cover, richness, diversity, and heterogeneity. With expected increases in herbaceous plant vigor through decreased competition for sunlight and moisture, and more rapid nutrient cycling by fire there could be greater herbage growth. Current average herbaceous cover ranging from 23-45 percent and average estimated

production ranging from 260-440 pounds per acre have the potential to increase by as much as 46 and 66 percent for cover and production, respectively (table 48). Overall, woody overstory canopy elimination should facilitate movement of the existing understory situation where low and moderately-low ecological conditions occur on more than 160,000 acres, to higher ecological levels and closer to DCs.

Semi-desert grassland: Semi-desert grassland is naturally an open herbaceous vegetation dominated PNV and DCs are to have less than 10 percent (10,695 acres) of this PNV with closed woody canopy cover. By the end of the 15-year planning period both alternatives B and D proposed average acre treatment objectives produce reductions in closed woody canopy acres (figure 30) from 84,492 to 70,588 acres, a 16 percent reduction (table 77), however, during the same period, under both alternatives A and C closed woody canopy acres increase by six and four percent, respectively. By the end of 50-year modeling period both alternatives B and D have reduced closed woody canopy acres by 30 percent, while during the same period, under alternative A and C closed woody canopy acres increased by an additional 19 and 16 percent, respectively, from current conditions. It appears that under all alternatives insufficient acres would be treated within this PNV to achieve the DCs over time. See Appendix I tables 4 and 6 for more information regarding changes in canopy cover for the proposed high and low acre treatment objectives by the end of the 15-year planning period and the 50-year modeling period for semi-desert.

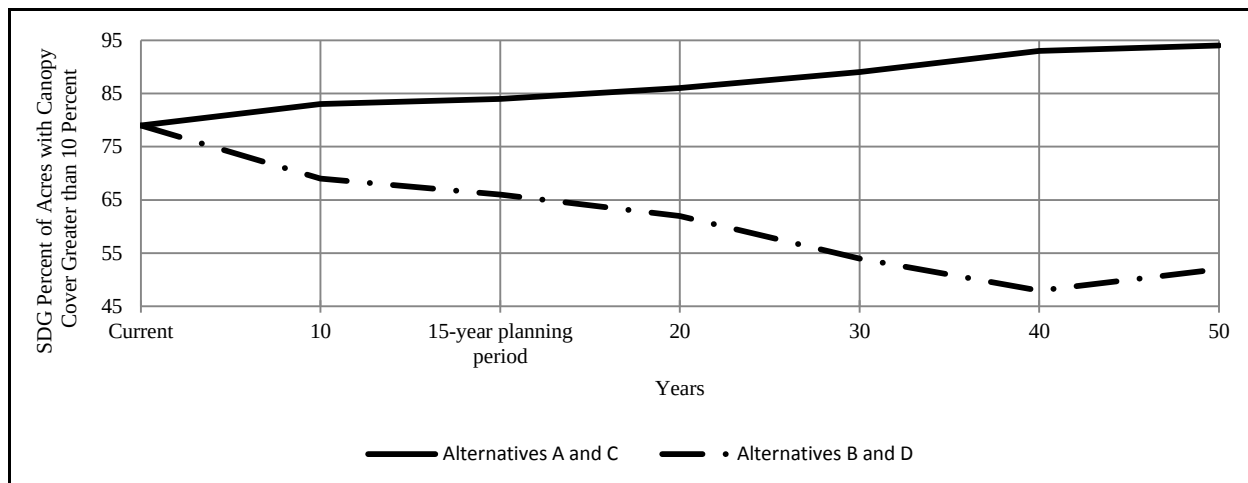


Figure 30. Percent of semi-desert grassland PNV acres with woody canopy cover greater than 30 percent over a 50-year timeframe, based on the proposed average acre treatment objectives for alternatives B, C and D, and alternative A

As a result of woody canopy cover elimination through the introduction of periodic fire on a regular basis within this PNV, under alternatives B and D there should be an increase in understory plant cover, richness, diversity, and heterogeneity. With expected increases in herbaceous plant vigor through decreased competition for sunlight and moisture, and more rapid nutrient cycling by fire there could be greater herbage growth. Current average herbaceous cover ranging from 7-16 percent and average estimated production ranging from 50-105 pounds per acre have the potential to increase by as much as 56 and 89 percent for cover and production, respectively (table 48). Overall, woody overstory canopy elimination should facilitate movement of the existing understory situation where low and moderately-low ecological conditions occur on more than 44,800 acres, to higher ecological levels and closer to DCs.

When combining Great Basin and semi-desert grasslands' closed woody canopy acre changes (table 77), alternative B results in the greatest overall reduction (47%) by the end of the 15-year planning period, however, by the end of the 50-year modeling period alternative D results in the greatest overall reduction (48%). Both alternatives A and C result in a slight (1% and 3%, respectively) decrease in closed woody canopy cover acres by the end of the 15-year planning period, however by the end of the 50-year

modeling period the number of acres of closed woody canopy cover have increased for alternative A by five percent, while under alternative C they are the same as current conditions.

In summary, for a complete display of the tabular summations of the 15-year planning period and the 50-year modeling period comparisons of the environmental consequences to the vegetation indicators between the proposed high, average, and low acre treatment objectives for alternatives B, C, and D, and alternative A see Appendix G tables 1 through 6, for the alternative with the greatest overall contribution to the movement toward DC and HRV and all other indicator variables by the end of the 15-year planning period and the 50-year modeling period under the proposed high acre treatment objectives is alternative D, followed by alternative B, then alternative C, and lastly by alternative A.

For the proposed average acreage treatment objectives the alternative with the greatest overall contribution to the movement toward DC and HRV and all other indicator variables by the end of the 15-year planning period under is alternative B, followed by alternative D, then alternative C, and lastly by alternative A. However, for the proposed average acreage treatment objectives the alternative with the greatest overall contribution to the movement toward DC and HRV and all other indicator variables by the end of the 50-year modeling period under is alternative D, followed by alternative B, then alternative C, and lastly by Alternative A.

For the proposed low acreage treatment objectives the alternative with the greatest overall contribution to the movement toward DC and HRV and all other indicator variables by the end of the 15-year planning period and the 50-year modeling period under the proposed low acre treatment objectives is alternative B, followed by alternative D, then alternative C, and lastly by Alternative A.

Climate Change

Refer to appendix A in the Apache-Sitgreaves National Forests Proposed Land Management Plan for a more in-depth discussion of this topic.

Plant biogeography is principally governed by climate, exhibiting strong responses with both temperature and precipitation (Richardson et al., 2012). Native plants and animals of the Southwest have adapted to cope with and survive the harsh and variable climate conditions that are characteristic of this region (Robles and Enquist, 2010). However, eighty percent of the habitats in the Southwest have warmed over the last 55 years; some have warmed twice as fast as others (Karl et al., 2009; Robles and Enquist, 2010; Beschta et al., 2013). In addition, plants and animals in this arid region already live near their physiological limits for water and temperature stress (Archer and Predick, 2008). Therefore, even slight changes in temperature and moisture or a change in the scale and frequency of extreme climatic events could significantly alter the composition, abundance and distribution of species. According to Archer and Predick (2008), there is broad consensus among climate models that the arid regions of the southwestern U.S. will become drier in the 21st century and that the transition to a more arid climate is already underway. The effects of climate change could be particularly profound for native fishes and aquatic ecosystems of the Rocky Mountains and Arizona-New Mexico Mountains because those systems often lack resilience and are strongly dependent on temperature and stream flow regimes that are already documented to be changing (Riemann and Isaak 2010). Thus, the responsiveness of species to recent and past climate change raises the possibility that anthropogenic climate change could act as a major cause of extinctions in the near future (Thomas et al., 2004). The importance of climate change on and its potential effects to natural systems is extremely important for the proper management of the A-SNFs; ecosystems, and biological diversity and the services they support, are intrinsically dependent on climate (Staudinger et al., 2012a). And forests influence atmospheric composition and climate significantly because they act as important sources and sinks of trace gases and energy, both locally and regionally (Misson et al.,

2007). According to Staudinger et al. (2012a), climate change will have significant bearing on the following:

- Biological diversity (Staudinger et al., 2012b)
- Ecosystem structure and functioning (Grimm et al., 2012)
- Ecosystem services (Kareiva et al., 2012)
- Already stressed biological diversity, ecosystems, and ecosystem services (Staudt et al., 2012)

According to Springer (2014), stability is the natural ability of a system to return to equilibrium after a temporary disturbance; the more rapidly it returns and the less it fluctuates, the more stable²⁵ it is. Promoting resilience²⁶ is the strategy most often recommended for adaptation (Hansen et al 2003; Folke et al., 2004; Peterson et al., 2011; Beschta et al., 2013). According to the USFS (2010), restoring and maintaining PNVT resilience will likely improve the potential for ecosystems to retain or return to DCs after being influenced by climate change related influences and variability. Managing for resistance²⁷ (e.g., maintenance thinning to prevent uncharacteristic fire, forest insect or disease epidemics) or resilience (e.g., invasive plant control), both traditional sustainability subjects, offer common ground and present opportunities for meaningful response to climate change. Of the themes of resistance or resilience identified by Millar et al. (2007), the following may be useful for planning:

- Manage for asynchrony²⁸, promoting diversity. Asynchrony can be achieved by promoting diverse age classes, species mixes, within-stand and across-landscape structural diversities, and genetic diversity
- Promote connected landscapes. Connectivity is also critical for preserving the ecological processes for evolutionary adaptations to climate change (Cowling and Pressey, 2001). The capacity to move (migrate) in response to changing climates has been key to adaptation and long-term survival of plants and animals in historical ecosystems
- Reset significantly disrupted animal and plant communities. For forests that have been significantly disturbed and are far outside historical ranges of variation, restoration treatments are often prescribed.

According to Benson and Garmestani (2011), emphasis is increasingly being placed on the resilience of ecological systems as the primary basis for sustainability (Walker et al., 2002; Chapin et al., 2009b). Particularly within the context of environmental change, natural resource managers are now raising the concept of resilience as a management goal (Federal Register, 2013). Modifying or resetting forest structure, towards desired (DC) and reference conditions (HRV), and restoring historic fire regime, should make these communities more resistant, and resilience, function more as they did historically, and provide the capability of and capacity for these systems to absorb disturbance and reorganize while undergoing change so as to retain essentially the same function, structure, identity, and feedbacks (Walker et al., 2004; Springer, 2014). This is very important in the uncertainty of climate prediction. The alternative that

²⁵ Stability is a measure of persistence in the face of disturbance. Two components of stability are resistance and resilience.

²⁶ Resilience is the capability and speed (Gunderson, 2000; Carpenter et al., 2001; Suding et al., 2004) of an ecosystem to endure disturbances and retain its structure and functions; the capacity of an ecosystem, which is subject to disturbance or change, to reorganize and renew itself (Federal Register, 2013) while retaining or exhibiting essentially the same function, structure, feedbacks and identity (Hollings, 1973; Heitschmidt and Stuth, 1991; Springer, 2014).

²⁷ Resistance is the ability of the community to avoid displacement when a given type, frequency or magnitude of disturbance occurs (Begon et al., 1996), and the amount of change or disruption (or management perturbation) that can be absorbed before processes change that control the structure and behavior of a system (Gunderson, 2000; Carpenter et al., 2001; Suding et al., 2004).

²⁸ Asynchrony in the general meaning, is the state of not being synchronized. In this usage, asynchrony refers to the promotion of diversity by managing for a range of conditions, occurring at different times, within a given ecosystem.

makes the most progress towards these two DCs will provide the best resiliency and adaptation for all 14 of the PNVTs in the face of climate change. According to the CEICC (2008), a resilient ecosystem is one that can withstand a stress like pollution or rebuild after a major disturbance like a serious storm or fire. A resilient ecosystem can also cope with a drought or an unusually hot summer in ways that alter some aspects of ecosystem function but do not lead to a major shift in the type of ecosystem or the services it provides.

Climate change and ecosystems are intricately connected and impacts on one will often feedback to affect the other (Staudinger et al., 2012a). According to Spriggs et al. (2000), natural ecosystems are regulated by climate. Long-term or short-term climate variability may cause shifts in the structure, composition, functioning and process of ecosystems, particularly in the fragile boundaries of the semiarid regions. These areas already contain plants, insects, and animals highly specialized and adapted to the landscape. A changing climate of wetter, warmer winters and overall temperature increases would alter their range, type, and number throughout the Southwest and on the A-SNFs. Responding differently to shifts in climate, the somewhat tenuous balance among ecosystem components will also change because ecosystems are complex and their constituent species do not necessarily react to climate change at the same pace or in the same ways. As the health of the ecosystem is a function of water availability, temperature, carbon dioxide (CO₂), and many other factors, it is difficult to determine accurately the extent, type, and magnitude of ecosystem change under future climate scenarios. Yet, should vegetation cover and moisture exchanging properties of the land change, important local and regional climate characteristics such as light reflectivity, humidity, wind, and temperature will also change.

Climate scientists agree that human activities have led to elevated atmospheric concentrations of CO₂ and other greenhouse gases that cause global warming, and observed concentrations are projected to increase (NRC, 2012). Climate change can intensify the risk of ecosystem change for terrestrial and aquatic systems, affecting ecosystem composition, structure, function, and productivity (Collins and Larry, 2007; Vose et al., 2012). Climate change is not the only stress affecting ecosystems, and other stresses, like habitat loss, and pollution, complicate species' and ecosystems' ability to adapt to climate change. If effective adaptations to the adverse effects of climate change are to be accomplished on the A-SNFs, large-scale reductions or cessation of ecosystem stressors are crucial (Beschta et al., 2012).

Currently there appears to be broad agreement among most climate modelers that the southwestern United States is experiencing a warming and drying trend that will continue well into the later part of the 21st century (Sprigg et al., 2000). Climate models depict temperatures rising approximately 4° to 5° F by 2030 and between 7° to 12° F by 2090 (Seager et al., 2007). Many researchers have identified the types of ecological change that could be attributed as an effect of climate change. These include species population declines (e.g. drought induced mortality), changes in phenology, shifts in distribution in either elevation or latitude, and increases in invasive species (native and non-native) (Parmesan and Yohe, 2003; Root et al., 2003; Allen, 2009; Vose et al., 2012).

The potential ecological implications of climate change trends in the Southwest and on the A-SNFs also include:

- Increasing large-wildfire frequency, longer wildfire durations, and longer wildfire seasons (Westerling et al., 2006),
- More extreme disturbance events, intense rain and floods, wind events, drought, epidemic insect and disease outbreaks, etc. (Swetnam et al., 1999; GAO, 2007; Lenart, 2007; Deal et al., 2010; Williams et al., 2010; Vose et al., 2012; among others)
- Long-term shifts in vegetation patterns (Perry and Borchers, 1990; Parton et al., 1994; Westerling et al., 2006; GAO, 2007; Millar et al., 2007; Backlund et al., 2008; Deal et al., 2010; Vose et al.,

2012; Zhu and Reed, 2012; Richardson et al., 2012; among others), and shifts in species distributions (Root et al., 2003; Thomas et al., 2004; GAO, 2007; Jetz et al., 2007; La Sorte and Thompson, 2007; McCain, 2007; Backlund et al., 2008; Vose et al., 2012; Brantley and Ford, 2012; among others)

- Increased desertification (Emanuel et al., 1985a and 1985b; Schlesinger et al., 1990; Le Houérou, 1996; Lavee et al., 1998; Lal, 2001; Scheffer et al., 2001; UNCCD, 2007 and 2014; among others), with accompanying altered patterns of aboveground net primary production and plant biomass (Huenneke et al., 2002; House et al., 2003), and biogeochemistry (Hibbard et al., 2003)
- Changes in the timing and synchronization of seasonal plant, animal and insects life history events (Brown et al., 1999; Root et al., 2005; Parmesan, 2006 and 2007; Svoma, 2011; among others)
- Alterations in animal plant interactions (Martin and Maron, 2012; Forcada and Hoffman, 2014), and insect plant interactions (Brantley and Ford, 2012)
- Declines in species populations (Pounds et al., 2006; Martin, 2007; Hunter et al., 2010; Forcada and Hoffman, 2014; among others)
- Reduced precipitation (water-limited) will act as a limiting factor to overall forest health (USFS, 2005; Vose et al., 2012), and changes in forest structures and compositions, with transition of forests in the southwestern U.S. (Williams et al., 2012)
- Effects of forest diseases on forest ecosystems will change and potentially decrease the ability of forests to provide goods and services (Sturrock et al., 2011)
- Declines in forest productivity and tree survival as a result of amplified water limitations due to drought (Deal et al., 2010; Vose et al., 2012; Williams et al., 2012) and heat induced mortality (Allen et al., 2010)
- Declines in stream system discharge (Serrat-Capdevila et al., 2007; Miller et al., 2010), and reduced streamflows in the Southwest (Barnett et al., 2008), this is particularly profound for native fish and aquatic ecosystems (Rieman and Isaak, 2010)
- Shifts in the timing of snowmelt (Westerling et al., 2006; GAO, 2007; Barnett and Pierce, 2009), along with increases in summer temperatures, have serious implications for the survival of fish species and may challenge efforts to reintroduce species into their historic range (Joyce et al., 2006; Millar et al., 2007; Rieman and Isaak, 2010)
- Increasing temperatures, water shortages, and changing ecological conditions will likely affect biological diversity, and put pressure on wildlife populations, distribution, viability, habitat and migration patterns (Finch et al., 2012). There may also be more vulnerability from invasive plant and animal species (Deal et al., 2010; Runyon et al., 2012)
- The importance of snow, uncertain climate change impacts on snow, and mediation of snow by interacting with environment dependent factors in complex mountain terrain may pose substantial difficulties for understanding how these diverse vegetation communities may respond to future climate conditions (GAO, 2007; Vose et al., 2012; Zald et al., 2012)
- Shorter winters, and less snowpack, also affect the timing of natural cycles such as plant dormancy and blooming, and peak river-flows (Svoma 2011)
- Increased atmospheric CO₂ and N deposition will potentially alter physiological function and productivity of ecosystems, with considerable variation in response among species, vegetation types, ecosystem, and regions (Perry and Borchert, 1990; Parton et al., 1994; Vose et al., 2012; Zhu and Reed, 2012; among others)
- Decreased species' adaptation ability (Brantley and Ford, 2012; Richardson et al., 2012; Finch et al., 2012; Hunter et al., 2010; Forcada and Hoffman, 2014; among others), and potential for species extinction (Thomas et al., 2004; Hunter et al., 2010)

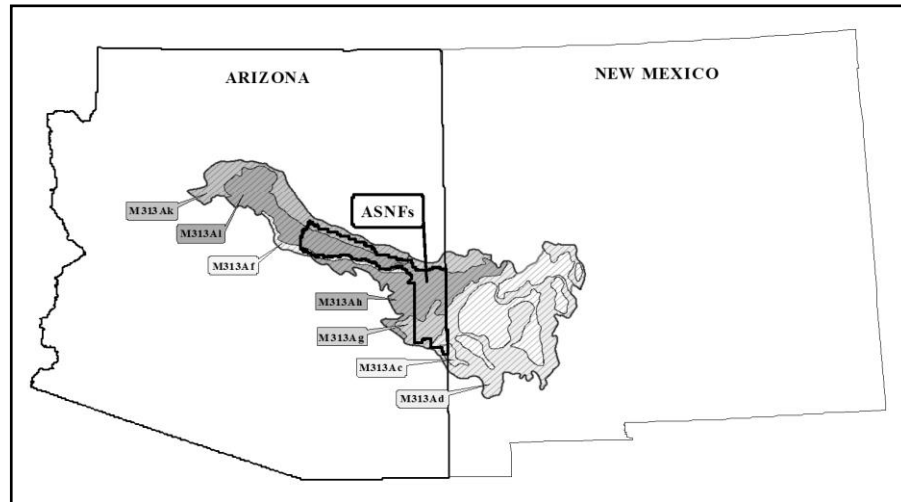
The extent to which shifts in vegetation structure lag behind climatic changes which drive them and the extent to which vegetation can ever be said to be in equilibrium with climate are largely unknown (Heitschmidt and Stuth, 1991). There is no perfect way to examine these complex ecological implications with the limited resources currently available. The risks are especially profound when coupled with the synergistic effects of land use change (Sala et al., 2000; Hansen et al., 2001; Root et al., 2003; Deal et al., 2010; Zhu and Reed, 2012; among others). Climate change is likely to exacerbate the effects of natural and altered disturbance regimes, including wildfire, insect outbreaks, flooding and erosion, across all A-SNFs' PNVTs and may prompt abrupt ecological changes. Resilience has limits. When a change exceeds those limits, or is coupled with other simultaneous changes that cause stress, the ecosystem undergoes a major change, often shifting to a fundamentally different ecosystem type occur (Gunderson and Pritchard, 2002), or an alternate state (Scheffer et al., 2001). This is particularly true in ecosystems such as grasslands (Scheffer et al., 2001), riparian areas (Rieman and Isaak, 2010), and woodlands and forests where the effects of past management and land use change have been substantial on the A-SNFs.

Ecological redundancy (the presence of multiple occurrences of ecological conditions such that not all occurrences may be eliminated by a catastrophic event (Proposed FSH 1909.12, Version—02/14/2013)) is practical because it enhances ecosystem resilience (Walker, 1995). According to Scheffer et al. (2001), recent studies show that a loss of resilience usually precedes a transition to an alternative state, possibly irreversible without extensive expenditures of time and money (Scheffer et al., 2001). This suggests that strategies for sustainable management of such ecosystems should focus on maintaining resilience. Resilient and redundant resource conditions provide reasonable assurances of the ability of these PNVTs to adapt to the uncertainties of potentially changing climate. Modifying current forest, woodland, and grassland vegetation composition and structure towards their DC and/or HRV and restoring historic ecological process regimes should make these PNVTs more functional, enabling them to be more resistant and resilient in the face of uncertain future climate shifts and disturbance events. The closer ecological composition, structure, and process are to their historic conditions, the more properly each vegetation type is functioning and the more secure dependent species (plants and animals) are within the associated habitats. This is especially important with potential changes in the climate. The alternative that best provides for the greatest moment towards DC and HRV and therefore, the greatest reduction in risk, within the planning period is Alternative B.

According to Deal et al. (2010), about 20 percent of human induced CO₂ emissions are due to land-use changes and deforestation, sustainable forest management can play an important role in climate mitigation. Re-establishing the ecological processes and patterns necessary to make these terrestrial ecosystems sustainable, resilient, and healthy under proposed restoration alterations and future climatic conditions is of primary importance to their continued existence or evolutionary ability to adapt. One obvious means of slowing the release of sequestered C is to increase forest resistance to fire, drought, and disease, usually by reducing the density of small trees (Millar et al., 2007). Based on this analysis, when assessing each alternatives combined contribution toward achieving DCs (i.e., modeled movement toward DC/reference conditions, acres old/large trees, snags/acre, coarse woody debris, aspen retention, overstory/understory) the alternative that best provides for the greatest moment towards DC and HRV is Alternative B. Alternative B results in the greatest reduction in risk, and the greatest increases in resistance and resilience, and adaptive capacity of these PNVTs to absorb disturbances and reorganize while undergoing change so as to still retain essentially the same function, structure, identity, and feedback, within the planning period. The other alternatives rank in order of most contribution after Alternative B as follows: Alternatives D, C and A, respectively.

Cumulative Environmental Consequences

Numerous national forests within Arizona and New Mexico are revising, or preparing to revise their forest plans. These plans may emphasize vegetation treatments that change the PNVTs vegetation composition and structure. Neighboring national forests, tribal, state, and BLM lands are also conducting vegetation treatments within vegetative communities very similar to those found on the A-SNFs (map 17). These efforts would contribute to landscape restoration, overall change in movement toward HRV and DC, and a reduction in uncharacteristic wildfire across the broader landscape and contributing to the resiliency of these PNVTs.



Map 17. A-SNFs in context to the land areas of the White Mountains-San Francisco Peaks-Mogollon Rim ecoregion section in context within Arizona and New Mexico

Some of the reasonably foreseeable projects occurring within the White Mountains-San Francisco Peaks-Mogollon Rim M313A ecoregion section (map 16) include the following:

1. Mechanical Vegetation Treatments (restoration/biomass/wildland urban interface (WUI) treatments)

- Reasonably foreseeable mechanical treatments that may impact the composition, structure, and function of vegetation. Various activities including commercial harvesting, pre-commercial thinning, site preparation, wood cutting, and natural and artificial regeneration occurring on the State lands, Fort Apache and San Carlos Indian Reservations, Bureau of Land Management, Coconino, Gila, and Tonto NFs. The amounts and timing of these treatments are unknown
- The Four-Forest Restoration Initiative (4FRI) is a planning effort designed to restore forest resiliency and function across four National Forests in Arizona including the Coconino, Kaibab, A-SNFs, and Tonto NFs. Due to the size of the landscape involved, at least two environmental analyses will be conducted. The first environmental analysis focuses on the Coconino NF and Kaibab NF with a project area totaling approximately 988,764 acres. Within the 988,764 acre project area, the Forest Service is preparing an environmental impact statement (EIS) that proposes to conduct restoration activities on approximately 600,000 acres on the Coconino NF and Kaibab NF. Of this total, approximately 361,379 acres would be treated on the Coconino NF and 233,991 acres would be treated on the Kaibab NF. The objective of the project is to re-establish forest structure, pattern, and composition, which will lead to increased forest resiliency and function. Resiliency increases the ability of the ponderosa pine forest to survive natural disturbances such as insect and disease, fire, and climate change. Treatments include a range of both mechanical and fire treatments. There are also road (opening of temporary and closed roads, reconstruction, decommissioning) and aquatic restoration treatments. (Source: final refined Proposed Action for Four-Forest Restoration Initiative, August 2011). If successful, this effort

could decrease susceptibility to large and uncharacteristic disturbances, increase water yields from winter snowfall through the creation of interspaces, and provide long-term carbon sequestration in large old trees at a scale meaningful to improving the resiliency and ability to adapt to climate change in the ponderosa pine type of the Southwest. The Gila NF is also managing for improved ecosystem health, movement toward reference conditions, and the reduction of fire risk.

- The White Mountain and San Carlos Apache Tribes also continue to manage their lands for multiple resource purposes. Management within these lands has been directed at reducing fire risks.

2. Planned and Unplanned Ignitions

- Both planned (prescribed) and unplanned (wildfire) ignitions are expected to continue as management strategies on adjacent lands including Fort Apache Indian Reservation, Bureau of Land Management, Coconino, Gila, and Tonto NFs. The amounts and timing of these fires are unknown.

3. Fire Suppression Activities

- Fire suppression actions are expected to continue on adjoining lands: local municipalities, Fort Apache Indian Reservation, Bureau of Land Management, Coconino, Gila, and Tonto NFs. The amounts and timing of these activities are variable and based on occurrence and behavior of wildfire.

4. Treatments of Invasive Species

- Arizona Game and Fish Department's plan emphasizes programs to eliminate or limit the spread of invasive plants and animals.
- Coconino NF management strategy is to prevent any new noxious weeds from being established. Tonto NF identifies noxious weed treatment on their SOPA.
- Agreement in place with ADOT to minimize spread of noxious weeds. NEPA in place for ADOT treatment of invasive and hazardous vegetation along highways within Arizona national forests.

In summary, the sum of past management actions over time has resulted in the departure of most PNVTs from their characteristic vegetation states on and around the A-SNFs. These departures are largely due to fire suppression, in conjunction with past, unsustainable timber and livestock grazing practices, and other anthropogenic disturbances of natural processes. It has resulted in a dramatic increase in stand-replacing fires, particularly since the mid-1990s, decreases in water yields, degradation of aspen stands, and woody species encroachment of grasslands with resultant loss of species diversity, and resulted in the priority needs for change identified for forest plan revision. Departures from reference conditions exist in all vegetation types on the forest, and most continue to trend further from reference conditions.

The cumulative environmental consequences of proposed management under all alternatives in the context of the larger ecoregion would contribute to the movement of vegetation towards DCs. These efforts would contribute to landscape restoration, control of invasive species, a reduction in uncharacteristic wildfire across the broader landscape, and the resiliency of these PNVTs to adapt to climate change.

Unavoidable Adverse Impacts

The land management plan provides a programmatic framework that guides site-specific actions but does not authorize, fund, or carryout any project or activity. Before any ground-disturbing actions take place, they must be authorized in a subsequent environmental analysis. Therefore none of the alternatives cause

unavoidable adverse impacts. Mechanisms are in place to monitor and use adaptive management principles in order to help alleviate any unanticipated impacts that need to be addressed singularly or cumulatively.

Adaptive Management

All alternatives assume the use of adaptive management principles. Forest Service decisions are made as part of an on-going process. The land management plan identifies a monitoring program. Monitoring the results of actions will provide a flow of information that may indicate the need to change a course of action or the land management plan. Scientific findings and the needs of society may also indicate the need to adapt resource management to new information

The changes in departure from DC and HRV resulting from A-SNFs' proposed plan restoration efforts that primarily affect forest structure (distribution of size classes, canopy cover, and storiedness) will be observed. With monitoring and future updates to plan direction, the actual treatments applied over the course of the planning period (15 years) may be adjusted to reflect the consequences of prior treatments. Any changes in management should be made to adjust the trajectory of trend towards PNV DC and/or HRV. The A-SNFs has provided the adaptive framework to deal with impacts from climate change – “resilient and redundant resource conditions provide reasonable assurance of the ability to adapt to a changing climate.”

Consistency with Law, Regulation, and Policy

All alternatives are designed to guide A-SNFs' management activities in meeting federal law, regulations, and policy.

Irreversible and Irretrievable Commitment of Resources

As mentioned above, the land management plan provides a programmatic framework and does not authorize, fund, or carryout any project or activity. Because of this the land management plan does not authorize or mandate any ground-disturbing actions, none of the alternatives cause an irreversible or irretrievable commitment of resources.

Other Planning Efforts

There are no are potential conflicts between the proposed action and the objectives of Federal, regional, State, local, or Tribal land use plans, policies, and controls for the area concerned?

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Appendices

**Appendix A - Terrestrial Ecosystem Survey Map Unit Make-up of Each PNVT
with Maps Displaying the Spatial Arrangement of the PNVTs on the Apache-
Sitgreaves National Forests**

Terrestrial Ecosystem Survey (TES) map units (Laing et al., 1987) were used as the foundational bases for the delineation of the potential natural vegetation types on the A-SNFs. Mapping was done at a scale of 1:24000 (roughly a 10 acre minimum polygon size); the bases of map unit delineations were differences in topography, geology, vegetation, and climate class. Because of the complexity of the A-SNFs, map units contain various combinations of soils, miscellaneous land types and vegetation communities (for more information, see the Soils Specialist Report). Appendix A tables 1 and 2 display the map unit contribution to each PNVT. Appendix A maps 1 and 2 display the spatial arrangement of the PNVTs on the A-SNFs.

Appendix A table 1. Terrestrial Ecosystem Survey map unit make-up of each PNVT on the A-SNFs for ponderosa pine, wet mixed conifer, dry mixed conifer and spruce-fir forests, Madrean pine-oak and piñon-juniper woodlands, and interior chaparral PNVTs. Map units are arranged from greatest contributor to the least (acres and percent [if greater than or equal to 0.5%])

Apache-Sitgreaves National Forests' Potential Natural Vegetation Types (PNVTs)																				
forested PNVTs									woodland PNVTs									chaparral PNVT		
ponderosa pine			wet mixed conifer			dry mixed conifer			spruce-fir			Madrean pine-oak			piñon-juniper			interior		
TES MU	acres	percent	TES MU	acres	percent	TES MU	acres	percent	TES MU	acres	percent	TES MU	acres	percent	TES MU	acres	percent	TES MU	acres	percent
537	71,315	11.8	565	38,990	21.9	189	21,194	14.3	585	12,692	71.8	130	97,297	24.6	051	82,029	36.9	732	45,509	81.3
192	48,843	8.1	574	35,795	20.1	572	20,589	13.9	586	4,930	27.9	514	43,331	11.0	052	29,489	13.3	714	5,346	9.6
532	40,937	6.8	583	24,356	13.7	565	17,817	12.0				612	36,952	9.4	503	24,623	11.1	720	3,566	6.4
182	37,421	6.2	577	22,512	12.6	206	14,436	9.8				412	36,443	9.2	523	22,484	10.1	618	1,560	2.8
538	35,095	5.8	576	12,335	6.9	673	13,663	9.2				632	32,401	8.2	504	17,905	8.1			
183	33,531	5.6	690	11,939	6.7	574	13,530	9.1				131	28,215	7.1	516	15,873	7.1			
196	33,178	5.5	667	10,163	5.7	561	13,295	9.0				573	15,249	3.9	178	15,335	6.9			
197	31,466	5.2	201	7,919	4.4	202	12,573	8.5				691	12,408	3.1	061	6,623	3.0			
193	30,241	5.0	203	6,916	3.9	672	12,311	8.3				620	11,788	3.0	055	6,042	2.7			
191	29,790	4.9	584	4,841	2.7	567	8,478	5.7				634	10,920	2.8	540	1,756	0.8			
179	28,934	4.8	207	2,228	1.3							512	10,043	2.5						
181	27,511	4.6										624	9,989	2.5						
199	18,261	3.0										236	9,415	2.4						
187	17,421	2.9										575	8,904	2.3						
543	16,989	2.8										630	8,008	2.0						
186	16,598	2.8										560	6,836	1.7						
650	15,633	2.6										432	6,706	1.7						
535	12,904	2.1										638	6,240	1.6						
140	10,859	1.8										601	2,662	0.7						
628	9,425	1.6																		
592	8,616	1.4																		
591	8,315	1.4																		
536	5,646	0.9																		
141	5,296	0.9																		
570	4,607	0.8																		
27¹	598,832	99.4	11	177,995	100	10	147,885	100	4²	17,622	99.7	20³	393,808	99.7	11⁴	222,159	100	4	55,981	100

¹ Only 25 TEU MUs are listed; 2 TEU MUs (505 and 534) are not displayed because they each contribute < 0.5% to the total acreage of the 602,206 acre PPF PNVT (for a combined total of 0.6%, or 3,374 acres)

² Only 2 TES MUs are listed; 2 TEU MUs (565 and 574) are not displayed because they each contribute < 0.5% to the total acreage of the 17,667 acre SFF PNVT (for a combined total of 0.3%, or 48 acres)

³ Only 19 TEU MUs are listed; 1 TEU MU (224) is not displayed because it contributes < 0.5% to the total acreage of the 394,297 acre MPOW PNVT (for a total of 0.3%, or 1,119 acres)

⁴ Only 10 TES MUs are listed; 1 TEU MU (181) is not displayed because it contributes < 0.5% to the total acreage of the 222,166 acre PJW PNVT (for a total of 0.003%, or 7 acres)

Appendix A table 2. Terrestrial Ecosystem Survey map unit make-up of each PNVT on the A-SNFs for Great Basin, semi-desert and montane/subalpine grasslands, wetland/cienega riparian areas, and cottonwood-willow, mixed broadleaf deciduous and montane willow riparian forests PNVTS. Map units are arranged from greatest contributor to the least (acres and percent [if greater than or equal to 0.5%])

Apache-Sitgreaves National Forests' Potential Natural Vegetation Types (PNVTs)																				
grassland PNVTS						riparian areas PNVT						riparian forested PNVT								
Great Basin			semi-desert			montane/subalpine			wetland/cienega			cottonwood-willow			mixed broadleaf deciduous			montane willow		
TES MU	acres	percent	TES MU	acres	percent	TES MU	acres	percent	TES MU	acres	percent	TES MU	acres	percent	TES MU	acres	percent	TES MU	acres	percent
053	70,910	38.2	220	27,656	25.9	551	38,258	68.3	010	8,436	47.1	198	5,223	32.9	102	4,765	49.3	208	2,236	46.5
054	24,476	13.2	589	14,866	13.9	550	11,073	19.8	016	4,469	25.0	100	3,092	19.5	060	1,987	20.6	673	627	13.0
043	16,162	8.7	312	13,621	12.7	557	4,521	8.1	004	3,398	19.0	058	2,876	18.1	130	944	9.8	565	423	8.8
502	15,780	8.5	587	10,389	9.7	556	2,129	3.8	565	234	1.3	189	1,290	8.1	220	391	4.1	591	215	4.5
041	12,212	6.6	480	6,935	6.5				551	213	1.2	055	867	5.5	514	345	3.6	518	160	3.3
515	12,162	6.6	479	6,494	6.1				550	197	1.1	206	567	3.6	412	235	2.4	016	148	3.1
518	9,140	4.9	469	5,995	5.6				585	102	0.6	052	253	1.6	612	219	2.3	650	146	3.0
580	8,420	4.5	470	4,493	4.2				672	100	0.6	592	239	1.5	512	120	1.2	516	133	2.8
506	6,982	3.8	582	4,248	4.0				557	83	0.5	191	154	1.0	131	114	1.2	537	95	2.0
531	2,683	1.4	379	3,770	3.5							131	135	0.8	691	79	0.8	672	91	1.9
501	2,441	1.3	482	3,060	2.9							130	125	0.8	634	49	0.5	535	54	1.1
058	2,351	1.3	481	2,876	2.7							591	121	0.8	312	44	0.5	206	53	1.1
044	1,802	1.0	483	1,622	1.5							192	97	0.6				191	48	1.0
			484	925	0.9													574	47	1.0
																		585	40	0.8
																		638	40	0.8
																		690	36	0.8
																		537	30	0.6
																		557	27	0.6
																		197	24	0.5
13	185,523	100	14	106,952	100	4	55,981	100	34¹	17,231	96.3	51²	15,040	94.7	37³	9,292	96.2	39⁴	4,671	97.1

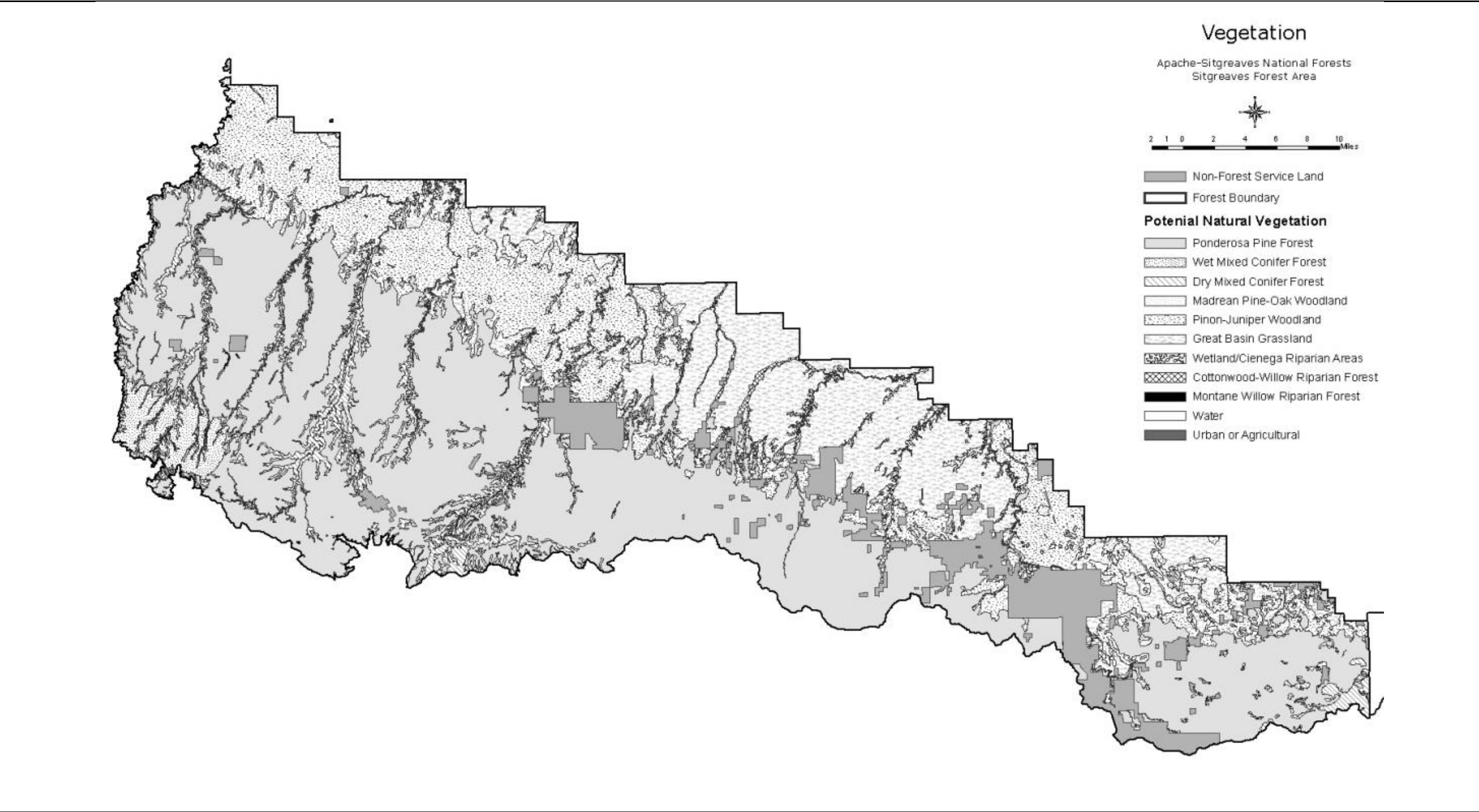
¹ Only 9 TEU MUs are listed; 25 TEU MUs (140, 197, 502, 515, 518, 523, 532, 535, 536, 537, 538, 502, 515, 523, 536, 538, 543, 556, 561, 572, 574, 576, 577, 583, 591, 592, 650, 667, 673 and 690) are not displayed because they each contribute < 0.5% to the total acreage of the 17,900 acre WCRA PNVT (for a combined total of 3.7%, or 669 acres)

² Only 13 TEU MUs are listed; 39 TEU MUs (041, 043, 044, 051, 053, 054, 140, 141, 179, 181, 182, 187, 193, 196, 199, 202, 203, 501, 502, 503, 504, 515, 516, 518, 523, 532, 535, 537, 538, 543, 550, 560, 565, 570, 624, 667, 732 and 999) are not displayed because they each contribute < 0.5% to the total acreage of the 15,876 acre CWRP PNVT (for a combined total of 5.3%, or 836 acres)

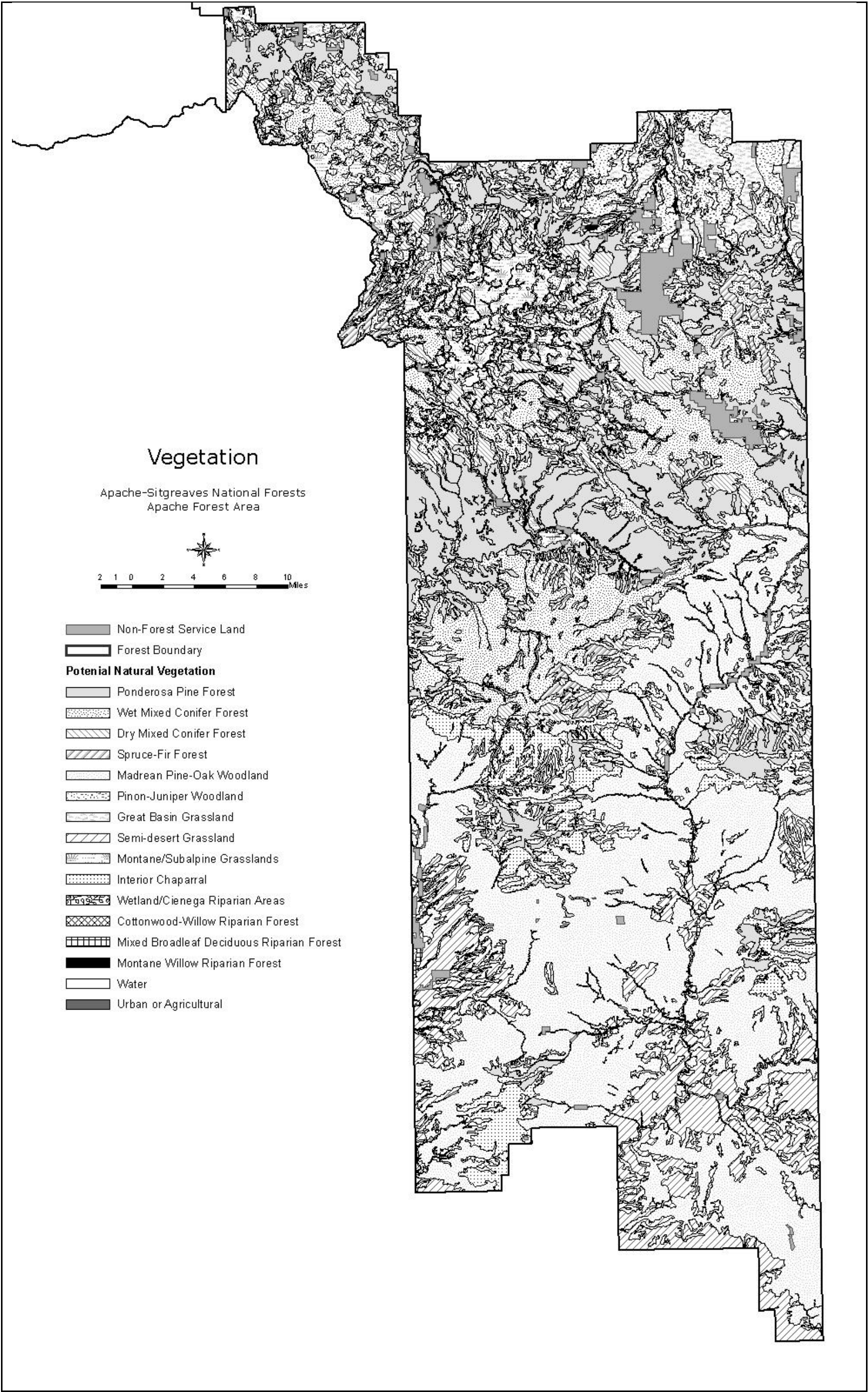
³ Only 12 TEU MUs are listed; 25 TEU MUs (206, 236, 379, 432, 469, 470, 479, 480, 482, 484, 560, 565, 574, 575, 582, 587, 620, 624, 628, 630, 632, 638, 650, 714 and 732) are not displayed because they each contribute < 0.5% to the total acreage of the 9,657 acre MBDRF PNVT (for a combined total of 3.8%, or 365 acres)

⁴ Only 20 TEU MUs are listed; 19 TEU MUs (140, 141, 182, 189, 192, 199, 202, 503, 523, 532, 543, 550, 551, 572, 576, 577, 583, 592 and 667) are not displayed because they each contribute < 0.5% to the total acreage of the 4,808 acre MWRF PNVT (for a combined total of 2.9%, or 137 acres)

Because of mapping scale issues and mapping errors, particularly within the long, linear riparian area polygons; several map units considered upland or non-riparian are represented within riparian PNVTS (Triepke et al., 2013). As indicated by Appendix A table 2, these map units contribute a small percentage to each riparian PNVT, and are probably hydric soils with plant species that are hydrophilic (riparian obligate species) or dependent on the water table or its capillary fringe zone (facultative wetland species) and these inclusions should be reclassified as riparian communities when TES is updated.



Appendix A map 1. Potential natural vegetation types (PNVTs) found on the Sitgreaves National Forest portion of the A-SNFs (USFS, 2012a)



Appendix A map 2. Potential natural vegetation types (PNVTs) found on the Apache National Forest portion of the A-SNFs (USFS, 2012b)

Appendix B - State and Transition Modeling and Apache-Sitgreaves NFs' PNV Vegetation Models

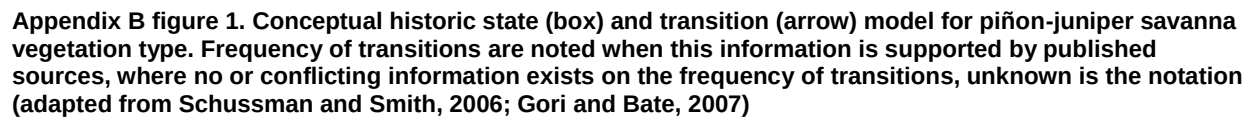
Vegetation State and Transition Models

In response to the USDA Forest Service Southwestern Region's need for landscape scale planning tools, the Nature Conservancy (TNC) (Smith and Schussman, 2007) developed broad-scale state and transition models for several Potential Natural Vegetation Types (PNVTs) in the Southwest based on a comprehensive literature review. TNC utilized this information to describe vegetation model states, identify parameter values for these models and to run quantitative scenario analysis, using Vegetation Dynamics Development Tool (VDDT) software (ESSA Technologies Ltd., 2006), to determine the relative proportion of model states on the landscape. Vegetation Dynamics Development Tool software is a non-spatial model that allows the user to model vegetation change over time as a series of vegetation states that differ in structure, composition, and cover and to specify the amount of time it takes to move from one vegetation state to another in the absence of disturbance (ESSA Technologies Ltd., 2006). Various disturbance agents affecting the movement of vegetation between states (or transitions) are incorporated (e.g., surface fires, stand-replacing fires, grazing, insect outbreaks, and drought events). By varying the types and rates of disturbance across the landscape, the effects of different disturbance regimes, such as historic and current fire regimes, or different management treatments, such as wildland fire use, fire suppression, prescribed burning, grazing practices, and mechanical fuel treatments, on vegetation can be investigated. These models will summarize and synthesize the current state of scientific knowledge of vegetation dynamics. Additionally, they will provide forest planners and managers with powerful tools for understanding, investigating, and demonstrating the effects of alternative scenarios for the management of vegetation on national forests at scales ranging from the Ranger District to the Southwestern Region.

According to Smith and Schussman (2007), the region-wide scale at which TNC constructed the models, as well as the sole reliance on published scientific information to build and parameterize the models, necessarily limits the level of detail in a model as well as the applicability of the model to a given site. Given these constraint, it is important to utilize information from these models to understand general trends in vegetation change and dynamics at large scales while utilizing finer scale models (such as those found in Ecological Site Descriptions²⁹ developed by the Natural Resources Conservation Service) and/or expert information to model and evaluate land management at site specific levels.

Historic (pre-1880) and current (1880 to present) state and transition models for piñon-juniper savanna are shown in appendix B figures 1 and 2. Additionally, TNC used information in the HRV (Schussman and Smith, 2006a; Gori and Bate, 2007) to estimate parameter values for transitions between model states (succession) and disturbance frequencies, allowing them to develop quantitative VDDT models. TNC's model parameters, output, and analysis for pinyon-juniper savanna are presented below (appendix B figures 1 and 2, and appendix B tables 1 and 2).

²⁹ Ecological sites are the basic component of a land-type classification system that describes ecological potential and ecosystem dynamics of land areas. All land/land use types are identified within the ecological site system, including rangeland, pasture, and forest land. An ecological site is defined as a distinctive kind of land with specific soil and physical characteristics that differ from other kinds of land in its ability to produce a distinctive kind and amount of vegetation and its ability to respond similarly to management actions and natural disturbances. Lands are classified considering discrete physical and biotic factors. Physical factors include soils, climate, hydrology, geology, and physiographic features. Biotic factors include plant species occurrence, plant community compositions, annual biomass production, wildlife-vegetation interactions, and other factors. Ecological dynamics, primarily disturbance regimes, such as grazing; fire; drought; management actions; and all resulting interactions are also a primary factor of ecological sites. Information and data pertaining to a particular ecological site is organized into a reference document known as an Ecological Site Description (ESD). ESDs function as a primary repository of ecological knowledge regarding an ecological site. ESDs are maintained on the USDA NRCS Ecological Site Information System (ESIS), which is the repository for information associated with ESDs and the collection of all site data. (Caudle et al., 2013)



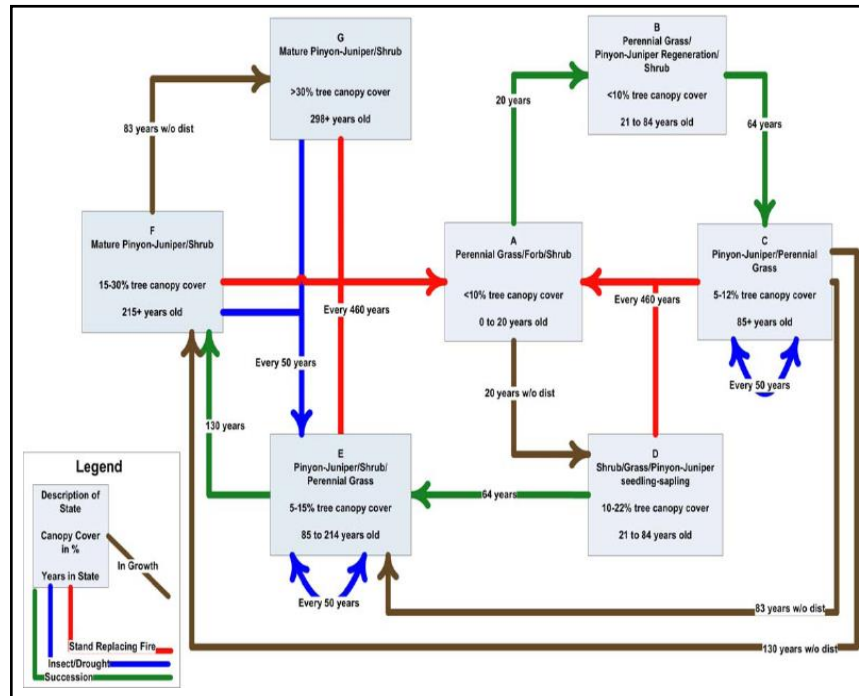
Appendix B table 1. Identification of the historic transition types, transition frequency or length, sources of information and assumptions made in developing the piñon-juniper savanna VDDT model, (adapted from Gori and Bate, 2007) displayed in appendix B figure 1, above

Transition Type	Transition Frequency or Length	Information Sources	Assumptions
Plant growth (20 years, 64 years)	After 20 years, 64 years without a stand replacing fire (or disturbance event)	Allen, 1990; Arnold et al., 1964; Baisan and Swetnam, 1997; Barnes and Cunningham, 1987; Barney and Frischknecht, 1974; Blackburn and Tueller, 1970; Brown et al., 2001b; Erdman, 1970; Floyd et al., 2000; Gottfried and Severson, 1993; Huffman et al., 2006a; Koniak, 1985; Muldavin et al., 2003; Boykin, 2000; Schott, 1984; Wilkinson, 1997; Young and Evans, 1978	Plant growth refers to the growth and ageing process of a stand in the absence of a stand-replacing fire. There are no fire history reconstructions that document historic stand-replacing fire (SRF) or succession after SRF in piñon-juniper savanna. We assume that 1) SRF's (or some other stand-replacing disturbance) occurred but were rare events as they were not recorded in savanna woodland fire histories that date back as early as 1400; and 2) succession in savannas is similar to that described for shrub woodlands, but that with surface fire the savanna understory stays primarily grassy. We base the latter assumption on the fact that 1) piñon-juniper savannas and shrub woodlands share many of the same perennial grass and shrub species, the latter increasing at the expense of the former in the absence of surface fire (USDA, 1997); 2) historic savannas have increased in tree and shrub densities post-settlement due in large part to human alteration of the fire regime (Allen, 2001; Brockway et al., 2002; Humphrey, 1953, 1958; Jacobs and Gatewood, 1999; Jacobs et al., 2002; Leopold, 1924; Miller, 1999; McPherson, 1997); and 3) present day tree densities in historical savannas and shrub woodlands are similar (table 12-7). Studies of post-fire vegetation succession in shrub- or persistent woodland indicate that annual grasses and forbs dominate for the first 3 years. Perennial grasses become dominant on sites 5 to 6 years post fire while shrubs become dominant (in terms of cover) 12 to 30 years post-fire; shrub dominance persists until trees become dominant 70-100 years after SRF (see sources). We took the mean value of the latter two time ranges to estimate the amount of time vegetation was in the perennial grass/forb/shrub and shrub/grass/tree seedling-sapling states, 20 years and 64 years, respectively. We have not included an annual stage in the savanna model because perennial grasses will re-sprout after fire and preclude annuals from becoming an important component of the herbaceous community. With a regime of frequent surface fires, shrubs will be continually knocked back and young trees will be thinned, resulting in a perennial grass/tree seedling/sapling state following the perennial grass/forb/shrub state along the main successional pathway (Arnold et al., 1964; Leopold, 1924; McPherson, 1995).
In-growth	83 years	Arnold et al., 1964; Howell, 1941; Pieper and Wittie, 1990	In growth refers to the infill of trees that would not have survived with recurrent surface or mixed severity fire and occurs after an estimated period of 83 years without fire. We arrived at this time value based on the following information. Howell (1941) estimated that it takes up to 75 years for a juniper trees to grow > 1.2 m tall, a size where post-fire survivorship is high (Pieper and Wittie, 1990). Similarly, Miller and Tausch (2001) found that it takes piñons and junipers up to 90 years to reach > 3 m tall, a height at which they found post-fire survivorship to be high; 83 years is the mean of these two estimates. If there is no surface fire during this period, tree recruitment and growth will likely increase tree density and canopy cover to levels characteristic of historic piñon-juniper shrub woodland [see table 12.7 for tree density increases in the absence of fire; tree density vs. canopy cover regression (cover = 0.031 (tree density) + 10.3) derived from the following studies: Grier et al., 1992; Landis and Bailey, 2005; Lymbery and Pieper, 1983; Rowlands and Brian, 2001; Mason et al., 1967]. At this point, we assume a mixed-severity fire is needed to reduce tree density and canopy cover, restoring a savanna structure.
Shrub accumulation + in-growth (130 years)	After 83 years, then 47 years without fire	Tress and Klopatek, 1987	Tress and Klopatek (1987) estimated that it took approximately 215 years for a shrub-woodland to fully recover in tree density, canopy cover and species composition following a SRF. This indicates an additional 47-year time period to move from an open canopy piñon-juniper/shrub/perennial grass state to a mature, open canopy piñon-juniper/shrub state after 83 years without fire.

Appendix B table 1. Continued

Transition Type	Transition Frequency or Length	Information Sources	Assumptions
Surface fire	Every 10 to 43 years	Allen, 1990; Baisan and Swetnam, 1997; Brown et al., 2001b; Huffman et al., 2006a; Leopold, 1924; Wilkinson, 1997; Muldavin et al., 2003; Boykin, 2000	Mean fire return intervals (MFRI) for piñon-juniper savanna based on analyses of fire-scarred trees range from 10 to 43 years; most estimates are point mean fire intervals (PMFI) based on analyses of individual trees which likely underestimate the stand-level MFRI. Restricted composite estimates all fall within the above range (Allen, 1990; Huffman et al., 2006a); however, Baisan and Swetnam (1997) report composite estimates of the MFRI of between 6 and 11.2 years for a northern New Mexico site. We did not consider these latter estimates because they likely overestimate the stand-level fire occurrence (Baker and Ehle, 2001; Baker and Shinneman, 2004). In general, surface fires kill or top kill shrubs and remove young trees < 1.2 m but mortality of young trees is not always 100% (Arnold et al., 1964; Dwyer and Pieper, 1967; Johnson et al., 1962). For example, if fire occurs in the shrub/perennial grass/tree seedling-sapling state, shrub mortality will create an opportunity for grass to rebound in the understory after fire, shifting the stand into the perennial grass/tree seedling/sapling/shrub state (Arnold et al., 1964).
Mixed severity fire	Every 62 years	Huffman et al., 2006a	Historic PMFIs for mixed severity fire in shrub-woodland at the upper ecotone ranged from 42 to 81 years (mean value = 62 years). The effect of mixed severity fire in low and open cover shrub woodland stands will be a reduction in cover and mortality in younger trees, more similar to a surface fire than to a replacement fire, and in stands with shrub and grass understory, a fire will result in a shift to grass-dominated understory. In mature stands with greater than 30% canopy cover, we assume that a mixed severity fire will have both a stand replacing component (50%) and surface fire component (50%), in the latter case thinning trees and reducing canopy cover and in the former, sending the vegetation back to the perennial grass/forb/shrub state. In support of this, several studies found trees surviving successive fires that were > 100 years apart (Despain and Mosley, 1990; Huffman et al., 2006a; Tausch et al., 1981, Tausch and West, 1988) while other authors report stand-replacing fires in pre-settlement closed woodlands (table 12-3, HRV ¹). We chose the 50-50 split because in the absence of better information, this break minimizes estimation error (Sokal and Rohlf, 1994).
Surface fire, mixed severity fire	Every 460 years	Allen, 1990; Baisan and Swetnam, 1997; Brown et al., 2001b; Huffman et al., 2006a; Leopold, 1924; Wilkinson, 1997; Muldavin et al., 2003; Boykin, 2000	Fire history reconstructions using fire-scarred trees provide a continuous record dating from 1400 to 1684, a period of roughly 320 to 600 years before present (mean = 460 years). Assuming that these stands initiated after a stand-replacing fire, this gives a conservative estimate of its frequency of (0.002).
Drought/insect-caused tree die-off	Every 200 to 500 years	Allen and Breshears, 1998; Betancourt et al., 1993; Breshears et al., 2005	Betancourt et al. (1993) estimated that the 1950's drought was a 200- to 500-year return interval event; the 1996-2003 droughts were wetter but warmer than the 1950's drought (Breshears et al., 2005). The relationship between drought, insect outbreaks, and tree die-off in piñon-juniper woodlands is well established (Allen and Breshears 1998; Gottfried et al., 1995; Breshears et al., 2005; Wilson and Tkacz, 1992), however, there is only one estimate of the amount (hectares) of piñon-juniper woodland affected regionally and this is for the recent 1996-2003 drought (Breshears et al., 2005). Since not all stands were affected during this drought (Mueller et al., 2005a; Negrón and Wilson, 2003), we adjusted the drought frequency by the estimated proportion of woodland in Arizona and New Mexico with discernible tree die-off (0.07) based on aerial surveys (Breshears et al., 2005) to derive a patch level probability of tree die-off during drought. Piñon mortality was greater than juniper mortality, older individuals had higher mortality than younger ones, and denser stands were more susceptible to insect infestation and tree die-off was more severe than in less dense stands (Breshears et al., 2005; Mueller et al., 2005a; Negrón and Wilson, 2003). Based on this information, drought/insect effects in tree-dominated states were modeled to move stands from higher canopy cover states to lower cover ones and to reset stand-age to the youngest age value for that state.

¹See Gori and Bate, 2007



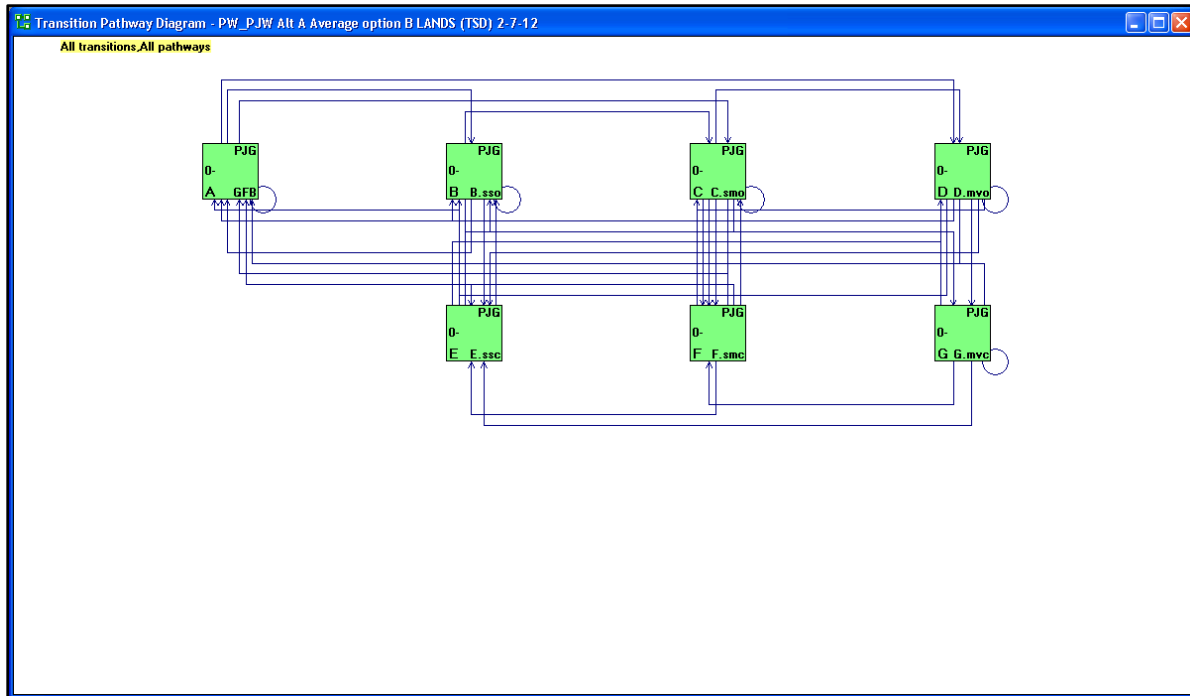
Appendix B figure 2. Conceptual current state (box) and transition (arrow) model for piñon-juniper savanna vegetation type. Frequency of transitions are noted when this information is supported by published sources, where no or conflicting information exists on the frequency of transitions, unknown is the notation (adapted from Schussman and Smith, 2006; Gori and Bate, 2007)

Appendix B table 2. Identification of the current transition types, transition frequency or length, sources of information and assumptions made in developing the piñon-juniper savanna VDDT model, (adapted from Gori and Bate, 2007¹) displayed in appendix B figure 2, above

Transition Type	Transition Frequency or Length	Information Sources	Assumptions
Surface fire, mixed severity fire	Not used in current model	Allen, 1990, 2001; Baisan and Swetnam, 1997; Brown et al., 2001b; Huffman et al., 2006a; Leopold, 1924; Wilkinson, 1971; Muldavin et al., 2003; Boykin, 2000	Based on fire-history reconstructions and direct observation, Gori and Bate (2007) reported that surface fire and mixed severity fire have essentially ceased at the scale of piñon-juniper occurrence in Arizona and New Mexico (7.5 million ha). Occasional surface fires and mixed severity fires do occur, but not at the same scale, either because fine fuels are too sparse for fire spread or enough fuels have accumulated in many areas to quickly shift surface fires to stand replacing ones (Allen, 2001; Butler et al., 1998). Prescribed fires and fire use are occurring in some areas at some times, but there is no published information on the amount of piñon-juniper savanna (and former savanna) affected and it is likely that this treatment level is not within the historic range of variability for this system.
Stand replacing fire	Every 460 years	Brown et al., 2001b; Huffman et al., 2006a; Leopold, 1924; Wilkinson, 1971; Muldavin et al., 2003; Boykin, 2000	Cessation of surface fires and accumulation of fuels and development of fuel ladders has led to an increase in the frequency of stand replacing fires, especially during the last decade or two (Crimmins and Comrie, 2004; Floyd et al., 2004 and 2006; Romme et al., 2003). There is only a single study that provides information that would permit calculation of this increased SRF frequency for historic savanna or open-canopy persistent woodland at the upper ecotone (Crimmins and Comrie, 2004), but there are technical problems with VDDT using this increased SRF frequency for the last 10-20 years in a relatively short (120-year) run. The increased SRF frequency is better applied to prospective scenario analyses (looking into the future) where the modeling time frame is 50 to 100 years. For this reason, we used the historic frequency for SRF. The effects of stand replacing fire on vegetation have been documented by Savage and Mast (2005).
Drought/insect outbreak	Once every 50 years	Allen and Breshears, 1998; Breshears et al., 2005	Two major droughts and regional outbreaks of <i>piñon Ips</i> have occurred over the last century (e.g., 50-year return interval) and their combined mortality effects on piñons and junipers have been quite variable on a population basis (Breshears et al., 2005; Mueller et al., 2005a; Negrón and Wilson, 2003). See above historical drought/insect outbreak section for further detail.
Silvicultural activities, mechanical treatments	Highly variable through time and across space, thus not included in the model	Bahre, 1991; Bahre and Hutchinson, 1985; Gottfried et al., 1995	Fuelwood cutting from piñon-juniper systems was a major source of fuel for mining until the end of the 19th century and for domestic heating and cooking as late as the 1940s; piñon-juniper fuelwood continues to be an important source for domestic heating and income generation in rural communities. However, there are no regional estimates of amount (hectares) of fuelwood cutting that has occurred over the last 120 years, nor are there equivalent estimates for areas treated mechanically or chemically to reduce tree density in piñon-juniper systems.

¹ See Gori and Bate, 2007

The actual Alternative A state and transition model developed and used for the piñon-juniper woodland on the A-SNFs is presented in appendix B figures 3 through 10. Current and reference condition (historic range of variability) vegetation state descriptions and existing vegetation crosswalk for piñon-juniper woodland PNVNT on the A-SNFs (USFS, 2010) is displayed in appendix B table 3.



Appendix B figure 3. Alternative A VDDT model state (box) and transition (arrow) pathway model for piñon-juniper woodland PNVNT used for analysis on the A-SNFs. Cover type is represented by PJG, state name is found in the lower left of each box, state class or code is found in the lower right of each box, state age is found in the center-left of each box

Class Properties for Class A: PJG GFB

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	A	PJG	GFB

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	To Class		
				Box	Cover	Stage
2_B	0.0164	1.00	0.0164	B	PJG	B.sso
2_C	0.0048	1.00	0.0048	C	PJG	C.smo
2_D	0.0184	1.00	0.0184	D	PJG	D.mvo
J RX FIRE ONLY Low	0.0100	1.00	0.0100	A	PJG	GFB
K RX FIRE ONLY Moderate	0.0001	1.00	0.0001	A	PJG	GFB
L RX FIRE ONLY High	0.0001	1.00	0.0001	A	PJG	GFB
Mixed Severity Fire	0.0001	1.00	0.0001	A	PJG	GFB
Nonlethal Fire	0.0100	1.00	0.0100	A	PJG	GFB
Stand-Replacing Fire	0.0001	1.00	0.0001	A	PJG	GFB

Display Pathways

☒ From Class

☐ To Class

☐ TSD

☐ Ages

OK Cancel Apply

Appendix B figure 4. Appendix B figure 4. Alternative A piñon-juniper woodland PNVN naturally driven (6)¹ and potentially management driven (3)² transitional pathways for STATE A (*PJ Grassland-PJ Woodland submodel GFB/SHR*): Recently burned, grass, forb and shrub types with less than 10% woody canopy cover; early successional development state used in Alternative A VDDT modeling on the A-SNFs

¹ Naturally driven transition types:

- **natural succession:**
 1. 2_B, from state A to state B
 2. 2_C, from state A to state C
 3. 2_D, from state A to state D
- **wild fire:**
 4. Mixed severity fire, moderate intensity, from state A to state A (circular transition)
 5. Nonlethal fire, low intensity, from state A to state A (circular transition)
 6. Stand replacement fire, high intensity, from state A to state A (circular transition)

² Management driven transition types:

- **prescribed fire:**
 1. J Rx fire, low intensity, from state A to state A (circular transition)
 2. K Rx fire, moderate intensity, from state A to state A (circular transition)
 3. L Rx fire, high intensity, from state A to state A (circular transition)

Class Properties for Class B: PJG B.sso

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	B	PJG	B.sso

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
2_C	0.0110	1.00	0.0110	C	PJG	C.smo
2_E	0.0632	1.00	0.0632	E	PJG	E.ssc
2_F	0.0110	1.00	0.0110	F	PJG	F.smc
G Clearcut with legacy trees	0.0100	1.00	0.0100	A	PJG	GFB
Insect/Disease	0.0010	1.00	0.0010	B	PJG	B.sso
J RX FIRE ONLY Low	0.0100	0.43	0.0043	A	PJG	GFB
J RX FIRE ONLY Low	0.0100	0.14	0.0014	C	PJG	C.smo
K RX FIRE ONLY Moderate	0.0001	0.86	0.0001	A	PJG	GFB
L RX FIRE ONLY High	0.0001	0.86	0.0001	A	PJG	GFB
Mixed Severity Fire	0.0001	0.86	0.0001	A	PJG	GFB
Nonlethal Fire	0.0100	0.43	0.0043	A	PJG	GFB
Nonlethal Fire	0.0100	0.14	0.0014	C	PJG	C.smo
Stand Replacing Fire	0.0001	0.86	0.0001	A	PJG	GFB

Display Pathways

☒ From Class
☐ To Class

☐ TSD
☐ Ages

OK Cancel Apply

Appendix B figure 5. Alternative A piñon-juniper woodland PNVN naturally driven (8)¹ and potentially management driven (5)² transitional pathways for STATE B (PJ Grassland-PJ Woodland submodel SSO): Seedling and sapling size, less than 5" diameter, trees with open, less than or equal to 30% canopy cover; all tree types; early successional development state used in Alternative A VDDT modeling on the A-SNFs

¹ Naturally driven transition types:

- **natural succession:**
 1. 2_C, from state B to state C
 2. 2_E, from state B to state E
 3. 2_F, from state B to state F
- **insect/disease:**
 4. Insect/Disease, from state B to state B (circular transition)
- **wild fire:**
 5. Mixed severity fire, moderate intensity, from state B to state A
 6. Nonlethal fire, low intensity, from state B to state A
 7. Nonlethal fire, low intensity, from state B to state C
 8. Stand replacing fire, high intensity, from state B to state A

² Management driven transition types:

- **harvest treatments:**
 1. G Clearcut with legacy trees, from state B to state A
- **prescribed burning:**
 2. J Rx fire, low intensity, from state B to state A
 3. J Rx fire, low intensity, from state B to state C
 4. K Rx fire, moderate intensity, from state B to state A
 5. L Rx fire, high intensity, from state B to state A

Class Properties for Class C: PJG C.smo

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	C	PJG	C.smo

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	To Class		
				Box	Cover	Stage
2_B	0.0054	1.00	0.0054	B	PJG	B.sso
2_D	0.0272	1.00	0.0272	D	PJG	D.mvo
2_E	0.0048	1.00	0.0048	E	PJG	E.ssc
2_F	0.0382	1.00	0.0382	F	PJG	F.smc
2_G	0.0091	1.00	0.0091	G	PJG	G.mvc
B Free thin all sizes to target	0.0100	0.56	0.0056	A	PJG	GFB
B Free thin all sizes to target	0.0100	0.07	0.0007	D	PJG	D.mvo
D Thin under	0.0100	1.00	0.0100	A	PJG	GFB
G Clearcut with legacy trees	0.0100	1.00	0.0100	A	PJG	GFB
Insect/Disease	0.0010	1.00	0.0010	C	PJG	C.smo
J RX FIRE ONLY Low	0.0100	0.31	0.0031	A	PJG	GFB
J RX FIRE ONLY Low	0.0100	0.01	0.0001	B	PJG	B.sso
J RX FIRE ONLY Low	0.0100	0.13	0.0013	D	PJG	D.mvo

Display Pathways

☒ From Class

☐ To Class

Buttons: New, Copy, Delete, TSD, Ages, Sort...

Buttons: OK, Cancel, Apply

Appendix B figure 6. Alternative A piñon-juniper woodland PNVT naturally driven (14)¹ and potentially management driven (12)² transitions for STATE C (*PJ Grassland-PJ Woodland submodel SMO*): Small size, 5" to 9.9" diameter, trees, with open, less than or equal to 30% canopy cover; all tree types; mid successional development state used in Alternative A VDDT modeling on the A-SNFs. Alternative A piñon-juniper woodland PNVT State C transitions continued in Appendix B figure 6a

¹ Naturally driven transition types:

- **natural succession:**
 1. 2_B, from state C to state B
 2. 2_D, from state C to state D
 3. 2_E, from state C to state E
 4. 2_F, from state C to state F
 5. 2_G, from state C to state G
- **insect/disease:**
 6. Insect/Disease, from state C to state C (circular transition)
- **wild fire:**
 7. Mixed severity fire, moderate intensity, from state C to state A
 8. Mixed severity fire, moderate intensity, from state C to state B
 9. Mixed severity fire, moderate intensity, from state C to state D
 10. Nonlethal fire, low intensity, from state C to state A
 11. Nonlethal fire, low intensity, from state C to state B
 12. Nonlethal fire, low intensity, from state C to state D
 13. Stand replacing fire, high intensity, from state C to state A
 14. Stand replacing fire, high intensity, from state C to state A

² Management driven transition types:

- **harvest treatments:**
 1. B Free thin all sizes to target BA, from state C to state A
 2. B Free thin all sizes to target BA, from state C to state D
 3. D Thin under 16 inch diameter to BA, from state C to state A
 4. G Clearcut with legacy trees, from state C to state A
- **prescribed burning:**
 5. J Rx fire, low intensity, from state C to state A
 6. J Rx fire, low intensity, from state C to state B
 7. J Rx fire, low intensity, from state C to state D
 8. K Rx fire, moderate intensity, from state C to state A
 9. K Rx fire, moderate intensity, from state C to state B
 10. K Rx fire, moderate intensity, from state C to state D
 11. L Rx fire, high intensity, from state C to state A
 12. L Rx fire, high intensity, from state C to state D

Class Properties for Class C: PJG C.smo

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	C	PJG	C.smo

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	To Class		
				Box	Cover	Stage
K RX FIRE ONLY Moderate	0.0001	0.41	0.0000	A	PJG	GFB
K RX FIRE ONLY Moderate	0.0001	0.03	0.0000	B	PJG	B.sso
K RX FIRE ONLY Moderate	0.0001	0.16	0.0000	D	PJG	D.mvo
L RX FIRE ONLY High	0.0001	0.96	0.0001	A	PJG	GFB
L RX FIRE ONLY High	0.0001	0.01	0.0000	D	PJG	D.mvo
Mixed Severity Fire	0.0001	0.41	0.0000	A	PJG	GFB
Mixed Severity Fire	0.0001	0.03	0.0000	B	PJG	B.sso
Mixed Severity Fire	0.0001	0.16	0.0000	D	PJG	D.mvo
Nonlethal Fire	0.0100	0.31	0.0031	A	PJG	GFB
Nonlethal Fire	0.0100	0.01	0.0001	B	PJG	B.sso
Nonlethal Fire	0.0100	0.13	0.0013	D	PJG	D.mvo
Stand-Replacing Fire	0.0001	0.96	0.0001	A	PJG	GFB
Stand-Replacing Fire	0.0001	0.01	0.0000	D	PJG	D.mvo

Display Pathways

☒ From Class

☐ To Class

☐ TSD

☐ Ages

OK Cancel Apply

Appendix B figure 6a. Alternative A piñon-juniper woodland PNVt State C transitions continued

Class Properties for Class D: PJG D.mvo

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	D	PJG	D.mvo

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
2_B	0.0063	1.00	0.0063	B	PJG	B.sso
2_C	0.0014	1.00	0.0014	C	PJG	C.smo
2_E	0.0024	1.00	0.0024	E	PJG	E.ssc
2_F	0.0007	1.00	0.0007	F	PJG	F.smc
2_G	0.0157	1.00	0.0157	G	PJG	G.mvc
B Free thin all sizes to target	0.0100	0.93	0.0093	A	PJG	GFB
B Free thin all sizes to target	0.0100	0.01	0.0001	C	PJG	C.smo
D Thin under	0.0100	0.50	0.0050	D	PJG	D.mvo
D Thin under	0.0100	0.50	0.0050	G	PJG	G.mvc
E GroupSelect with matrix thin	0.0100	0.04	0.0004	A	PJG	GFB
E GroupSelect with matrix thin	0.0100	0.07	0.0007	C	PJG	C.smo
G Clearcut with legacy trees	0.0100	1.00	0.0100	A	PJG	GFB
Insect/Disease	0.0010	1.00	0.0010	D	PJG	D.mvo

Display Pathways

☒ From Class
☐ To Class

Buttons: New, Copy, Delete, TSD, Ages, Sort..., OK, Cancel, Apply

Appendix B figure 7. Alternative A piñon-juniper woodland PNVT naturally driven (11)¹ and potentially management driven (12)² transitions for STATE D (*PJ Grassland-PJ Woodland submodel MVO*): Medium and large to very large size, greater than or equal to 10" diameter, trees, with open, less than or equal to 30% canopy cover; all tree types; late successional development, open piñon-juniper stand with "savannah-like" appearance; mixed shrub/herbaceous community state used in Alternative A VDDT modeling on the A-SNFs. Alternative A piñon-juniper woodland PNVT State D transitions continued in Appendix B figure 7a

¹ Naturally driven transition types:

- **natural succession:**
 1. 2_B, from state D to state B
 2. 2_C, from state D to state C
 3. 2_E, from state D to state E
 4. 2_F, from state D to state F
 5. 2_G, from state D to state G
- **insect/disease:**
 6. Insect/Disease, from state D to state D (circular transition)
- **wild fire:**
 7. Mixed severity fire, moderate intensity, from state D to state A
 8. Mixed severity fire, moderate intensity, from state D to state C
 9. Nonlethal fire, low intensity, from state D to state A
 10. Nonlethal fire, low intensity, from state D to state B
 11. Stand replacing fire, high intensity, from state D to state A

² Management driven transition types:

- **harvest treatments:**
 1. B Free thin all sizes to target BA, from state D to state A
 2. B Free thin all sizes to target BA, from state D to state C
 3. D Thin under 16 inch diameter to BA, from state D to state D (circular transition)
 4. D Thin under 16 inch diameter to BA, from state D to state G
 5. E GroupSelect with matrix thin, from state D to state A
 6. E GroupSelect with matrix thin, from state D to state C
 7. G Clearcut with legacy trees, from state D to state A
- **prescribed burning:**
 8. J Rx fire, low intensity, from state D to state A
 9. J Rx fire, low intensity, from state D to state B
 10. K Rx fire, moderate intensity, from state D to state A
 11. K Rx fire, moderate intensity, from state D to state C
 12. L Rx fire, high intensity, from state D to state A

Class Properties for Class D: PJG D.mvo

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	D	PJG	D.mvo

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	To Class		
				Box	Cover	Stage
G Clearcut with legacy trees	0.0100	1.00	0.0100	A	PJG	GFB
Insect/Disease	0.0010	1.00	0.0010	D	PJG	D.mvo
J RX FIRE ONLY Low	0.0100	0.22	0.0022	A	PJG	GFB
J RX FIRE ONLY Low	0.0100	0.01	0.0001	B	PJG	B.sso
K RX FIRE ONLY Moderate	0.0001	0.31	0.0000	A	PJG	GFB
K RX FIRE ONLY Moderate	0.0001	0.01	0.0000	C	PJG	C.smo
L RX FIRE ONLY High	0.0001	0.94	0.0001	A	PJG	GFB
Mixed Severity Fire	0.0100	0.31	0.0031	A	PJG	GFB
Mixed Severity Fire	0.0100	0.01	0.0001	C	PJG	C.smo
Nonlethal Fire	0.0100	0.22	0.0022	A	PJG	GFB
Nonlethal Fire	0.0100	0.01	0.0001	B	PJG	B.sso
Stand-Replacing Fire	0.0001	0.94	0.0001	A	PJG	GFB

Display Pathways

☒ From Class
☐ To Class

Buttons: New, Copy, Delete, TSD, Ages, Sort...

Footer: OK, Cancel, Apply

Appendix B figure 7a. Alternative A piñon-juniper woodland PNVt State D transitions continued

Class Properties for Class E: PJG E.ssc

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	E	PJG	E.ssc

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
2_F	0.0751	1.00	0.0751	F	PJG	F.smc
2_G	0.0058	1.00	0.0058	G	PJG	G.mvc
B Free thin all sizes to target	0.0100	0.67	0.0067	A	PJG	GFB
B Free thin all sizes to target	0.0100	0.08	0.0008	B	PJG	B.sso
B Free thin all sizes to target	0.0100	0.25	0.0025	C	PJG	C.smo
D Thin under	0.0100	1.00	0.0100	A	PJG	GFB
G Clearcut with legacy trees	0.0100	1.00	0.0100	A	PJG	GFB
Insect/Disease	0.0010	1.00	0.0010	B	PJG	B.sso
J RX FIRE ONLY Low	0.0100	0.42	0.0042	B	PJG	B.sso
J RX FIRE ONLY Low	0.0100	0.25	0.0025	C	PJG	C.smo
J RX FIRE ONLY Low	0.0100	0.33	0.0033	F	PJG	F.smc
K RX FIRE ONLY Moderate	0.0001	0.08	0.0000	A	PJG	GFB
K RX FIRE ONLY Moderate	0.0001	0.42	0.0000	B	PJG	B.sso

Display Pathways:
☒ From Class
☐ To Class

Buttons: New, Copy, Delete, TSD, Ages, Sort...

Buttons: OK, Cancel, Apply

Appendix B figure 8. Alternative A piñon-juniper woodland PNVT naturally driven (13)¹ and potentially management driven (15)² transitions for State E (PJ Grassland-PJ Woodland submodel SSC): Seedling and sapling size, less than 5" diameter, trees with closed, greater than 30% canopy cover; all tree types; early successional development state used in Alternative A VDDT modeling on the A-SNFs. Alternative A piñon-juniper woodland PNVT State E transitions continued in Appendix B figures 8a and 8b

¹ Naturally driven transition types:

- **natural succession:**
 1. 2_F, from state E to state F
 2. 2_G, from state E to state G
- **insect/disease:**
 3. Insect/Disease, from state E to state B
- **wild fire:**
 4. Mixed severity fire, moderate intensity, from state E to state A
 5. Mixed severity fire, moderate intensity, from state E to state B
 6. Mixed severity fire, moderate intensity, from state E to state C
 7. Mixed severity fire, moderate intensity, from state E to state F
 8. Nonlethal fire, low intensity, from state E to state B
 9. Nonlethal fire, low intensity, from state E to state C
 10. Nonlethal fire, low intensity, from state E to state F
 11. Stand replacing fire, high intensity, from state E to state A
 12. Stand replacing fire, high intensity, from state E to state B
 13. Stand replacing fire, high intensity, from state E to state F

² Management driven transition types:

- **harvest treatments:**
 1. B Free thin all sizes to target BA, from state E to state A
 2. B Free thin all sizes to target BA, from state E to state B
 3. B Free thin all sizes to target BA, from state E to state C
 4. D Thin under 16 inch diameter to BA, from state E to state A
 5. G Clearcut with legacy trees, from state E to state A
- **prescribed burning:**
 6. J Rx fire, low intensity, from state E to state B
 7. J Rx fire, low intensity, from state E to state C
 8. J Rx fire, low intensity, from state E to state F
 9. K Rx fire, moderate intensity, from state E to state A
 10. K Rx fire, moderate intensity, from state E to state B
 11. K Rx fire, moderate intensity, from state E to state C
 12. K Rx fire, moderate intensity, from state E to state F
 13. L Rx fire, high intensity, from state E to state A
 14. L Rx fire, high intensity, from state E to state B
 15. L Rx fire, high intensity, from state E to state C

Class Properties for Class E: PJG E.ssc

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	E	PJG	E.ssc

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
K RX FIRE ONLY Moderate	0.0001	0.42	0.0000	C	PJG	C.smo
K RX FIRE ONLY Moderate	0.0001	0.08	0.0000	F	PJG	F.smc
L RX FIRE ONLY High	0.0001	0.67	0.0001	A	PJG	GFB
L RX FIRE ONLY High	0.0001	0.08	0.0000	B	PJG	B.sso
L RX FIRE ONLY High	0.0001	0.25	0.0000	C	PJG	C.smo
Mixed Severity Fire	0.0100	0.08	0.0008	A	PJG	GFB
Mixed Severity Fire	0.0100	0.42	0.0042	B	PJG	B.sso
Mixed Severity Fire	0.0100	0.42	0.0042	C	PJG	C.smo
Mixed Severity Fire	0.0100	0.08	0.0008	F	PJG	F.smc
Nonlethal Fire	0.0100	0.42	0.0042	B	PJG	B.sso
Nonlethal Fire	0.0100	0.25	0.0025	C	PJG	C.smo
Nonlethal Fire	0.0100	0.33	0.0033	F	PJG	F.smc
Stand-Replacing Fire	0.0100	0.67	0.0067	A	PJG	GFB

Display Pathways

☒ From Class

☐ To Class

☐ TSD

☐ Ages

OK Cancel Apply

Appendix B figure 8a. Alternative A piñon-juniper woodland PNVT State E transitions continued

Class Properties for Class E: PJG E.ssc

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	E	PJG	E.ssc

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
L RX FIRE ONLY High	0.0001	0.08	0.0000	B	PJG	B.sso
L RX FIRE ONLY High	0.0001	0.25	0.0000	C	PJG	C.smo
Mixed Severity Fire	0.0100	0.08	0.0008	A	PJG	GFB
Mixed Severity Fire	0.0100	0.42	0.0042	B	PJG	B.sso
Mixed Severity Fire	0.0100	0.42	0.0042	C	PJG	C.smo
Mixed Severity Fire	0.0100	0.08	0.0008	F	PJG	F.smc
Nonlethal Fire	0.0100	0.42	0.0042	B	PJG	B.sso
Nonlethal Fire	0.0100	0.25	0.0025	C	PJG	C.smo
Nonlethal Fire	0.0100	0.33	0.0033	F	PJG	F.smc
Stand-Replacing Fire	0.0100	0.67	0.0067	A	PJG	GFB
Stand-Replacing Fire	0.0100	0.08	0.0008	B	PJG	B.sso
Stand-Replacing Fire	0.0100	0.25	0.0025	C	PJG	C.smo

Display Pathways

☒ From Class

☐ To Class

☐ TSD

☐ Ages

OK Cancel Apply

Appendix B figure 8b. Alternative A piñon-juniper woodland PNVT State E transitions continued

Class Properties for Class F: PJG F.smc

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	F	PJG	F.smc

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	To Class		
				Box	Cover	Stage
2_E	0.0005	1.00	0.0005	E	PJG	E.ssc
2_G	0.0243	1.00	0.0243	G	PJG	G.mvc
B Free thin all sizes to target	0.0100	0.88	0.0088	A	PJG	GFB
B Free thin all sizes to target	0.0100	0.07	0.0007	C	PJG	C.smo
B Free thin all sizes to target	0.0100	0.05	0.0005	D	PJG	D.mvo
D Thin under	0.0100	0.50	0.0050	D	PJG	D.mvo
D Thin under	0.0100	0.50	0.0050	G	PJG	G.mvc
E GroupSelect with matrix thin	0.0100	0.02	0.0002	A	PJG	GFB
E GroupSelect with matrix thin	0.0100	0.20	0.0020	C	PJG	C.smo
E GroupSelect with matrix thin	0.0100	0.78	0.0078	D	PJG	D.mvo
G Clearcut with legacy trees	0.0100	1.00	0.0100	A	PJG	GFB
Insect/Disease	0.0010	1.00	0.0010	C	PJG	C.smo
Low Fire Only Low	0.0100	0.02	0.0002	B	PJG	B.ssc

Display Pathways

☒ From Class

☐ To Class

☐ TSD

☐ Ages

OK Cancel Apply

Appendix B figure 9. Alternative A piñon-juniper woodland PNVT naturally driven (14)¹ and potentially management driven (20)² transitions for STATE F (*PJ Grassland-PJ Woodland submodel SMC*): Small size, 5” to 9.9” diameter, trees with closed, greater than 30% canopy cover; all tree types; understory beginning to disappear; mid successional development state used in Alternative A VDDT modeling on the A-SNFs. Alternative A piñon-juniper woodland PNVT State F transitions continued in Appendix B figures 9a and 9b

¹ Naturally driven transition types:

- **natural succession:**
 1. 2_E, from state F to state E
 2. 2_G, from state F to state G
- **insect/disease:**
 3. Insect/Disease, from state F to state C
- **wild fire:**
 4. Mixed severity fire, moderate intensity, from state F to state B
 5. Mixed severity fire, moderate intensity, from state F to state C
 6. Mixed severity fire, moderate intensity, from state F to state D
 7. Mixed severity fire, moderate intensity, from state F to state G
 8. Nonlethal fire, low intensity, from state F to state B
 9. Nonlethal fire, low intensity, from state F to state C
 10. Nonlethal fire, low intensity, from state F to state D
 11. Nonlethal fire, low intensity, from state F to state G
 12. Stand replacing fire, high intensity, from state F to state A
 13. Stand replacing fire, high intensity, from state F to state C
 14. Stand replacing fire, high intensity, from state F to state D

² Management driven transition types:

- **harvest treatments:**
 1. B Free thin all sizes to target BA, from state F to state A
 2. B Free thin all sizes to target BA, from state F to state C
 3. B Free thin all sizes to target BA, from state F to state D
 4. D Thin under 16 inch diameter to BA, from state F to state D
 5. D Thin under 16 inch diameter to BA, from state F to state G
 6. E GroupSelect with matrix thin, from state F to state A
 7. E GroupSelect with matrix thin, from state F to state C
 8. E GroupSelect with matrix thin, from state F to state D
 9. G Clearcut with legacy trees, from state F to state A
- **prescribed burning:**
 10. J Rx fire, low intensity, from state F to state B
 11. J Rx fire, low intensity, from state F to state C
 12. J Rx fire, low intensity, from state F to state D
 13. J Rx fire, low intensity, from state F to state G

14. K Rx fire, moderate intensity, from state F to state B
15. K Rx fire, moderate intensity, from state F to state C
16. K Rx fire, moderate intensity, from state F to state D
17. K Rx fire, moderate intensity, from state F to state G
18. L Rx fire, high intensity, from state F to state A
19. L Rx fire, high intensity, from state F to state C
20. L Rx fire, high intensity, from state F to state D

Class Properties for Class F: PJG F.smc

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	F	PJG	F.smc

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
J RX FIRE ONLY Low	0.0100	0.61	0.0061	C	PJG	C.smo
J RX FIRE ONLY Low	0.0100	0.19	0.0019	D	PJG	D.mvo
J RX FIRE ONLY Low	0.0100	0.07	0.0007	G	PJG	G.mvc
K RX FIRE ONLY Moderate	0.0100	0.01	0.0001	B	PJG	B.sso
K RX FIRE ONLY Moderate	0.0100	0.61	0.0061	C	PJG	C.smo
K RX FIRE ONLY Moderate	0.0100	0.29	0.0029	D	PJG	D.mvo
K RX FIRE ONLY Moderate	0.0100	0.08	0.0008	G	PJG	G.mvc
L RX FIRE ONLY High	0.0001	0.36	0.0000	A	PJG	GFB
L RX FIRE ONLY High	0.0001	0.27	0.0000	C	PJG	C.smo
L RX FIRE ONLY High	0.0001	0.36	0.0000	D	PJG	D.mvo
Mixed Severity Fire	0.0100	0.02	0.0002	B	PJG	B.sso
Mixed Severity Fire	0.0100	0.61	0.0061	C	PJG	C.smo
Mixed Severity Fire	0.0100	0.29	0.0029	D	PJG	D.mvo

Display Pathways
☒ From Class
☐ To Class

OK Cancel Apply

Appendix B figure 9a. Alternative A piñon-juniper woodland PNVT State F transitions continued

Class Properties for Class F: PJG F.smc

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	F	PJG	F.smc

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
L RX FIRE ONLY High	0.0001	0.36	0.0000	D	PJG	D.mvo
Mixed Severity Fire	0.0100	0.02	0.0002	B	PJG	B.sso
Mixed Severity Fire	0.0100	0.61	0.0061	C	PJG	C.smo
Mixed Severity Fire	0.0100	0.29	0.0029	D	PJG	D.mvo
Mixed Severity Fire	0.0100	0.08	0.0008	G	PJG	G.mvc
Nonlethal Fire	0.0100	0.02	0.0002	B	PJG	B.sso
Nonlethal Fire	0.0100	0.61	0.0061	C	PJG	C.smo
Nonlethal Fire	0.0100	0.19	0.0019	D	PJG	D.mvo
Nonlethal Fire	0.0100	0.07	0.0007	G	PJG	G.mvc
Stand-Replacing Fire	0.0100	0.36	0.0036	A	PJG	GFB
Stand-Replacing Fire	0.0100	0.27	0.0027	C	PJG	C.smo
Stand-Replacing Fire	0.0100	0.36	0.0036	D	PJG	D.mvo

Display Pathways
☒ From Class
☐ To Class

OK Cancel Apply

Appendix B figure 9b. Alternative A piñon-juniper woodland PNVT State F transitions continued

Class Properties for Class G: PJG G.mvc

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	G	PJG	G.mvc

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	To Class		
				Box	Cover	Stage
2_D	0.0004	1.00	0.0004	D	PJG	D.mvc
2_E	0.0002	1.00	0.0002	E	PJG	E.ssc
2_F	0.0014	1.00	0.0014	F	PJG	F.smc
B Free thin all sizes to target	0.0100	0.99	0.0099	A	PJG	GFB
B Free thin all sizes to target	0.0100	0.01	0.0001	D	PJG	D.mvc
D Thin under	0.0100	1.00	0.0100	G	PJG	G.mvc
E GroupSelect with matrix thin	0.0100	0.01	0.0001	A	PJG	GFB
E GroupSelect with matrix thin	0.0100	0.35	0.0035	C	PJG	C.smo
E GroupSelect with matrix thin	0.0100	0.60	0.0060	D	PJG	D.mvc
G Clearcut with legacy trees	0.0100	1.00	0.0100	A	PJG	GFB
Insect/Disease	0.0010	1.00	0.0010	D	PJG	D.mvc
J RX FIRE ONLY Low	0.0100	0.02	0.0002	C	PJG	C.smo
J RX FIRE ONLY Low	0.0100	0.64	0.0064	D	PJG	D.mvc

Display Pathways:
☒ From Class
☐ To Class

Buttons: New, Copy, Delete, TSD, Ages, Sort..., OK, Cancel, Apply

Appendix B figure 10. Alternative A piñon-juniper woodland PNVN naturally driven (13)¹ and potentially management driven (15)² transitions for STATE G (PJ Grassland-PJ Woodland submodel MVC): Medium and large to very large size, greater than or equal to 10" diameter trees, with closed, greater than 30% canopy cover; all tree types; closed piñon-juniper forest with depauperate understory, may be multi-storied; substantial mortality within stands; late successional development state used in Alternative A VDDT modeling on the A-SNFs. Alternative A piñon-juniper woodland PNVN State F transitions continued in Appendix B figures 10a and 10b

¹ Naturally driven transition types:

- **natural succession:**
 1. 2_D, from state G to state D
 2. 2_E, from state G to state E
 3. 2_F, from state G to state F
- **insect/disease:**
 4. Insect/Disease, from state G to state D
- **wild fire:**
 5. Mixed severity fire, moderate intensity, from state G to state A
 6. Mixed severity fire, moderate intensity, from state G to state C
 7. Mixed severity fire, moderate intensity, from state G to state D
 8. Nonlethal fire, low intensity, from state G to state B
 9. Nonlethal fire, low intensity, from state G to state C
 10. Nonlethal fire, low intensity, from state G to state D
 11. Stand replacing fire, high intensity, from state G to state A
 12. Stand replacing fire, high intensity, from state G to state C
 13. Stand replacing fire, high intensity, from state G to state D

² Management driven transition types:

- **harvest treatments:**
 1. B Free thin all sizes to target BA, from state G to state A
 2. B Free thin all sizes to target BA, from state G to state D
 3. D Thin under 16 inch diameter to BA, from state G to state G (circular transition)
 4. E GroupSelect with matrix thin, from state G to state A
 5. E GroupSelect with matrix thin, from state G to state C
 6. E GroupSelect with matrix thin, from state G to state D
 7. G Clearcut with legacy trees, from state G to state A
- **prescribed burning:**
 8. J Rx fire, low intensity, from state G to state C
 9. J Rx fire, low intensity, from state G to state D
 10. K Rx fire, moderate intensity, from state G to state A
 11. K Rx fire, moderate intensity, from state G to state C
 12. K Rx fire, moderate intensity, from state G to state D
 13. L Rx fire, high intensity, from state G to state A
 14. L Rx fire, high intensity, from state G to state C

15. L Rx fire, high intensity, from state G to state D

Class Properties for Class G: PJG G.mvc

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	G	PJG	G.mvc

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	Stage
K RX FIRE ONLY Moderate	0.0100	0.01	0.0001	A	PJG	GFB
K RX FIRE ONLY Moderate	0.0100	0.01	0.0001	C	PJG	C.smo
K RX FIRE ONLY Moderate	0.0100	0.83	0.0083	D	PJG	D.mvo
L RX FIRE ONLY High	0.0001	0.27	0.0000	A	PJG	GFB
L RX FIRE ONLY High	0.0001	0.02	0.0000	C	PJG	C.smo
L RX FIRE ONLY High	0.0001	0.71	0.0001	D	PJG	D.mvo
Mixed Severity Fire	0.0100	0.01	0.0001	A	PJG	GFB
Mixed Severity Fire	0.0100	0.01	0.0001	C	PJG	C.smo
Mixed Severity Fire	0.0100	0.83	0.0083	D	PJG	D.mvo
Nonlethal Fire	0.0100	0.02	0.0002	C	PJG	C.smo
Nonlethal Fire	0.0100	0.64	0.0064	D	PJG	D.mvo
Stand-Replacing Fire	0.0100	0.27	0.0027	A	PJG	GFB
Stand-Replacing Fire	0.0100	0.02	0.0002	C	PJG	C.smo
Stand-Replacing Fire	0.0100	0.71	0.0071	D	PJG	D.mvo

Display Pathways

☒ From Class

☐ To Class

☐ TSD

☐ Ages

OK Cancel Apply

Appendix B figure 10a. Alternative A piñon-juniper woodland PNV State G transitions continued

Class Properties for Class G: PJG G.mvc

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	G	PJG	G.mvc

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	Stage
K RX FIRE ONLY Moderate	0.0100	0.83	0.0083	D	PJG	D.mvo
L RX FIRE ONLY High	0.0001	0.27	0.0000	A	PJG	GFB
L RX FIRE ONLY High	0.0001	0.02	0.0000	C	PJG	C.smo
L RX FIRE ONLY High	0.0001	0.71	0.0001	D	PJG	D.mvo
Mixed Severity Fire	0.0100	0.01	0.0001	A	PJG	GFB
Mixed Severity Fire	0.0100	0.01	0.0001	C	PJG	C.smo
Mixed Severity Fire	0.0100	0.83	0.0083	D	PJG	D.mvo
Nonlethal Fire	0.0100	0.02	0.0002	C	PJG	C.smo
Nonlethal Fire	0.0100	0.64	0.0064	D	PJG	D.mvo
Stand-Replacing Fire	0.0100	0.27	0.0027	A	PJG	GFB
Stand-Replacing Fire	0.0100	0.02	0.0002	C	PJG	C.smo
Stand-Replacing Fire	0.0100	0.71	0.0071	D	PJG	D.mvo

Display Pathways

☒ From Class

☐ To Class

☐ TSD

☐ Ages

OK Cancel Apply

Appendix B figure 10b. Alternative A piñon-juniper woodland PNV State G transitions continued

Appendix B table 3. Current and reference condition (historic range of variability) vegetation state descriptions and existing vegetation crosswalks developed by Region 3 for piñon-juniper woodland PNV on the A-SNFs (USFS, 2010)

Current Trend Model ¹				Reference Condition ²				Baseline Desired Condition	
source	state	description ³	state (%)	source	state	historic mean (%)	description	state (%)	description
USFS R3 model PJG	A	GFB/SHR	5	LANDFIRE RA JUPI1	A	5	Post-fire community of forbs and perennial grasses	5	Based on reference condition
	B	SSO	8		C	25	Early-development, open (< 40% cover) juniper-piñon stand with mixed shrub/herbaceous community in understory	25	Based on reference condition
	E	SSC	8						
	C	SMO	8						
	D	MVO	50		D	50	Late-development, open juniper-piñon stand with “savannah-like” appearance; mixed shrub/herbaceous community	50	Based on reference condition
	F	SMC	10		B	10	Mid-development, dense (> 40% cover) juniper-piñon woodland; understory presence diminishing	10	Based on reference condition
	G	MVC	10		E	10	Late-development, closed juniper-piñon forest. May be multi-storied. Substantial mortality within stand; depauperate understory	10	Based on reference condition

¹ Current trend model provided by the Southwestern Regional Office, Albuquerque, New Mexico

² Potential Natural Vegetation Group: Juniper-Pinyon (Frequent Fire Type), PNV Code: *JUPI1*, April 6, 2005. Fire Regime Condition Class (FRCC) Interagency Handbook Reference Conditions (LANDFIRE, 2005)

³ GFB/SHR = grass, forb, shrub; with less than 10 percent woody canopy cover

SSO = Seedling, sapling size trees; with open woody canopy cover (< 5 inch diameter; and ≥ 10 percent and ≤ 30 percent)

SSC = Seedling, sapling size trees; with closed woody canopy cover (< 5 inch diameter; and > 30 percent)

SMO = Small size trees; with open woody canopy cover (5 to 9.9 inch diameter; and ≥ 10 percent and ≤ 30 percent)

MVO = Medium to very large size trees; with open woody canopy cover (> 10 inch diameter; and ≥ 10 percent and ≤ 30 percent)

SMC = Small size trees; with closed woody canopy cover (5 to 9.9 inch diameter; and > 30 percent)

MVC = Medium to very large size trees; with closed woody canopy cover (> 10 inch diameter; and > 30 percent)

Appendix B table 4. Vegetative states, structure and respective compositions, cover and departure index to desired conditions (DC) and historic range of variability (HRV) for the piñon-juniper woodland PNVT (developed from LANDFIRE Rapid Assessment model description *JUPI1*)

Historic State	Successional Structure, Composition, and Cover Classes ¹	Percent Composition		Lesser Value Between A _i and B _i (c)	Departure Index ² (%)
		current (A _i)	DC/HRV (B _i)		
A	Early-development, post-fire community of forbs and perennial grasses	7	5	5	26
B	Mid-development, dense (> 40% cover) juniper-piñon woodland; understory presence diminishing	6	10	6	
C	Early-development, open (< 40% cover) juniper-piñon stand with mixed shrub/herbaceous community in understory	3	25	3	
D	Late-development, open juniper-piñon stand with “savannah-like” appearance; mixed shrub/herbaceous community	69	50	50	
E	Late-development, closed juniper-piñon forest. May be multi-storied. Substantial mortality within stand; depauperate understory	15	10	10	
		100	100	74	

¹ See appendix B table 3 for the vegetation state descriptions and appendix B table 3 for the vegetation map crosswalk for Piñon-Juniper Woodland PNV on the A-SNFs. See appendix B figures 1 and 2 for the conceptual historic and current piñon-juniper savanna vegetation type state and transition models (Gori and Bate 2007)

² Percent departure index based on Czekanowski Coefficient (Czekanowski, 1913; as cited in Kent and Coker, 1992)

In the example above, the piñon-juniper woodland PNV has a departure index (DI) of 26 percent and as a result is 26 percent departed from DCs and HRV. The following is Czekanowski’s Coefficient:

$$DI = \frac{2 \sum_{i=1}^m \min(A_i, B_i)}{\sum_{i=1}^m A_i + \sum_{i=1}^m B_i}$$

where: A_i and B_i = abundance of percent composition *i* (column A and column B)

$\sum_{i=1}^m \min(A_i, B_i)$ = is sum of lesser values of percent composition *i* where it occurs in both A_i and B_i
m = total number of states

- Double the sum of the lesser values between states for Current (A_i) and DC/HRV (B_i) composition, this equals Column C [in this case (2 x 74) = 148]
- Divide that value by the sum of the Current (A_i) composition plus the sum of the DC/HRV (B_i) composition [in this case (148 / (100 + 100)) = 0.74]
- Subtract that value from 1 [in this case (1 - 0.74) = 0.26]
- Multiply that value by 100 [in this case (0.26 x 100) = 26]
- Departure Index = 26 percent

Additional PNV Models and Modeling Information

The following tables, appendix B tables 5 through 15 display, where available, the following information: the Region 3 crosswalks between the current trend model, R3 mid-scale existing vegetation mapping, reference conditions, and baseline DCs.

Forested PNVTs

Ponderosa Pine Forest PNVT

Appendix B table 5. Ponderosa pine forest PNVT crosswalks developed by Region 3 (19 March 2010) used in the determination of departure from HRV and DCs. DCs were provided by the Regional Office, and HRV was derived from the Nature Conservancy (Smith, 2006a)

				INPUT PROPORTION OF PPO/PPG HERE		68	area or proportion of A-SNFs landscape in ponderosa pine/bunchgrass																						
						32	area or proportion of A-SNFs landscape in ponderosa pine/Gambel oak																						
Current Trends Model				R3 Mid-scale Existing Vegetation Mapping				Reference Condition				Baseline Desired Conditions for Ponderosa Pine/Gambel Oak				Baseline Desired Conditions for Ponderosa Pine/Bunchgrass				Baseline Desired Conditions for Ponderosa Pine Forest - All (PPO/PPG)									
source	state	description		dominance unit - size/cover		source	TNC state	historic mean ¹ (%)	description		structural stage (%)	description		structural stage (%)	description		structural stage (%)	description											
USFS R3 model PPF	A, N	GFB/SHR	=	Non-treed: Recently burned, grass, forb, and shrub types - N/A		TNC Ponderosa Pine - Bunchgrass	A, J	0	Grass seedling/sapling < 10% tree cover and uncharacteristic grassland		0	Reference condition		0	Reference condition		0	Reference condition ¹											
	B	SSO	=	All tree types - Seedling/sapling - open canopy			F	0	Seedling/sapling > 10% tree cover		2	Conditions indicative of occasional even-aged stand dynamics and the development of Mexican spotted owl (MSO) habitat ¹		1	Conditions indicative of occasional even-aged stand dynamics and the development of northern goshawk nesting habitat ¹		1	Conditions indicative of occasional even-aged stand dynamics and the development of closed mature forest habitat ¹											
	F	SSC	=	All tree types - Seedling/sapling - closed canopy			B	0	Ponderosa pine young forest, < 30% cover		2	Conditions indicative of occasional even-aged stand dynamics and the development of MSO habitat ¹		1	Conditions indicative of occasional even-aged stand dynamics and the development of northern goshawk nesting habitat ¹		1	Conditions indicative of occasional even-aged stand dynamics and the development of closed mature forest habitat ¹											
	C	SMO	=	All tree types – Small - open canopy			C	0	Ponderosa pine mid-age forest, < 30% cover		79 (primarily in J & K)	Based on reference condition, and the predominance of uneven-aged dynamics and open forest. The plurality of stands on low-productivity sites likely to occur as state J, versus high-productivity sites where state K is more likely ²		94 (primarily in J & K)	Based on reference condition, and the predominance of uneven-aged dynamics and open forest. The plurality of stands on low-productivity sites likely to occur as state J, versus high-productivity sites where state K is more likely		89 (primarily in J & K)	Based on reference condition, and the predominance of uneven-aged dynamics and open forest. The plurality of stands on low-productivity sites likely to occur as state J, versus high-productivity sites where state K is more likely											
	D, J	MOS, MOM	=	All tree types - Medium - open canopy			D, E	100	Ponderosa pine mature/old forest with regeneration, < 30% cover																				
	E, K	VOS, VOM	=	All tree types - Very large - open canopy																									
	Contemporary landscapes only...			¹ Based on 15.6-yr fire interval																									
	G	SMC	=	All tree types - Small - closed canopy		2	Conditions indicative of occasional even-aged stand dynamics and the development of MSO habitat ¹		1	Conditions indicative of occasional even-aged stand dynamics and the development of northern goshawk nesting habitat ¹		1	Conditions indicative of occasional even-aged stand dynamics and the development of closed mature forest habitat ¹																
	H, L	MCS, MCM	=	All tree types - Medium - closed canopy		15	Conditions indicative of MSO habitat, and occasional even-aged dynamics that occurred in the reference condition (Romme et al., 2009a), particularly on north facing slopes and canyons. The plurality of stands on low-productivity sites likely to occur as state H/L, versus high-productivity sites where state I/M is more likely		3	Conditions indicative of northern goshawk nesting habitat, and occasional even-aged dynamics that occurred in the reference condition (Romme et al., 2009a), particularly on north facing slopes and canyons. The plurality of stands on low-productivity sites likely to occur as state H/L, versus high-productivity sites where state I/M is more likely		7	Conditions indicative of mature closed forest habitat and occasional even-aged dynamics that occurred in the reference condition (Romme et al., 2009a), particularly on north facing slopes and canyons. The plurality of stands on low-productivity sites likely to occur as state H/L, versus high-productivity sites where state I/M is more likely																
	I, M	VCS, VCM	=	All tree types - Very large - closed canopy																									
										¹ Reflects percentage of seral forests necessary to sustain at least 15% MSO habitat in mature closed forest										¹ Reflects percentage of early-mid seral forest necessary to sustain at least 3% mature closed forest condition as northern goshawk nesting habitat									
										² Based on residual proportion of the landscape not including mature closed forest (states H, L, I, M) and early-mid even-aged states (B, F, C, G)										¹ Percentage may also be based on area weighting of PPO and PPG subclasses									

Ponderosa Pine Forest PNVT State and Transition Models

The following is Smith's (2006b) discussion concerning the current modeling results for ponderosa pine forest.

In response to the USDA Forest Service Southwestern Region's need for landscape scale planning tools, Schussman and Smith (2006a and 2006b) developed broad-scale state and transition models for eight PNVTs in the Southwest based on a comprehensive literature review. They utilized this information to describe vegetation model states, identify parameter values for these models and to run quantitative scenario analysis, using VDDT software, to determine the relative proportion of model states on the landscape. VDDT software is a non-spatial model that allows the user to model vegetation change over time as a series of vegetation states that differ in structure, composition, and cover and to specify the amount of time it takes to move from one vegetation state to another in the absence of disturbance. Various disturbance agents affecting the movement of vegetation between states (or transitions) are incorporated (e.g., surface fires, stand-replacing fires, grazing, insect outbreaks, and drought events). By varying the types and rates of disturbance across the landscape, the effects of different disturbance regimes, such as historic and current fire regimes, or different management treatments, such as wildland fire use, fire suppression, prescribed burning, grazing practices, and mechanical fuel treatments, on vegetation can be investigated. These models will summarize and synthesize the current state of scientific knowledge of vegetation dynamics. Additionally, they will provide forest planners and managers with powerful tools for understanding, investigating, and demonstrating the effects of alternative scenarios for the management of vegetation on national forests at scales ranging from the RD to the Southwestern Region.

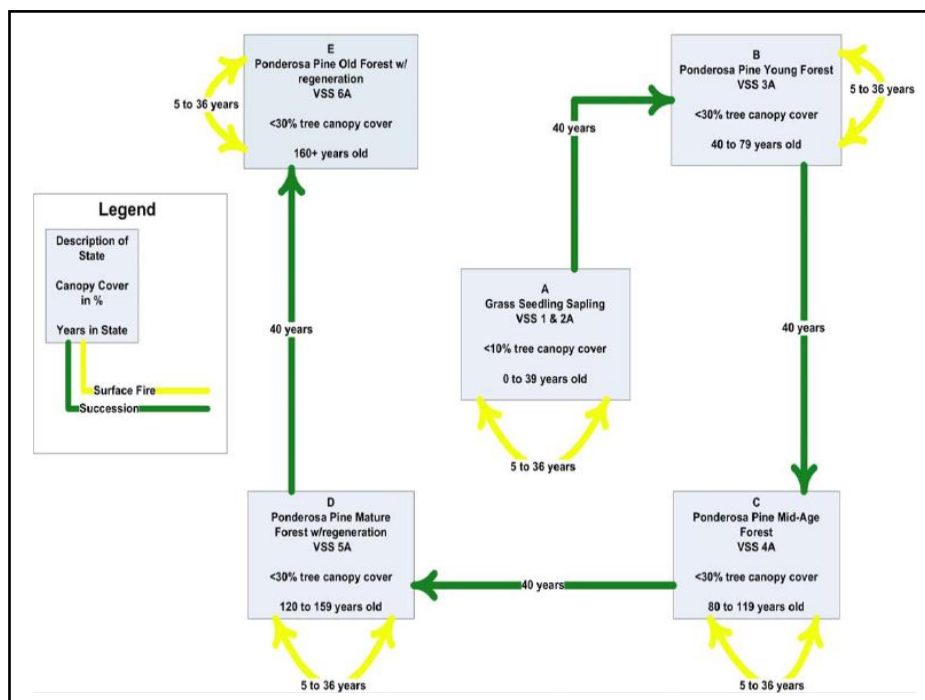
The region-wide scale at which the models were constructed, as well as the sole reliance on published scientific information to build and parameterize the models, necessarily limits the level of detail in a model as well as the applicability of the model to a given site. Given these constraint, it is important to utilize information from these models to understand general trends in vegetation change and dynamics at large scales while utilizing finer scale models (such as those found in ecological site descriptions developed by the Natural Resources Conservation Service) and/or expert information to model and evaluate land management at the site level.

Schussman and Smith (2006a and 2006b) defined all model states, transitions between states, and transition probabilities using information from published, peer-reviewed journal articles, as well as published conference proceedings, reports, theses and dissertations, and book chapters. They limited their search to relevant literature that came from studies of Southwest ecosystems, with a geographical emphasis on Arizona, New Mexico, and northern Mexico to ensure compatibility and relevance to Southwest ecosystems. This information is synthesized in narrative form for each PNVT in a companion document entitled *Historic range of variation for potential natural vegetation types of the Southwest* (Schussman and Smith, 2006a).

Schussman and Smith (2006a and 2006b) described each model state by 1) its dominant vegetation and/or life form, 2) percent canopy cover or density of one vegetation component (i.e. grass, shrubs or trees), and 3) the number of years that can be spent in that state (without a disturbance) before it transitions to another state. Dominant vegetation and life form definitions followed the Forest Service's guidelines which break down or identify dominance types in terms of a single dominant species or genera when either accounts for greater than or equal to 60 percent canopy cover, or in terms of co-dominant species or genera when two or more species or genera account for greater than or equal to 80 percent canopy cover together with each individually having greater than or equal to 20 percent canopy cover. Life forms are classified as tree if tree canopy cover is greater than or equal to ten percent, shrub if shrub canopy cover is greater than or equal to ten percent, and herbaceous if herbaceous canopy cover is greater than or equal to

ten percent herbaceous canopy cover (Brohman and Bryant, 2005). The Nature Conservancy utilized Forest Service guidelines in the model building process in order to make the models directly comparable to Region 3's mid-scale mapping of current vegetation. Parity of this nature will allow modeled estimates of historic vegetation to be compared with current vegetation in order to determine departure from historic and too help identify desired future conditions.

Smith (2006a) identified 19 types of transitions that are likely under historical (pre-1880) (figure 4) and/or current (post-1880) (figure 5) conditions: stand replacing fire, mixed severity fire, surface fire, in-growth, drought event, wet event, large droughts followed immediately by erosion events such as large wet events or wind events (drought/wet/wind), windthrow, avalanche, insect outbreak, disease outbreak, herbivory (native and non-native), use by native people, plant growth, prescribed fire or wildland fire use, spread of non-native species, and mechanical or chemical treatments. This is not an exhaustive list of possible transitions but rather represents a list for which there was information available to determine the effect and/or frequency of the transition.

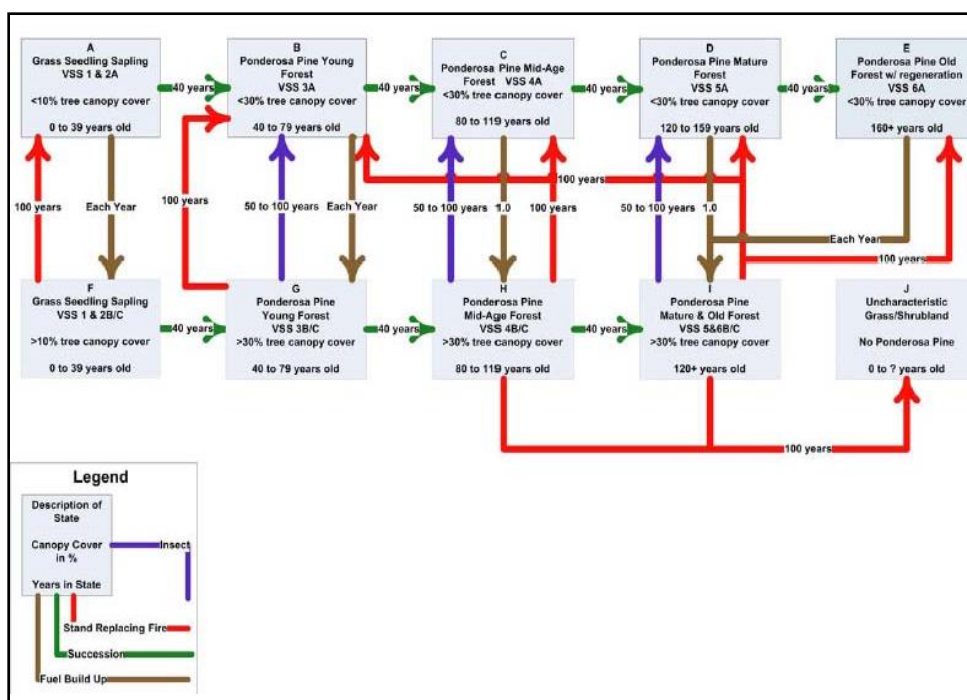


Appendix B figure 11. Conceptual historic state and transition model for the ponderosa pine-bunchgrass vegetation type. Frequency of transitions are noted when this information is supported by published sources; where no or conflicting information exists on the frequency of transitions, unknown is the notation

The level of model complexity (number of model states and transitions) varies by PNVT based on the amount of available information. For example, there is a great deal of disturbance, cover, and post-disturbance regeneration information available for the ponderosa pine forest PNVT; hence a ten state model with five transitions was created. In contrast, there is little to nothing known about these same factors for the Madrean encinal woodland PNVT (as an example), hence no model was created. Figure 5 displays a conceptual current state and transition model for the Ponderosa Pine forest-bunchgrass vegetation type (Smith 2006a) used in VDDT modeling. In table 6, Smith (2006a) describes the parameters included or not included within the current VDDT models (Schussman and Smith 2006a and 2006b), as well as the sources of information and any assumptions used to create the model parameters. Figures 6 through 16 display the actual state and transition model used in the VDDT program to

determine future departure conditions and assessment of trends for the ponderosa pine and dry mixed conifer forest PNVT (“AKA - mixed conifer with frequent fire forest”) on the A-SNFs.

According to Smith (2006a and 2006b), results of the historic ponderosa pine-bunchgrass model indicate a small amount of variability in the 900-year average for each state based on the fire interval range. Historic models simulate the average (15.6 years), maximum (36.3 years), and minimum (5.4 years) of the estimated fire return interval range. All three fire return intervals predicted that a majority of the landscape (99 percent) would be in the open old forest (State E), with a very small proportion of the landscape in the mature open forests, (State D) (< 1 percent). The states represent uneven-aged stands or patches with the range of ages given representing the maximum age of the stand rather than the absolute range of ages within the patch.



Appendix B figure 12. Conceptual current state and transition model for ponderosa pine-bunchgrass native vegetation type. Frequency of transitions are noted when this information is supported by published sources, where no or conflicting information exists on the frequency of transitions, unknown is the notation. Dashed outlines represent states which may have been uncharacteristic for the Nature Conservancy’s descriptions of the VDDT model transitions (Smith, 2006a; Schussman and Smith, 2006a and 2006b)

The current ponderosa pine-bunchgrass model, which was run for 120 years, had very different results from the historic model. Old forest open (State E) has been reduced 70-90 percent, while mature/old forest closed (State I) increased from 0 percent in the historic model to a range of 53 to 57 percent in the current model. The percentage of open states is very low (0 to 1 percent) in the current model, while there is low abundance of the closed states other than state I (1 to 6 percent). Uncharacteristic grasslands (State J) accumulated up to 16 percent of the landscape under the current scenario, compared to 0 percent under the historic scenario. The minimum and average fire return intervals produced identical values for landscape proportion for all classes, indicating that the model is not sensitive to this variability in fire regime.

According to Smith (2006a and 2006b), these modeled scenarios implicate the importance of frequent surface fire in maintaining open ponderosa pine-bunchgrass ecosystems. When comparing the historic

versus the current models, the increase in proportion of the landscape that is closed and susceptible to stand replacing fires that result in uncharacteristic grasslands that are not forested, and may have a low probability of becoming reforested without costly intervention, is readily apparent. When comparing the model outputs to existing conditions, it is likely that the model overestimates all classes of mature and old forest, which in reality have been reduced as a result of timber harvest (Bahre, 1985), and underestimate the seedling and sapling class abundance due to the lack of a regeneration transition that would increase these class abundances (States A and F). The abundance of these model states could be refined through a careful assessment of forthcoming datasets that will quantify their current abundance in the mid-scale vegetation analysis.

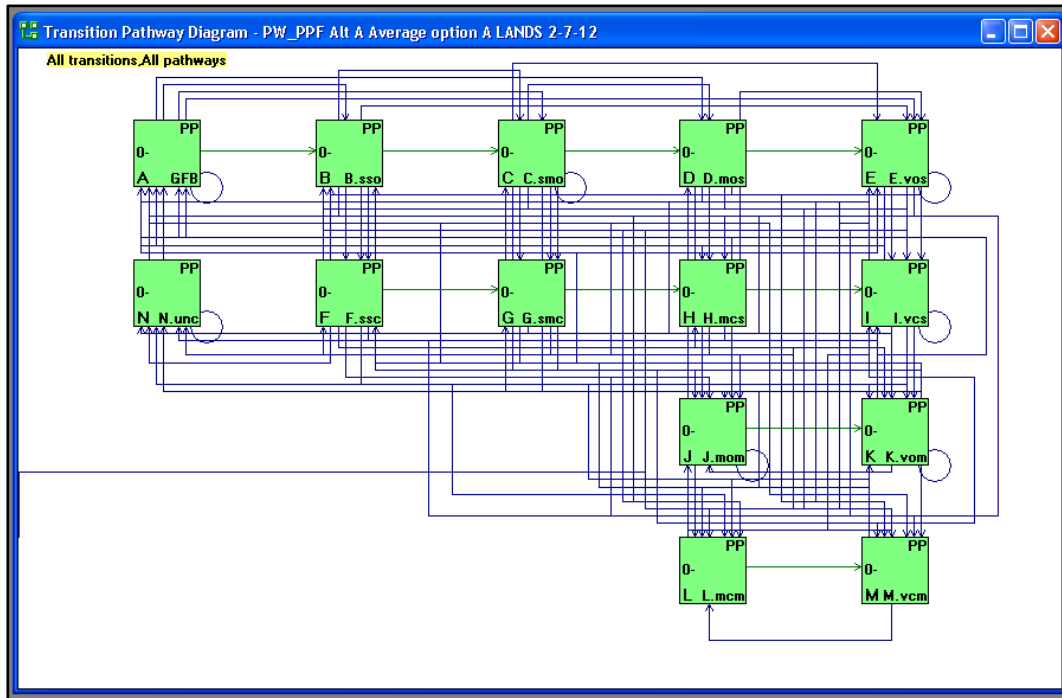
These modeled scenarios implicate the importance of frequent surface fire in maintaining open ponderosa pine-bunchgrass ecosystems. When comparing the Historic versus the current models, the increase in proportion of the landscape that is closed and susceptible to stand replacing fires that result in uncharacteristic grasslands that are not forested, and may have a low probability of becoming reforested without costly intervention, is readily apparent. When comparing the model outputs to existing conditions, it is likely that the model overestimates all classes of mature and old forest, which in reality have been reduced as a result of timber harvest (Bahre, 1985), and underestimate the seedling and sapling class abundance due to the lack of a regeneration transition that would increase these class abundances (States A and F). The abundance of these model states could be refined through a careful assessment of forthcoming datasets that will quantify their current abundance in the mid-scale vegetation analysis.

Appendix B figures 13 through 27 display the actual VDDT model for ponderosa pine forest, developed by the USDA FS Southwestern Region 3, and utilized during the planning effort on the A-SNFs to determine future departure conditions and assessment of trends.

Appendix B table 6. Identification of current transitions, frequency of transitions, sources of information used, and assumptions used to develop the frequency of transitions and its effect on vegetation for the ponderosa pine forest included in the VDDT models (adapted from Smith, 2006b¹)

Transition Type	Transition Frequency or Length	Information Sources	Assumptions
Fuel build-up	Once every year after 25 years of growth	Several authors have documented the cessation of surface fires around 1880, which has led to the accumulation of fuels (Covington and Moore, 1994; Swetnam and Baisan, 1996; Allen et al., 2002; Fulé et al., 2003)	Smith assumed that it would take approximately 25 years of growth since the last surface fire to move from an open canopy state (< 30% canopy cover) to a higher canopy state (> 30%).
Surface fire	Not used in current model	Covington and Moore, 1994; Swetnam and Baisan, 1996; Sneed et al., 2003; Allen et al., 2002; Fulé et al., 2003	Based on direct observation, we assume that surface fire has ceased at the scale of this model (9 million acres). Occasional surface fires do occur, but not at the same scale, and typically enough fuels have accumulated in most areas to quickly transition surface fires to stand replacing fires. Prescribed fire and fire use fires are occurring in some areas at some times, but not within the range of variability for this system.
Stand replacing fire	Once every 100 years	Cessation of surface fires and accumulation of fuels and development of fuel ladders has led to an increase in the frequency of stand replacing fires (Covington and Moore, 1994; Swetnam and Baisan, 1996; Covington et al., 1997; Allen et al., 2002). The effects of stand replacing fire on vegetation have been documented by Savage and Mast (2005)	Smith based his estimate of fire on fire scar data. Specifically, regional fire scar data shows drastic declines in fires from 1900 to present. Given these data, we estimated a fire occurrence of 1 in the last 100 years. Fires studied by Savage and Mast (2005) give proportions of ponderosa pine forests resulting from stand replacing fires of the 1940s to 1970s. These values were used in modeling the relative proportion of states resulting from stand replacing fire in ponderosa pine forests of the Southwest.
Insect outbreak	Once every 50 to 100 years	Bark beetle insect outbreaks have occurred 1 to 2 times over the last century (Dahms and Geils, 1997; Negrón et al., 2000)	Insect-mediated mortality of ponderosa pines is highly variable spatially and temporally, but stands seldom experience 100% mortality, and it is assumed that beetle outbreaks take patches from a closed to an open state of the same age.
Plant growth	40 years	Transitions among model states were taken from silvicultural data summarized by Reynolds et al. (1992)	Smith assumed that transition from seedling/sapling to young forest takes approximately 40 years, and transitions from young to mid-age forest, mid-age to mature forest, and mature forest to old forest also take 40 years.
Silvicultural activities	Highly variable through time and across space, thus not included in the model	Ponderosa pine forests have been logged and thinned since the 1850s to 1880s, with silvicultural prescriptions ranging from clear-cutting to thinning of pole and smaller trees (Bahre, 1985)	Smith assumed that the model overestimates the proportion of the current landscape in the mature to old forest open and closed classes due to the loss of many of the larger trees to timber harvest.

¹ See Smith, 2006b



Appendix B figure 13. Actual Alternative A VDDT state and transition model used for assessing trends in the ponderosa pine forest PNVT on the A-SNFs

Class Properties for Class A: PP GFB

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	B	PP	B.sso

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	To Class		
				Box	Cover	Stage
2_B	0.0575	1.00	0.0575	B	PP	B.sso
2_C	0.0198	1.00	0.0198	C	PP	C.smo
2_D	0.0240	1.00	0.0240	D	PP	D.mos
2_E	0.0198	1.00	0.0198	E	PP	E.vos
Nonlethal Fire	0.0100	1.00	0.0100	A	PP	GFB

Display Pathways

☒ From Class

☐ To Class

☐ TSD

☐ Ages

OK Cancel Apply

Appendix B figure 14. Alternative A ponderosa pine forest PNVTs' potentially management driven (0) and naturally driven (5) transitions for State A

Class Properties for Class B: PP B.sso

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	C	PP	C.smo

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
2_C	0.0350	1.00	0.0350	C	PP	C.smo
2_F	0.0844	1.00	0.0844	F	PP	F.ssc
2_G	0.0527	1.00	0.0527	G	PP	G.smc
J RX FIRE ONLY Low	0.0100	0.40	0.0040	A	PP	GFB
J RX FIRE ONLY Low	0.0100	0.20	0.0020	E	PP	E.vos
J RX FIRE ONLY Low	0.0100	0.20	0.0020	J	PP	J.mom
K RX FIRE ONLY Moderate	0.0001	0.80	0.0001	A	PP	GFB
L RX FIRE ONLY High	0.0001	0.80	0.0001	A	PP	GFB
Mixed Severity Fire	0.0001	0.80	0.0001	A	PP	GFB
Nonlethal Fire	0.0100	0.40	0.0040	A	PP	GFB
Nonlethal Fire	0.0100	0.20	0.0020	E	PP	E.vos
Nonlethal Fire	0.0100	0.20	0.0020	J	PP	J.mom
Stand-Replacing Fire	0.0001	0.80	0.0001	A	PP	GFB

Display Pathways

☒ From Class

☐ To Class

Buttons: New, Copy, Delete, TSD, Ages, Sort...

Buttons: OK, Cancel, Apply

Appendix B figure 15. Alternative A ponderosa pine forest PNVTs' potentially management driven (5) and naturally driven (9) transitions for State B. Alternative A ponderosa pine forest PNV State B transitions continued in Appendix B figure 15a

Class Properties for Class B: PP B.sso

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	C	PP	C.smo

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
2_F	0.0844	1.00	0.0844	F	PP	F.ssc
2_G	0.0527	1.00	0.0527	G	PP	G.smc
J RX FIRE ONLY Low	0.0100	0.40	0.0040	A	PP	GFB
J RX FIRE ONLY Low	0.0100	0.20	0.0020	E	PP	E.vos
J RX FIRE ONLY Low	0.0100	0.20	0.0020	J	PP	J.mom
K RX FIRE ONLY Moderate	0.0001	0.80	0.0001	A	PP	GFB
L RX FIRE ONLY High	0.0001	0.80	0.0001	A	PP	GFB
Mixed Severity Fire	0.0001	0.80	0.0001	A	PP	GFB
Nonlethal Fire	0.0100	0.40	0.0040	A	PP	GFB
Nonlethal Fire	0.0100	0.20	0.0020	E	PP	E.vos
Nonlethal Fire	0.0100	0.20	0.0020	J	PP	J.mom
Stand-Replacing Fire	0.0001	0.80	0.0001	A	PP	GFB

Display Pathways

☒ From Class

☐ To Class

Buttons: New, Copy, Delete, TSD, Ages, Sort...

Buttons: OK, Cancel, Apply

Appendix B figure 15a. Alternative A ponderosa pine forest PNV State B transitions continued

Class Properties for Class C: PP C.smo

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	D	PP	D.mos

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
2_D	0.0075	1.00	0.0075	D	PP	D.mos
2_F	0.0062	1.00	0.0062	F	PP	F.ssc
2_G	0.0703	1.00	0.0703	G	PP	G.smc
2_H	0.0075	1.00	0.0075	H	PP	H.mcs
2_J	0.0062	1.00	0.0062	J	PP	J.mom
2_L	0.0088	1.00	0.0088	L	PP	L.mcm
B Free thin all sizes to target	0.0100	0.07	0.0007	J	PP	J.mom
C Thin from below to target	0.0100	1.00	0.0100	C	PP	C.smo
J RX FIRE ONLY Low	0.0100	0.14	0.0014	D	PP	D.mos
J RX FIRE ONLY Low	0.0100	0.14	0.0014	J	PP	J.mom
K RX FIRE ONLY Moderate	0.0100	0.29	0.0029	A	PP	GFB
K RX FIRE ONLY Moderate	0.0100	0.14	0.0014	D	PP	D.mos
K RX FIRE ONLY Moderate	0.0100	0.07	0.0007	E	PP	E.vos

Display Pathways

☒ From Class
☐ To Class

☐ TSD
☐ Ages

OK Cancel Apply

Appendix B figure 16. Alternative A ponderosa pine forest PNVTs' potentially management driven (9) and naturally driven (13) transitions for State C. Alternative A ponderosa pine forest PNVT State C transitions continued in Appendix B figure 16a

Class Properties for Class C: PP C.smo

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	D	PP	D.mos

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
K RX FIRE ONLY Moderate	0.0100	0.29	0.0029	A	PP	GFB
K RX FIRE ONLY Moderate	0.0100	0.14	0.0014	D	PP	D.mos
K RX FIRE ONLY Moderate	0.0100	0.07	0.0007	E	PP	E.vos
K RX FIRE ONLY Moderate	0.0100	0.21	0.0021	J	PP	J.mom
L RX FIRE ONLY High	0.0001	1.00	0.0001	A	PP	GFB
Mixed Severity Fire	0.0100	0.29	0.0029	A	PP	GFB
Mixed Severity Fire	0.0100	0.14	0.0014	D	PP	D.mos
Mixed Severity Fire	0.0100	0.07	0.0007	E	PP	E.vos
Mixed Severity Fire	0.0100	0.21	0.0021	J	PP	J.mom
Nonlethal Fire	0.0100	0.14	0.0014	D	PP	D.mos
Nonlethal Fire	0.0100	0.14	0.0014	J	PP	J.mom
Stand-Replacing Fire	0.0001	1.00	0.0001	A	PP	GFB

Display Pathways

☒ From Class
☐ To Class

☐ TSD
☐ Ages

OK Cancel Apply

Appendix B figure 16a. Alternative A ponderosa pine forest PNVT State C transitions continued

Class Properties for Class D: PP D.mos

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	E	PP	E.vos

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
2_B	0.0101	1.00	0.0101	B	PP	B.sso
2_E	0.0127	1.00	0.0127	E	PP	E.vos
2_F	0.0101	1.00	0.0101	F	PP	F.ssc
2_H	0.0466	1.00	0.0466	H	PP	H.mcs
2_J	0.0075	1.00	0.0075	J	PP	J.mom
2_L	0.0140	1.00	0.0140	L	PP	L.mcm
B Free thin all sizes to target	0.0100	0.05	0.0005	E	PP	E.vos
C Thin from below to target	0.0100	0.05	0.0005	H	PP	H.mcs
D Thin under	0.0100	0.02	0.0002	I	PP	I.vcs
E GroupSelect with matrix thin	0.0100	1.00	0.0100	J	PP	J.mom
F Shelterwood seed cut to	0.0100	0.19	0.0019	A	PP	GFB
F Shelterwood seed cut to	0.0100	0.02	0.0002	E	PP	E.vos
L RX FIRE ONLY Low	0.0100	0.02	0.0002	A	PP	GFB

Display Pathways
☒ From Class
☐ To Class

Buttons: New, Copy, Delete, TSD, Ages, Sort..., OK, Cancel, Apply

Appendix B figure 17. Alternative A ponderosa pine forest PNVTs' potentially management driven (10) and naturally driven (10) transitions for State D. Alternative A ponderosa pine forest PNVT State D transitions continued in Appendix B figure 17a

Class Properties for Class D: PP D.mos

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	E	PP	E.vos

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
D Thin under	0.0001	0.02	0.0000	E	PP	E.vos
E GroupSelect with matrix thin	0.0100	1.00	0.0100	J	PP	J.mom
F Shelterwood seed cut to	0.0100	0.19	0.0019	A	PP	GFB
F Shelterwood seed cut to	0.0100	0.02	0.0002	E	PP	E.vos
J RX FIRE ONLY Low	0.0100	0.02	0.0002	A	PP	GFB
K RX FIRE ONLY Moderate	0.0100	0.09	0.0009	A	PP	GFB
K RX FIRE ONLY Moderate	0.0100	0.02	0.0002	E	PP	E.vos
L RX FIRE ONLY High	0.0001	0.91	0.0001	A	PP	GFB
Mixed Severity Fire	0.0100	0.09	0.0009	A	PP	GFB
Mixed Severity Fire	0.0100	0.02	0.0002	E	PP	E.vos
Nonlethal Fire	0.0100	0.02	0.0002	A	PP	GFB
Stand-Replacing Fire	0.0001	0.91	0.0001	A	PP	GFB

Display Pathways
☐ From Class
☐ To Class

Buttons: New, Copy, Delete, TSD, Ages, Sort..., OK, Cancel, Apply

Appendix B figure 17a. Alternative A ponderosa pine forest PNVT State D transitions continued

Class Properties for Class E: PP E.vos

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	E	PP	E.vos

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	Stage
2_B	0.0053	1.00	0.0053	B	PP	B.sso
2_I	0.0053	1.00	0.0053	I	PP	I.vcs
2_K	0.0188	1.00	0.0188	K	PP	K.vom
2_M	0.0032	1.00	0.0032	M	PP	M.vcm
B Free thin all sizes to target	0.0100	1.00	0.0100	E	PP	E.vos
C Thin from below to target	0.0100	1.00	0.0100	E	PP	E.vos
D Thin under	0.0100	1.00	0.0100	I	PP	I.vcs
E GroupSelect with matrix thin	0.0100	1.00	0.0100	K	PP	K.vom
F Shelterwood seed cut to	0.0100	0.92	0.0092	A	PP	GFB
J RX FIRE ONLY Low	0.0100	0.08	0.0008	K	PP	K.vom
K RX FIRE ONLY Moderate	0.0100	0.15	0.0015	K	PP	K.vom
L RX FIRE ONLY High	0.0001	0.38	0.0000	A	PP	GFB
Mixed Severity Fire	0.0100	0.15	0.0015	K	PP	K.vom

Display Pathways

☒ From Class
☐ To Class

**PP - Ponderosa-Pine
E.vos - E.VLarge_Open_Single**

☐ TSD
☐ Ages

OK Cancel Apply

Appendix B figure 18. Alternative A ponderosa pine forest PNVTs' potentially management driven (8) and naturally driven (7) transitions for State E. Alternative A ponderosa pine forest PNVT State E transitions continued in Appendix B figure 18a

Class Properties for Class E: PP E.vos

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	E	PP	E.vos

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	Stage
2_M	0.0032	1.00	0.0032	M	PP	M.vcm
B Free thin all sizes to target	0.0100	1.00	0.0100	E	PP	E.vos
C Thin from below to target	0.0001	1.00	0.0001	E	PP	E.vos
D Thin under	0.0001	1.00	0.0001	E	PP	E.vos
E GroupSelect with matrix thin	0.0100	1.00	0.0100	K	PP	K.vom
F Shelterwood seed cut to	0.0100	0.92	0.0092	A	PP	GFB
J RX FIRE ONLY Low	0.0100	0.08	0.0008	K	PP	K.vom
K RX FIRE ONLY Moderate	0.0100	0.15	0.0015	K	PP	K.vom
L RX FIRE ONLY High	0.0001	0.38	0.0000	A	PP	GFB
Mixed Severity Fire	0.1000	0.15	0.0150	K	PP	K.vom
Nonlethal Fire	0.0100	0.08	0.0008	K	PP	K.vom
Stand-Replacing Fire	0.0001	0.38	0.0000	A	PP	GFB

Display Pathways

☒ From Class
☐ To Class

**PP - Ponderosa-Pine
E.vos - E.VLarge_Open_Single**

☐ TSD
☐ Ages

OK Cancel Apply

Appendix B figure 18a. Alternative A ponderosa pine forest PNVT State E transitions continued

Class Properties for Class F: PP F.ssc

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	G	PP	G.smc

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	Stage
2_G	0.0371	1.00	0.0371	G	PP	G.smc
2_L	0.0056	1.00	0.0056	L	PP	L.mcm
2_M	0.0033	1.00	0.0033	M	PP	M.vcm
B Free thin all sizes to target	0.0100	0.08	0.0008	C	PP	C.smo
B Free thin all sizes to target	0.0100	0.08	0.0008	D	PP	D.mos
B Free thin all sizes to target	0.0100	0.08	0.0008	E	PP	E.vos
B Free thin all sizes to target	0.0100	0.08	0.0008	G	PP	G.smc
B Free thin all sizes to target	0.0100	0.17	0.0017	J	PP	J.mom
C Thin from below to target	0.0100	0.08	0.0008	B	PP	B.sso
C Thin from below to target	0.0100	0.17	0.0017	G	PP	G.smc
J RX FIRE ONLY Low	0.0100	0.25	0.0025	B	PP	B.sso
J RX FIRE ONLY Low	0.0100	0.08	0.0008	C	PP	C.smo
J RX FIRE ONLY Low	0.0100	0.17	0.0017	D	PP	D.mos

Display Pathways

☒ From Class

☐ To Class

☐ TSD

☐ Ages

OK Cancel Apply

Appendix B figure 19. Alternative A ponderosa pine forest PNVTs' potentially management driven (21) and naturally driven (17) transitions for State F. Alternative A ponderosa pine forest PNVT State F transitions continued in Appendix B figures 19a and 19b

Class Properties for Class F: PP F.ssc

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	G	PP	G.smc

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	Stage
J RX FIRE ONLY Low	0.0100	0.17	0.0017	D	PP	D.mos
J RX FIRE ONLY Low	0.0100	0.08	0.0008	G	PP	G.smc
K RX FIRE ONLY Moderate	0.0100	0.25	0.0025	B	PP	B.sso
K RX FIRE ONLY Moderate	0.0100	0.17	0.0017	C	PP	C.smo
K RX FIRE ONLY Moderate	0.0100	0.08	0.0008	D	PP	D.mos
K RX FIRE ONLY Moderate	0.0100	0.08	0.0008	E	PP	E.vos
K RX FIRE ONLY Moderate	0.0100	0.25	0.0025	J	PP	J.mom
K RX FIRE ONLY Moderate	0.0100	0.08	0.0008	K	PP	K.vom
L RX FIRE ONLY High	0.0100	0.39	0.0039	A	PP	GFB
L RX FIRE ONLY High	0.0100	0.33	0.0033	B	PP	B.sso
L RX FIRE ONLY High	0.0100	0.08	0.0008	K	PP	K.vom
L RX FIRE ONLY High	0.0100	0.19	0.0019	N	PP	N.unc
Mixed Severity Fire	0.0100	0.25	0.0025	R	PP	R.sso

Display Pathways

☒ From Class

☐ To Class

☐ TSD

☐ Ages

OK Cancel Apply

Appendix B figure 19a. Alternative A ponderosa pine forest PNVT State F transitions continued

Class Properties for Class F: PP F.ssc

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	G	PP	G.smc

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class Stage
Mixed Severity Fire	0.0100	0.17	0.0017	C	PP	C.smo
Mixed Severity Fire	0.0100	0.08	0.0008	D	PP	D.mos
Mixed Severity Fire	0.0100	0.08	0.0008	E	PP	E.vos
Mixed Severity Fire	0.0100	0.25	0.0025	J	PP	J.mom
Mixed Severity Fire	0.0100	0.08	0.0008	K	PP	K.vom
Nonlethal Fire	0.0100	0.25	0.0025	B	PP	B.sso
Nonlethal Fire	0.0100	0.08	0.0008	C	PP	C.smo
Nonlethal Fire	0.0100	0.17	0.0017	D	PP	D.mos
Nonlethal Fire	0.0100	0.08	0.0008	G	PP	G.smc
Stand-Replacing Fire	0.0100	0.39	0.0039	A	PP	GFB
Stand-Replacing Fire	0.0100	0.33	0.0033	B	PP	B.sso
Stand-Replacing Fire	0.0100	0.08	0.0008	K	PP	K.vom
Stand-Replacing Fire	0.0100	0.19	0.0019	M	PP	M.vom

Display Pathways

☒ From Class
☐ To Class

Buttons: New, Copy, Delete, TSD, Ages, Sort..., OK, Cancel, Apply

Appendix B figure 19b. Alternative A ponderosa pine forest PNVT State F transitions continued

Class Properties for Class G: PP G.smc

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	H	PP	H.mcs

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class Stage
2_F	0.0012	1.00	0.0012	F	PP	F.ssc
2_H	0.0057	1.00	0.0057	H	PP	H.mcs
2_L	0.0177	1.00	0.0177	L	PP	L.mcm
2_M	0.0030	1.00	0.0030	M	PP	M.vcm
B Free thin all sizes to target	0.0100	0.14	0.0014	C	PP	C.smo
B Free thin all sizes to target	0.0100	0.66	0.0066	D	PP	D.mos
B Free thin all sizes to target	0.0100	0.05	0.0005	E	PP	E.vos
B Free thin all sizes to target	0.0100	0.02	0.0002	F	PP	F.ssc
B Free thin all sizes to target	0.0100	0.05	0.0005	J	PP	J.mom
B Free thin all sizes to target	0.0100	0.05	0.0005	K	PP	K.vom
C Thin from below to target	0.0100	0.05	0.0005	C	PP	C.smo
C Thin from below to target	0.0100	0.41	0.0041	D	PP	D.mos
C Thin from below to target	0.0100	0.02	0.0002	F	PP	F.ssc

Display Pathways

☒ From Class
☐ To Class

Buttons: New, Copy, Delete, TSD, Ages, Sort..., OK, Cancel, Apply

Appendix B figure 20. Alternative A ponderosa pine forest PNVTs' potentially management driven (35) and naturally driven (27) transitions for State G. Alternative A ponderosa pine forest PNVT State G transitions continued in Appendix B figures 20a through 20d

Class Properties for Class G: PP G.smc

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	H	PP	H.mcs

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class Stage
C Thin from below to target	0.0100	0.11	0.0011	H	PP	H.mcs
C Thin from below to target	0.0100	0.05	0.0005	J	PP	J.mom
C Thin from below to target	0.0100	0.05	0.0005	K	PP	K.vom
C Thin from below to target	0.0100	0.02	0.0002	L	PP	L.mcm
Insect/Disease	0.0100	1.00	0.0100	C	PP	C.smo
J RX FIRE ONLY Low	0.0100	0.09	0.0009	C	PP	C.smo
J RX FIRE ONLY Low	0.0100	0.05	0.0005	D	PP	D.mos
J RX FIRE ONLY Low	0.0100	0.20	0.0020	H	PP	H.mcs
J RX FIRE ONLY Low	0.0100	0.11	0.0011	L	PP	L.mcm
J RX FIRE ONLY Low	0.0100	0.05	0.0005	M	PP	M.vcm
K RX FIRE ONLY Moderate	0.0100	0.16	0.0016	C	PP	C.smo
K RX FIRE ONLY Moderate	0.0100	0.05	0.0005	D	PP	D.mos
K RX FIRE ONLY Moderate	0.0100	0.02	0.0002	F	PP	F.ssc

Display Pathways

☒ From Class

☐ To Class

PP - Ponderosa-Pine
G.smc - G.Small_Closed

☐ TSD
☐ Ages

OK Cancel Apply

Appendix B figure 20a. Alternative A ponderosa pine forest PNVT State G transitions continued

Class Properties for Class G: PP G.smc

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	H	PP	H.mcs

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class Stage
K RX FIRE ONLY Moderate	0.0100	0.02	0.0002	F	PP	F.ssc
K RX FIRE ONLY Moderate	0.0100	0.23	0.0023	H	PP	H.mcs
K RX FIRE ONLY Moderate	0.0100	0.02	0.0002	J	PP	J.mom
K RX FIRE ONLY Moderate	0.0100	0.02	0.0002	K	PP	K.vom
K RX FIRE ONLY Moderate	0.0100	0.09	0.0009	L	PP	L.mcm
K RX FIRE ONLY Moderate	0.0100	0.02	0.0002	M	PP	M.vcm
L RX FIRE ONLY High	0.0100	0.21	0.0021	A	PP	GFB
L RX FIRE ONLY High	0.0100	0.02	0.0002	B	PP	B.sso
L RX FIRE ONLY High	0.0100	0.27	0.0027	C	PP	C.smo
L RX FIRE ONLY High	0.0100	0.23	0.0023	D	PP	D.mos
L RX FIRE ONLY High	0.0100	0.02	0.0002	E	PP	E.vos
L RX FIRE ONLY High	0.0100	0.11	0.0011	J	PP	J.mom
L RX FIRE ONLY High	0.0100	0.02	0.0002	K	PP	K.vom

Display Pathways

☒ From Class

☐ To Class

PP - Ponderosa-Pine
G.smc - G.Small_Closed

☐ TSD
☐ Ages

OK Cancel Apply

Appendix B figure 20b. Alternative A ponderosa pine forest PNVT State G transitions continued

Class Properties for Class G: PP G.smc

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	H	PP	H.mcs

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class Stage
L RX FIRE ONLY High	0.0100	0.02	0.0002	K	PP	K.vom
L RX FIRE ONLY High	0.0100	0.11	0.0011	N	PP	N.unc
Mixed Severity Fire	0.0100	0.16	0.0016	C	PP	C.smo
Mixed Severity Fire	0.0100	0.05	0.0005	D	PP	D.mos
Mixed Severity Fire	0.0100	0.02	0.0002	E	PP	E.vos
Mixed Severity Fire	0.0100	0.02	0.0002	F	PP	F.ssc
Mixed Severity Fire	0.0100	0.23	0.0023	H	PP	H.mcs
Mixed Severity Fire	0.0100	0.02	0.0002	J	PP	J.mom
Mixed Severity Fire	0.0100	0.02	0.0002	K	PP	K.vom
Mixed Severity Fire	0.0100	0.09	0.0009	L	PP	L.mcm
Mixed Severity Fire	0.0100	0.02	0.0002	M	PP	M.vcm
Nonlethal Fire	0.0100	0.09	0.0009	C	PP	C.smo
Nonlethal Fire	0.0100	0.05	0.0005	D	PP	D.mos

Display Pathways
☒ From Class
☐ To Class

PP - Ponderosa-Pine G.smc - G.Small_Closed

☐ TSD
☐ Ages

OK Cancel Apply

Appendix B figure 20c. Alternative A ponderosa pine forest PNVT State G transitions continued

Class Properties for Class G: PP G.smc

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	H	PP	H.mcs

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class Stage
Nonlethal Fire	0.0100	0.05	0.0005	D	PP	D.mos
Nonlethal Fire	0.0100	0.20	0.0020	H	PP	H.mcs
Nonlethal Fire	0.0100	0.11	0.0011	L	PP	L.mcm
Nonlethal Fire	0.0100	0.05	0.0005	M	PP	M.vcm
Stand-Replacing Fire	0.0100	0.21	0.0021	A	PP	GFB
Stand-Replacing Fire	0.0100	0.02	0.0002	B	PP	B.sso
Stand-Replacing Fire	0.0100	0.27	0.0027	C	PP	C.smo
Stand-Replacing Fire	0.0100	0.23	0.0023	D	PP	D.mos
Stand-Replacing Fire	0.0100	0.02	0.0002	E	PP	E.vos
Stand-Replacing Fire	0.0100	0.11	0.0011	J	PP	J.mom
Stand-Replacing Fire	0.0100	0.02	0.0002	K	PP	K.vom
Stand-Replacing Fire	0.0100	0.11	0.0011	N	PP	N.unc

Display Pathways
☒ From Class
☐ To Class

PP - Ponderosa-Pine G.smc - G.Small_Closed

☐ TSD
☐ Ages

OK Cancel Apply

Appendix B figure 20d. Alternative A ponderosa pine forest PNVT State G transitions continued

Class Properties for Class H: PP H.mcs

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	I	PP	I.vcs

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
2_D	0.0004	1.00	0.0004	D	PP	D.mos
2_F	0.0005	1.00	0.0005	F	PP	F.ssc
2_I	0.0077	1.00	0.0077	I	PP	I.vcs
2_L	0.0118	1.00	0.0118	L	PP	L.mcm
2_M	0.0004	1.00	0.0004	M	PP	M.vcm
B Free thin all sizes to target	0.0100	0.10	0.0010	C	PP	C.smo
B Free thin all sizes to target	0.0100	0.85	0.0085	D	PP	D.mos
B Free thin all sizes to target	0.0100	0.05	0.0005	E	PP	E.vos
C Thin from below to target	0.0100	0.65	0.0065	D	PP	D.mos
C Thin from below to target	0.0100	0.05	0.0005	E	PP	E.vos
C Thin from below to target	0.0100	0.03	0.0003	G	PP	G.smc
C Thin from below to target	0.0100	0.03	0.0003	L	PP	L.mcm
D Thin under	0.0100	1.00	0.0100	I	PP	I.vcs

Display Pathways

☒ From Class

☐ To Class

PP - Ponderosa-Pine
H.mcs - H.Medium_Closed_Single

☐ TSD
☐ Ages

OK Cancel Apply

Appendix B figure 21. Alternative A ponderosa pine forest PNVTs' potentially management driven (22) and naturally driven (15) transitions for State H. Alternative A ponderosa pine forest PNVT State H transitions continued in Appendix B figures 21a and 21b

Class Properties for Class H: PP H.mcs

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	I	PP	I.vcs

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
D Thin under	0.0100	0.03	0.0003	J	PP	J.mom
E GroupSelect with matrix thin	0.0100	1.00	0.0100	J	PP	J.mom
F Shelterwood seed cut to	0.0001	0.80	0.0001	D	PP	D.mos
F Shelterwood seed cut to	0.0001	0.03	0.0000	E	PP	E.vos
Insect/Disease	0.0100	1.00	0.0100	D	PP	D.mos
J RX FIRE ONLY Low	0.0100	0.28	0.0028	D	PP	D.mos
J RX FIRE ONLY Low	0.0100	0.10	0.0010	L	PP	L.mcm
K RX FIRE ONLY Moderate	0.0100	0.33	0.0033	D	PP	D.mos
K RX FIRE ONLY Moderate	0.0100	0.03	0.0003	J	PP	J.mom
K RX FIRE ONLY Moderate	0.0100	0.08	0.0008	L	PP	L.mcm
L RX FIRE ONLY High	0.0001	0.50	0.0001	D	PP	D.mos
L RX FIRE ONLY High	0.0001	0.13	0.0000	N	PP	N.unc
Mixed Severely Fire	0.0100	0.33	0.0033	D	PP	D.mos

Display Pathways

☒ From Class

☐ To Class

PP - Ponderosa-Pine
H.mcs - H.Medium_Closed_Single

☐ TSD
☐ Ages

OK Cancel Apply

Appendix B figure 21a. Alternative A ponderosa pine forest PNVT State H transitions continued

Class Properties for Class H: PP H.mcs

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	I	PP	I.vcs

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
K RX FIRE ONLY Moderate	0.0100	0.08	0.0008	L	PP	L.mcm
L RX FIRE ONLY High	0.0001	0.50	0.0001	D	PP	D.mos
L RX FIRE ONLY High	0.0001	0.13	0.0000	N	PP	N.unc
Mixed Severity Fire	0.0100	0.33	0.0033	D	PP	D.mos
Mixed Severity Fire	0.0100	0.03	0.0003	J	PP	J.mom
Mixed Severity Fire	0.0100	0.08	0.0008	L	PP	L.mcm
Nonlethal Fire	0.0100	0.28	0.0028	D	PP	D.mos
Nonlethal Fire	0.0100	0.10	0.0010	L	PP	L.mcm
Stand-Replacing Fire	0.0100	0.27	0.0027	A	PP	GFB
Stand-Replacing Fire	0.0100	0.50	0.0050	D	PP	D.mos
Stand-Replacing Fire	0.0100	0.08	0.0008	J	PP	J.mom
Stand-Replacing Fire	0.0100	0.13	0.0013	N	PP	N.unc

Display Pathways

☒ From Class
☐ To Class

☐ TSD
☐ Ages

OK Cancel Apply

Appendix B figure 21b. Alternative A ponderosa pine forest PNVT State H transitions continued

Class Properties for Class I: PP I.vcs

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	I	PP	I.vcs

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
2_E	0.0024	1.00	0.0024	E	PP	E.vos
2_M	0.0077	1.00	0.0077	M	PP	M.vcm
B Free thin all sizes to target	0.0100	1.00	0.0100	E	PP	E.vos
C Thin from below to target	0.0100	1.00	0.0100	E	PP	E.vos
D Thin under	0.0100	1.00	0.0100	I	PP	I.vcs
E GroupSelect with matrix thin	0.0100	1.00	0.0100	K	PP	K.vom
F Shelterwood seed cut to	0.0100	1.00	0.0100	A	PP	GFB
Insect/Disease	0.0100	1.00	0.0100	E	PP	E.vos
J RX FIRE ONLY Low	0.0100	0.50	0.0050	E	PP	E.vos
K RX FIRE ONLY Moderate	0.0100	0.75	0.0075	E	PP	E.vos
L RX FIRE ONLY High	0.0001	0.50	0.0001	E	PP	E.vos
L RX FIRE ONLY High	0.0001	0.08	0.0000	N	PP	N.unc
Mixed Severity Fire	0.0100	0.75	0.0075	E	PP	E.vos

Display Pathways

☒ From Class
☐ To Class

☐ TSD
☐ Ages

OK Cancel Apply

Appendix B figure 22. Alternative A ponderosa pine forest PNVTs' potentially management driven (10) and naturally driven (8) transitions for State I. Alternative A ponderosa pine forest PNVT State I transitions continued in Appendix B figure 22a

Class Properties for Class I: PP I.vcs

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	I	PP	I.vcs

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
E GroupSelect with matrix thin	0.0100	1.00	0.0100	K	PP	K.vom
F Shelterwood seed cut to	0.0001	1.00	0.0001	A	PP	GFB
Insect/Disease	0.0100	1.00	0.0100	E	PP	E.vos
J RX FIRE ONLY Low	0.0100	0.50	0.0050	E	PP	E.vos
K RX FIRE ONLY Moderate	0.0100	0.75	0.0075	E	PP	E.vos
L RX FIRE ONLY High	0.0001	0.50	0.0001	E	PP	E.vos
L RX FIRE ONLY High	0.0001	0.08	0.0000	N	PP	N.unc
Mixed Severity Fire	0.0100	0.75	0.0075	E	PP	E.vos
Nonlethal Fire	0.0100	0.50	0.0050	E	PP	E.vos
Stand-Replacing Fire	0.0100	0.17	0.0017	A	PP	GFB
Stand-Replacing Fire	0.0100	0.50	0.0050	E	PP	E.vos
Stand-Replacing Fire	0.0100	0.08	0.0008	N	PP	N.unc

Display Pathways

☒ From Class

☐ To Class

PP - Ponderosa-Pine
I.vcs - I.VLarge_Closed_Single

☐ TSD

☐ Ages

OK Cancel Apply

Appendix B figure 22a. Alternative A ponderosa pine forest PNVT State I transitions continued

Class Properties for Class J: PP J.mom

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	K	PP	K.vom

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
2_B	0.0169	1.00	0.0169	B	PP	B.sso
2_D	0.0061	1.00	0.0061	D	PP	D.mos
2_F	0.0103	1.00	0.0103	F	PP	F.ssc
2_G	0.0051	1.00	0.0051	G	PP	G.smc
2_K	0.0071	1.00	0.0071	K	PP	K.vom
2_L	0.0237	1.00	0.0237	L	PP	L.mcm
B Free thin all sizes to target	0.0100	0.06	0.0006	B	PP	B.sso
B Free thin all sizes to target	0.0100	0.29	0.0029	D	PP	D.mos
C Thin from below to target	0.0100	0.18	0.0018	D	PP	D.mos
D Thin under	0.0001	0.06	0.0000	E	PP	E.vos
E GroupSelect with matrix thin	0.0100	1.00	0.0100	J	PP	J.mom
F Shelterwood seed cut to	0.0100	0.65	0.0065	A	PP	GFB
F Shelterwood seed cut to	0.0100	0.06	0.0006	D	PP	D.mos

Display Pathways

☒ From Class

☐ To Class

PP - Ponderosa-Pine
J.mom - J.Medium_Open_Multi

☐ TSD

☐ Ages

OK Cancel Apply

Appendix B figure 23. Alternative A ponderosa pine forest PNVTs' potentially management driven (17) and naturally driven (14) transitions for State J. Alternative A ponderosa pine forest PNVT State J transitions continued in Appendix B figures 23a and 23b

Class Properties for Class J: PP J.mom

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	K	PP	K.vom

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class Stage
F Shelterwood seed cut to	0.0100	0.06	0.0006	E	PP	E.vos
F Shelterwood seed cut to	0.0100	0.06	0.0006	K	PP	K.vom
J RX FIRE ONLY Low	0.0100	0.12	0.0012	A	PP	GFB
J RX FIRE ONLY Low	0.0100	0.29	0.0029	D	PP	D.mos
J RX FIRE ONLY Low	0.0100	0.06	0.0006	K	PP	K.vom
K RX FIRE ONLY Moderate	0.0100	0.18	0.0018	A	PP	GFB
K RX FIRE ONLY Moderate	0.0100	0.29	0.0029	D	PP	D.mos
K RX FIRE ONLY Moderate	0.0100	0.06	0.0006	K	PP	K.vom
L RX FIRE ONLY High	0.0001	0.82	0.0001	A	PP	GFB
L RX FIRE ONLY High	0.0001	0.06	0.0000	E	PP	E.vos
Mixed Severity Fire	0.0001	0.18	0.0000	A	PP	GFB
Mixed Severity Fire	0.0001	0.29	0.0000	D	PP	D.mos
Mixed Severity Fire	0.0001	0.06	0.0000	K	PP	K.vom

Display Pathways

☒ From Class

☐ To Class

☐ TSD

☐ Ages

OK Cancel Apply

Appendix B figure 23a. Alternative A ponderosa pine forest PNV State J transitions continued

Class Properties for Class J: PP J.mom

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	K	PP	K.vom

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class Stage
K RX FIRE ONLY Moderate	0.0100	0.29	0.0029	D	PP	D.mos
K RX FIRE ONLY Moderate	0.0100	0.06	0.0006	K	PP	K.vom
L RX FIRE ONLY High	0.0001	0.82	0.0001	A	PP	GFB
L RX FIRE ONLY High	0.0001	0.06	0.0000	E	PP	E.vos
Mixed Severity Fire	0.0001	0.18	0.0000	A	PP	GFB
Mixed Severity Fire	0.0001	0.29	0.0000	D	PP	D.mos
Mixed Severity Fire	0.0001	0.06	0.0000	K	PP	K.vom
Nonlethal Fire	0.0100	0.12	0.0012	A	PP	GFB
Nonlethal Fire	0.0100	0.29	0.0029	D	PP	D.mos
Nonlethal Fire	0.0100	0.06	0.0006	K	PP	K.vom
Stand-Replacing Fire	0.0001	0.82	0.0001	A	PP	GFB
Stand-Replacing Fire	0.0001	0.06	0.0000	E	PP	E.vos

Display Pathways

☒ From Class

☐ To Class

☐ TSD

☐ Ages

OK Cancel Apply

Appendix B figure 23b. Alternative A ponderosa pine forest PNV State J transitions continued

Class Properties for Class K: PP K.vom

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	K	PP	K.vom

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
2_B	0.0060	1.00	0.0060	B	PP	B.sso
2_C	0.0133	1.00	0.0133	C	PP	C.smo
2_E	0.0079	1.00	0.0079	E	PP	E.vos
2_F	0.0041	1.00	0.0041	F	PP	F.ssc
2_G	0.0046	1.00	0.0046	G	PP	G.smc
2_J	0.0032	1.00	0.0032	J	PP	J.mom
2_M	0.0079	1.00	0.0079	M	PP	M.vcm
B Free thin all sizes to target	0.0100	0.60	0.0060	E	PP	E.vos
C Thin from below to target	0.0100	0.50	0.0050	E	PP	E.vos
D Thin under	0.0001	0.50	0.0001	E	PP	E.vos
E GroupSelect with matrix thin	0.0100	1.00	0.0100	K	PP	K.vom
F Shelterwood seed cut to	0.0001	1.00	0.0001	A	PP	GFB
1 RX FIRE ONLY Low	0.0100	0.27	0.0027	E	PP	E.vos

Display Pathways

☒ From Class

☐ To Class

PP - Ponderosa-Pine
K.vom - K.VLarge_Open_Multi

OK Cancel Apply

Appendix B figure 24. Alternative A ponderosa pine forest PNVTs' potentially management driven (9) and naturally driven (11) transitions for State K. Alternative A ponderosa pine forest PNVT State K transitions continued in Appendix B figure 24a

Class Properties for Class K: PP K.vom

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	K	PP	K.vom

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
C Thin from below to target	0.0100	0.50	0.0050	E	PP	E.vos
D Thin under	0.0001	0.50	0.0001	E	PP	E.vos
E GroupSelect with matrix thin	0.0100	1.00	0.0100	K	PP	K.vom
F Shelterwood seed cut to	0.0001	1.00	0.0001	A	PP	GFB
J RX FIRE ONLY Low	0.0100	0.27	0.0027	E	PP	E.vos
K RX FIRE ONLY Moderate	0.0100	0.30	0.0030	E	PP	E.vos
L RX FIRE ONLY High	0.0001	0.60	0.0001	A	PP	GFB
L RX FIRE ONLY High	0.0001	0.30	0.0000	E	PP	E.vos
Mixed Severity Fire	0.0001	0.30	0.0000	E	PP	E.vos
Nonlethal Fire	0.0100	0.27	0.0027	E	PP	E.vos
Stand-Replacing Fire	0.0001	0.60	0.0001	A	PP	GFB
Stand-Replacing Fire	0.0001	0.30	0.0000	E	PP	E.vos

Display Pathways

☒ From Class

☐ To Class

PP - Ponderosa-Pine
K.vom - K.VLarge_Open_Multi

OK Cancel Apply

Appendix B figure 24a. Alternative A ponderosa pine forest PNVT State K transitions continued

Class Properties for Class L: PP L.mcm

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	M	PP	M.vcm

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
2_F	0.0008	1.00	0.0008	F	PP	F.ssc
2_G	0.0022	1.00	0.0022	G	PP	G.smc
2_H	0.0035	1.00	0.0035	H	PP	H.mcs
2_I	0.0006	1.00	0.0006	I	PP	I.vcs
2_J	0.0003	1.00	0.0003	J	PP	J.mom
2_K	0.0002	1.00	0.0002	K	PP	K.vom
2_M	0.0081	1.00	0.0081	M	PP	M.vcm
B Free thin all sizes to target	0.0100	0.23	0.0023	D	PP	D.mos
B Free thin all sizes to target	0.0100	0.23	0.0023	E	PP	E.vos
B Free thin all sizes to target	0.0100	0.30	0.0030	J	PP	J.mom
B Free thin all sizes to target	0.0100	0.23	0.0023	K	PP	K.vom
C Thin from below to target	0.0100	0.32	0.0032	D	PP	D.mos
C Thin from below to target	0.0100	0.21	0.0021	F	PP	F.ssc

Display Pathways

☒ From Class

☐ To Class

☐ TSD

☐ Ages

OK Cancel Apply

Appendix B figure 25. Alternative A ponderosa pine forest PNVTs' potentially management driven (26) and naturally driven (20) transitions for State L. Alternative A ponderosa pine forest PNVT State L transitions continued in Appendix B figures 25a through 25c

Class Properties for Class L: PP L.mcm

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	M	PP	M.vcm

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
C Thin from below to target	0.0100	0.04	0.0004	H	PP	H.mcs
C Thin from below to target	0.0100	0.28	0.0028	J	PP	J.mom
C Thin from below to target	0.0100	0.09	0.0009	K	PP	K.vom
D Thin under	0.0001	0.09	0.0000	K	PP	K.vom
E GroupSelect with matrix thin	0.0100	1.00	0.0100	K	PP	K.vom
F Shelterwood seed cut to	0.0001	0.79	0.0001	A	PP	GFB
F Shelterwood seed cut to	0.0001	0.04	0.0000	E	PP	E.vos
Insect/Disease	0.0100	1.00	0.0100	J	PP	J.mom
J RX FIRE ONLY Low	0.0100	0.02	0.0002	D	PP	D.mos
J RX FIRE ONLY Low	0.0100	0.17	0.0017	J	PP	J.mom
K RX FIRE ONLY Moderate	0.0100	0.11	0.0011	D	PP	D.mos
K RX FIRE ONLY Moderate	0.0100	0.02	0.0002	H	PP	H.mcs
K RX FIRE ONLY Moderate	0.0100	0.21	0.0021	I	PP	I.vcs

Display Pathways

☒ From Class

☐ To Class

☐ TSD

☐ Ages

OK Cancel Apply

Appendix B figure 25a. Alternative A ponderosa pine forest PNVT State L transitions continued

Class Properties for Class L: PP L.mcm

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	M	PP	M.vcm

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
L RX FIRE ONLY High	0.0001	0.21	0.0000	A	PP	GFB
L RX FIRE ONLY High	0.0001	0.15	0.0000	D	PP	D.mos
L RX FIRE ONLY High	0.0001	0.11	0.0000	E	PP	E.vos
L RX FIRE ONLY High	0.0001	0.04	0.0000	I	PP	I.vcs
L RX FIRE ONLY High	0.0001	0.28	0.0000	J	PP	J.mom
L RX FIRE ONLY High	0.0001	0.11	0.0000	K	PP	K.vom
L RX FIRE ONLY High	0.0001	0.11	0.0000	N	PP	N.unc
Mixed Severity Fire	0.0100	0.11	0.0011	D	PP	D.mos
Mixed Severity Fire	0.0100	0.02	0.0002	H	PP	H.mcs
Mixed Severity Fire	0.0100	0.21	0.0021	J	PP	J.mom
Nonlethal Fire	0.0100	0.02	0.0002	D	PP	D.mos
Nonlethal Fire	0.0100	0.17	0.0017	J	PP	J.mom
Stand-Replacing Fire	0.0100	0.21	0.0021	A	PP	GFB

Display Pathways

☒ From Class
☐ To Class

☐ TSD
☐ Ages

OK Cancel Apply

Appendix B figure 25b. Alternative A ponderosa pine forest PNVT State L transitions continued

Class Properties for Class L: PP L.mcm

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	M	PP	M.vcm

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
Mixed Severity Fire	0.0100	0.11	0.0011	D	PP	D.mos
Mixed Severity Fire	0.0100	0.02	0.0002	H	PP	H.mcs
Mixed Severity Fire	0.0100	0.21	0.0021	J	PP	J.mom
Nonlethal Fire	0.0100	0.02	0.0002	D	PP	D.mos
Nonlethal Fire	0.0100	0.17	0.0017	J	PP	J.mom
Stand-Replacing Fire	0.0100	0.21	0.0021	A	PP	GFB
Stand-Replacing Fire	0.0100	0.15	0.0015	D	PP	D.mos
Stand-Replacing Fire	0.0100	0.11	0.0011	E	PP	E.vos
Stand-Replacing Fire	0.0100	0.04	0.0004	I	PP	I.vcs
Stand-Replacing Fire	0.0100	0.28	0.0028	J	PP	J.mom
Stand-Replacing Fire	0.0100	0.11	0.0011	K	PP	K.vom
Stand-Replacing Fire	0.0100	0.11	0.0011	N	PP	N.unc

Display Pathways

☒ From Class
☐ To Class

☐ TSD
☐ Ages

OK Cancel Apply

Appendix B figure 25c. Alternative A ponderosa pine forest PNVT State L transitions continued

Class Properties for Class M: PP M.vcm

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	M	PP	M.vcm

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
2_F	0.0005	1.00	0.0005	F	PP	F.ssc
2_G	0.0022	1.00	0.0022	G	PP	G.smc
2_I	0.0074	1.00	0.0074	I	PP	I.vcs
2_K	0.0012	1.00	0.0012	K	PP	K.vom
2_L	0.0029	1.00	0.0029	L	PP	L.mcm
B Free thin all sizes to target	0.0100	0.45	0.0045	E	PP	E.vos
B Free thin all sizes to target	0.0100	0.09	0.0009	J	PP	J.mom
B Free thin all sizes to target	0.0100	0.45	0.0045	K	PP	K.vom
C Thin from below to target	0.0100	0.91	0.0091	E	PP	E.vos
C Thin from below to target	0.0100	0.09	0.0009	K	PP	K.vom
D Thin under	0.0100	1.00	0.0100	I	PP	I.vcs
E GroupSelect with matrix thin	0.0100	1.00	0.0100	K	PP	K.vom
F Shelterwood seed cut to	0.0100	0.91	0.0091	A	PP	GFB

Display Pathways
☒ From Class
☐ To Class

PP - Ponderosa-Pine M.vcm - M.VLarge_Closed_Multi

☐ TSD
☐ Ages

OK Cancel Apply

Appendix B figure 26. Alternative A ponderosa pine forest PNVTs' potentially management driven (15) and naturally driven (6) transitions for State M. Alternative A ponderosa pine forest PNV State M transitions continued in Appendix B figures 26a and 26b

Class Properties for Class M: PP M.vcm

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	M	PP	M.vcm

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
F Shelterwood seed cut to	0.0100	0.09	0.0009	D	PP	D.mos
Insect/Disease	0.0100	1.00	0.0100	K	PP	K.vom
J RX FIRE ONLY Low	0.0100	0.18	0.0018	E	PP	E.vos
J RX FIRE ONLY Low	0.0100	0.09	0.0009	I	PP	I.vcs
J RX FIRE ONLY Low	0.0100	0.18	0.0018	K	PP	K.vom
K RX FIRE ONLY Moderate	0.0100	0.27	0.0027	E	PP	E.vos
K RX FIRE ONLY Moderate	0.0100	0.09	0.0009	I	PP	I.vcs
K RX FIRE ONLY Moderate	0.0100	0.18	0.0018	K	PP	K.vom
L RX FIRE ONLY High	0.0001	0.18	0.0000	A	PP	GFB
L RX FIRE ONLY High	0.0001	0.09	0.0000	B	PP	B.sso
L RX FIRE ONLY High	0.0001	0.27	0.0000	E	PP	E.vos
L RX FIRE ONLY High	0.0001	0.09	0.0000	I	PP	I.vcs
L RX FIRE ONLY High	0.0001	0.09	0.0000	K	PP	K.vom

Display Pathways
☒ From Class
☐ To Class

PP - Ponderosa-Pine M.vcm - M.VLarge_Closed_Multi

☐ TSD
☐ Ages

OK Cancel Apply

Appendix B figure 26a. Alternative A ponderosa pine forest PNV State M transitions continued

Class Properties for Class M: PP M.vcm

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	M	PP	M.vcm

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
L RX FIRE ONLY High	0.0001	0.09	0.0000	N	PP	N.unc
Mixed Severity Fire	0.0100	0.27	0.0027	E	PP	E.vos
Mixed Severity Fire	0.0100	0.09	0.0009	I	PP	I.vcs
Mixed Severity Fire	0.0100	0.18	0.0018	K	PP	K.vom
Nonlethal Fire	0.0100	0.18	0.0018	E	PP	E.vos
Nonlethal Fire	0.0100	0.09	0.0009	I	PP	I.vcs
Nonlethal Fire	0.0100	0.18	0.0018	K	PP	K.vom
Stand-Replacing Fire	0.0100	0.18	0.0018	A	PP	GFB
Stand-Replacing Fire	0.0100	0.09	0.0009	B	PP	B.sso
Stand-Replacing Fire	0.0100	0.27	0.0027	E	PP	E.vos
Stand-Replacing Fire	0.0100	0.09	0.0009	I	PP	I.vcs
Stand-Replacing Fire	0.0100	0.18	0.0018	K	PP	K.vom
Stand-Replacing Fire	0.0100	0.09	0.0009	N	PP	N.unc

Display Pathways

☒ From Class
☐ To Class

☐ TSD
☐ Ages

OK Cancel Apply

Appendix B figure 26b. Alternative A ponderosa pine forest PNVT State M transitions continued

Class Properties for Class N: PP N.unc

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	N	PP	N.unc

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
I Plant Seedlings	0.0100	1.00	0.0100	B	PP	B.sso
Natural Regeneration	0.0900	1.00	0.0900	A	PP	GFB
Nonlethal Fire	0.0100	1.00	0.0100	N	PP	N.unc

Display Pathways

☒ From Class
☐ To Class

☐ TSD
☐ Ages

OK Cancel Apply

Appendix B figure 27. Alternative A ponderosa pine forest PNVTs' potentially management driven (1) and naturally driven (2) transitions for State N

Wet Mixed Conifer Forest PNVT

Appendix B table 7. Wet mixed conifer forest (AKA - *Mixed conifer with aspen PNVT (MCW) - with and without aspen succession*) PNVT crosswalks developed by Region 3 (9 December 2010) used in the determination of departure from HRV and DCs. DCs were provided by the Regional Office, and HRV was derived from the Nature Conservancy (Smith, 2006b)

Current Trend Model			R3 Mid-scale Existing Vegetation Mapping			Reference Condition				Baseline Desired Conditions	
source	state ^{1, 2}	description		dominance unit - size/cover		source	TNC state	historic mean ¹ (%)	description	historic mean (%)	description
USFS R3 model MCW	A, <i>K</i>	GFB/SHR (all)	=	NON-TREED: Recently burned, grass, forb, and shrub types - N/A		TNC SW Mixed Conifer with Aspen	A	1	Grass/forb with quaking aspen or oak ramets, 10 - 40% tree cover	7	Reference condition including systems with no quaking aspen succession ¹
	B	Aspen/mixed deciduous (all size and cover classes)	=	All quaking aspen, deciduous tree mix, and evergreen-deciduous mix tree types (e.g., quaking aspen_Douglas-fir) - Seedling/sapling, small, medium, and very-large all cover classes			B	21	Quaking aspen/mixed-quaking aspen forest, > 40% tree cover, dominated by quaking aspen or oak, conifer understory	21	Reference condition
	C ³	SSC, SMC shade tolerant/mixed shade tolerant conifer (SSO, SMO shade tolerant also included here) ⁴	=	Shade tolerant/mixed shade tolerant tree types (e.g., ponderosa pine_Douglas-fir) - Seedling/sapling, small, all cover classes			C, F	29	Mixed conifer forest with regeneration, 20 - 60%+ tree cover	18	Reference condition including systems with no quaking aspen succession [†]
	G, <i>P</i>	SSO, SMO shade intolerant conifer	=	Shade intolerant tree types - Seedling/sapling - open canopy, small - open canopy							
	<i>L</i>	SSC, SMC shade intolerant conifer	=	Shade intolerant tree types - Seedling/sapling - closed canopy, small - closed canopy						14	Reference condition including systems with no quaking aspen succession ¹
	D, <i>M</i>	MC shade tolerant/mixed shade tolerant conifer (MO shade tolerant also included here) ⁴	=	Shade tolerant/mixed shade tolerant tree types (e.g., ponderosa pine_Douglas-fir) - Medium, all cover classes							
	H, <i>Q</i>	MO shade intolerant conifer (MC shade intolerant also included here) ⁴	=	All shade intolerant tree types - Medium, all cover classes			D, G	49	Mixed conifer old forest with regeneration, 20 - 60%+ tree cover	40	Reference condition including systems with no quaking aspen succession. Higher proportions can be expected for associations with longer stand replacement intervals ²
	E, <i>N</i>	VCS shade tolerant conifer (VCS shade intolerant also included here) ⁴	=	Shade tolerant/shade intolerant tree types - Very large - closed canopy							
	F, <i>O</i>	VCM shade tolerant conifer (VCM shade intolerant also included here) ⁴	=								
	I, <i>R</i>	VOS shade tolerant conifer (include VOS shade intolerant conifers here) ⁴	=								
	J, <i>S</i>	VOM shade tolerant conifer (include VOM shade intolerant conifers here) ⁴	=	All shade tolerant/shade intolerant tree types - Very large - open canopy							

¹ States with elk and no or limited quaking aspen regeneration are indicated in **bold** and *italic*, and are found on contemporary landscapes only and were not part of the historic conditions

² Initial conditions are proportioned for A-K, D-M, E-N, F-O, G-P, H-Q, I-R, and J-S according to the proportion of the landscape outside and inside elk summer range, respectively

³ R3 model state C has only partial overlap in theme with TNC states C and F, but provides a better cross-reference than other options

⁴ Atypical type without a model state, included with the next most similar state

[†]Based on 15-yr non-lethal fire interval

¹ Weibull age-class distribution model used to estimate values for systems with no quaking aspen succession, model parameters below (300 years - stand cycle age, quaking aspen succession system; 200 years - stand cycle age, no quaking aspen succession system; 63% - proportion of landscape occurring with quaking aspen succession; 0.8 - severity coefficient, Weibull model; 263 - resulting average stand cycle age)

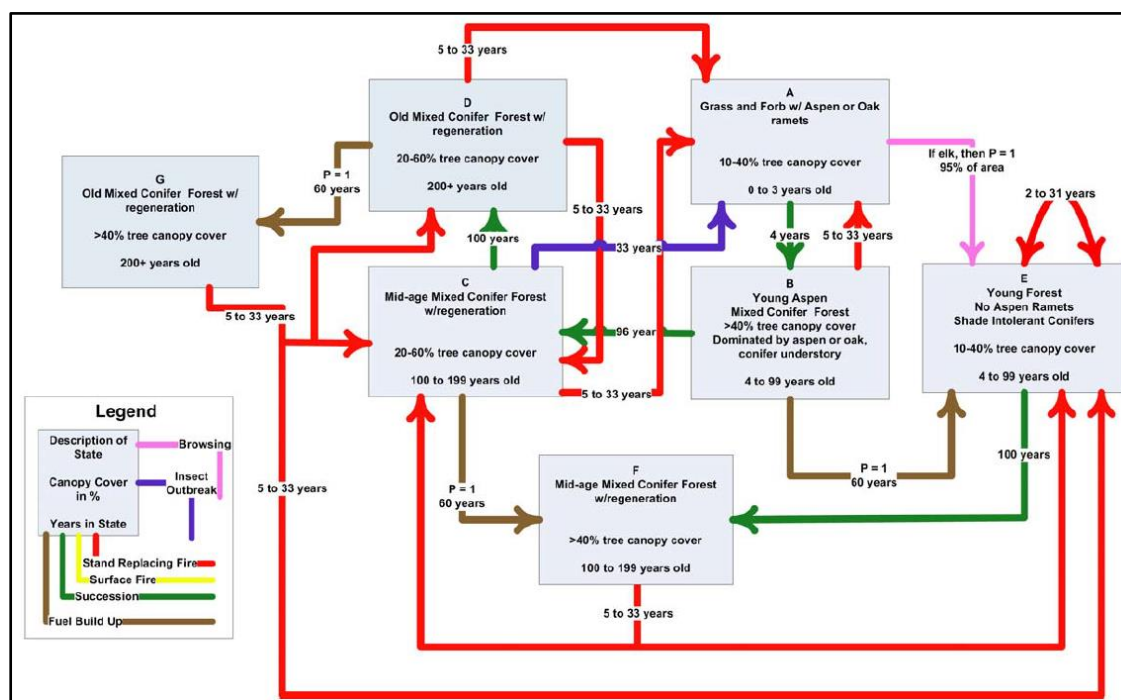
² Adaptation strategies to thin stands (to states C, F) are limited where white fir and spruce dominate.

Wet Mixed Conifer Forest (AKA - Mixed Conifer with Aspen) State and Transition Models

The following is Smith's (2006c) discussion concerning the current modeling results for wet mixed conifer forest.

Based on this understanding of vegetation dynamics, we created state and transition models depicting historic (pre-1880) and current (1880 to present) vegetation dynamics within this forest. Additionally, we used information from the state and transition models to develop quantitative VDDT models. The VDDT 17-3 software allows the user to model succession as a series of vegetation states that differ in structure, composition, and cover and to specify the amount of time it takes to move from one vegetation state to another in the absence of disturbance. Various disturbance agents affecting the movement of vegetation between states can then be incorporated (e.g., surface fires, stand-replacing fires, grazing and browsing, insect outbreaks). By varying the types and rates of disturbance across the landscape, the effects of different management treatments, such as wildland fire use, fire suppression, prescribed burning, grazing practices, and mechanical fuel treatments, on future vegetation can be investigated. While VDDT models can be used to "game play" with different management scenarios, the models we ran in this analysis only include states and transitions for which there is published information to support their inclusion within the model. Smith discusses model parameters, output, and analysis below.

Appendix B figure 28 displays a conceptual current state and transition model for the wet mixed conifer forest vegetation type (Smith 2006d) used in VDDT modeling. In table 23, Smith (2006d) describes the parameters included or not included within the current VDDT models (Schussman and Smith, 2006a and 2006b), as well as the sources of information and any assumptions used to create the model parameters.



Appendix B figure 28. Conceptual current state and transition model for the wet mixed conifer forest vegetation type. Frequency of transitions are noted when this information is supported by published sources, where no or conflicting information exists on the frequency of transitions, unknown is the notation. Dashed outlines represent states which may have been uncharacteristic for the historic period (Smith, 2006c)

The current mixed conifer with aspen model, which was run for 120 years following the development of historic conditions, had very different results from the historic model (table 17-4³⁰). Old forest open (state D) has been reduced by about half for all three fire interval models, and aspen regeneration (State A) has been reduced by about 75% for the two least frequently burned landscapes, and by about 90% for the most frequently burned landscape. With a fire return interval (FRI) of 33 years, slightly less than a third of the landscape is in the old forest closed state (state G), slightly more than a third is in the old forest open (state D), and around 10% is in states C, E, and F. Also, with an FRI = 33 years, the two youngest historic classes are not well represented (state A < 1%, state B < 3%), and over 50% of the landscape is in states that are not characteristic based on the historic model (states E, F, and G). With the average FRI (15 years), 56% of the landscape is uncharacteristic, and for the minimum FRI (5 years), almost 70% of the landscape is uncharacteristic.

These modeled scenarios implicate the importance of frequent surface fire in maintaining both ends of the age spectrum for mixed conifer with aspen forests. The reduction by half of the open, mature/old forest (state D) may have a large impact on wildlife species that depend on old trees and forests. Replacement of these older, more open-canopied forests with denser, closed-canopied forests may also affect the abundance and diversity of shrubs, understory grasses and forbs. Also, the loss of early aspen regeneration and subsequent young and mid-aged forest with a strong aspen component is important due to the potential decline of species of wildlife that utilize aspen. Typically, we think of aspen decline being caused by overtopping and succession by conifers (Shaw, 2004). In the absence of disturbance such as fire, few young aspen ramets are produced, and aspen regenerates in very small patches. However, under the scenario presented in the current model, lack of surface fire is compounded by the addition of heavy browsing by an introduced ungulate, Rocky Mountain elk, which hastens the decline of aspen by reducing young ramets across the landscape, and changes its trajectory along a hypothetically irreversible pathway.

Under the current scenario, there is a large increase in the proportion of closed, mid- age to old age forests. In a forest system that has evolved with occasional, small scale stand replacing fire, the elimination of surface fire may lead to increased frequency, and probably more importantly, more widespread spatially stand replacing fire, of higher intensity, covering more area per decade than was experienced in the historic, or prehistoric periods.

Appendix B figures 29 through 48 display the actual VDDT model for wet mixed conifer forest, developed by the USDA FS Southwestern Region 3, and utilized during the planning effort on the A-SNFs to determine future departure conditions and assessment of trends.

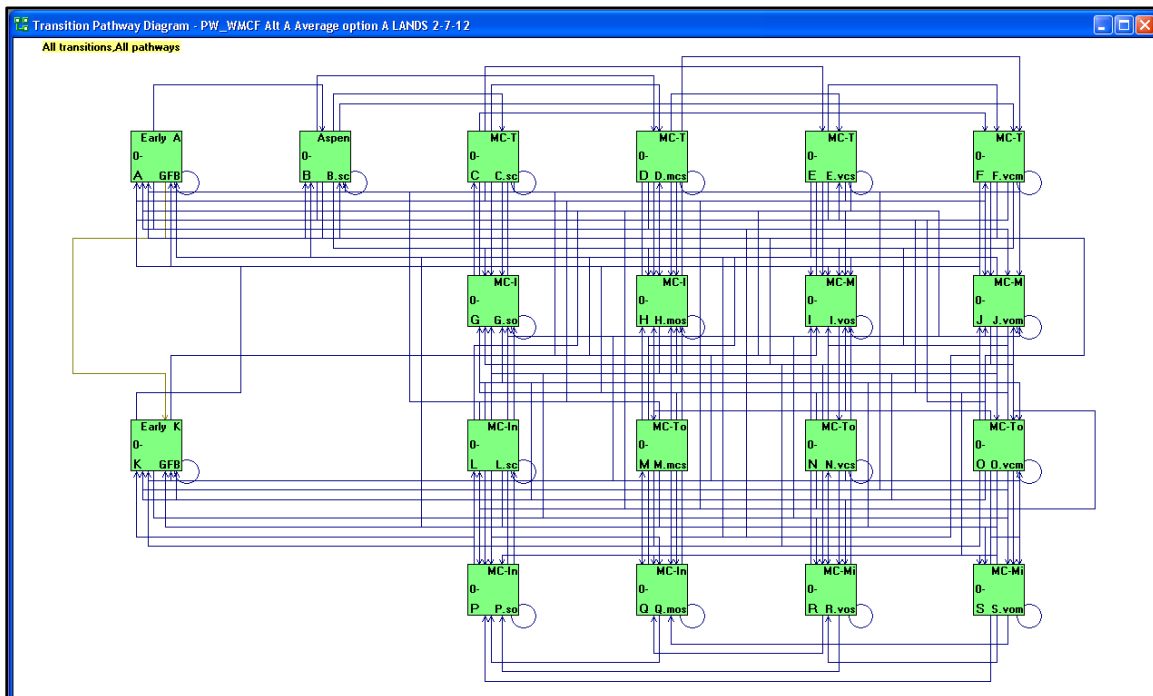
³⁰ See Smith, 2006c.

Appendix B table 8. Identification of current transitions, frequency of transitions, sources of information used, and assumptions used to develop the frequency of transitions and its effect on vegetation included in the VDDT models for wet mixed conifer forest vegetation type (adapted from Smith, 2006c¹)

Transition Type	Transition Frequency or Length	Information Sources	Assumptions
Fuel build up	Once every year.	Several authors have documented the cessation of surface fires around 1880, which has led to the accumulation of fuels (Covington and Moore, 1994; Swetnam and Baisan, 1996; Allen et al., 2002; Fulé et al., 2003)	Smith reported that it would take approximately 60 years of growth since the last surface fire to move from an open canopy state (< 30% canopy cover) to a higher canopy state (> 30%).
Surface fire	Not used in current model	Covington and Moore, 1994; Swetnam and Baisan, 1996; Sneed et al., 2003; Allen et al., 2002; Fulé et al., 2003.	Based on direct observation, we assume that surface fire has ceased at the scale of this model (~2 million ac.). Occasional surface fires do occur, but not at the same scale, and typically enough fuels have accumulated in most areas to quickly transition surface fires to stand replacing fires. Prescribed fire and fire use fires are occurring in some areas at some times, but not within the range of variability for this system.
Stand replacing fire	Once every 5 to 33 years	Cessation of surface fires and accumulation of fuels and development of fuel ladders has not yet led to an increase in the frequency of stand replacing fires, but the size of patches affected by these fire events may be increasing (Swetnam et al., 2005)	Smith reported that stand replacing fires have not changed in frequency, but that they have changed in how much area they affect, and which states they move forests to. We assumed that stand replacing fires currently move 10-20% of the landscape area (double historic values) to equal proportions of less dense or younger forest classes (e.g. state G goes to states E, C and D; state F goes to states C and E, but state E does not go to state B because aspen has been removed by browsing, so state E stays at state E.).
Insect outbreak	33 years between outbreaks	Swetnam, 1987; Lynch and Swetnam, 1992	Western spruce budworm outbreaks occurred once every 33 years on average, preferentially during wet periods, and primarily on mid-age forests. We assumed that the area affected by defoliations was small (< 5% of landscape) but openings would be moved back to the regeneration state (A).
Browsing	Once every year in presence of elk over 95% of landscape	If elk are present, they browse aspen until it does not produce ramets within 2-5 years (Bailey and Whitham, 2002; Rolf unpublished report ²)	Smith reported that elk have moved aspen recruitment dynamics into a new trajectory, where regeneration by conifers occurs not under the shade of aspens, but in full sun, preferentially selecting for shade intolerant species such as ponderosa pine. Since aspen are short-lived trees, this process may not be reversible unless mature aspen is still extant.
Plant growth State E to State F	95 years from young to mid-age forest	Jones and DeByle, 1985a	Smith reported that the transition from young forest to mid-age forest takes approximately 95 years, as conifer trees in the understory grow into the canopy. Tree composition may be different from historic based on above effects of browse pressure and lack of surface fires.
Plant growth State F to State G	100 years from mid-age forest to old/mature forest	Old growth characteristics begin developing around 200 years (Mehl, 1992)	Smith reported that transition from mid-age to mature/old forest takes approximately 100 years, with multiple conifer regeneration events occurring, aspen decline is nearly complete, and stand structure has closed due to infill by regeneration and growth of mid-age trees.
Silvicultural activities	Highly variable through time and across space, thus not included in the model	Mixed conifer forests have been logged and thinned since the 1850s to 1880s, with silvicultural prescriptions ranging from clear-cutting to thinning of pole and smaller trees (Bahre, 1985)	Smith reported that the model overestimates the proportion of the current landscape in the old forest open and closed classes (states D and G) due to the loss of many of the larger trees to timber harvest that is not accounted for in the model.

¹ See Smith, 2006c

² Rolf, James, 2005. Unpublished report. USDA Forest Service, Coconino National Forest, Flagstaff, AZ



Appendix B figure 29. Actual Alternative A VDDT state and transition model used for assessing trends in the wet mixed conifer forest PNVt on the A-SNFs

Class Properties for Class A: Early A GFB

Deterministic transitions

Timing	To Class			
Start Age	End Age	Box	Cover	Stage
0	1000	A	Early A	GFB

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
						Stage
2_B	0.0780	1.00	0.0780	B	Aspen	B.sc
2_G	0.0154	1.00	0.0154	G	MC-I	G.so
Herbivory Elk	0.5000	1.00	0.5000	K	Early K	GFB
Mixed Severity Fire	0.0001	1.00	0.0001	A	Early A	GFB
Nonlethal Fire	0.0100	1.00	0.0100	A	Early A	GFB
Stand-Replacing Fire	0.0001	1.00	0.0001	A	Early A	GFB

Early A - Early State with no elk
GFB - Grass-Forb-Brush

Display Pathways

☒ From Class

☐ To Class

☐ TSD

☐ Ages

Sort...

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Appendix B figure 30. Alternative A wet mixed conifer forest PNVt's potentially management driven (0) and naturally driven (6) transitions for State A

Class Properties for Class B: Aspen B.sc

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	B	Aspen	B.sc

Display Pathways

☒ From Class
☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
2_C	0.0080	1.00	0.0080	C	MC-T	C.sc
2_D	0.0036	1.00	0.0036	D	MC-T	D.mcs
2_F	0.0015	1.00	0.0015	F	MC-T	F.vcm
2_I	0.0003	1.00	0.0003	I	MC-M	I.vos
B Free thin all sizes to target	0.0100	1.00	0.0100	B	Aspen	B.sc
H Clearcut-Coppice	0.0100	0.95	0.0095	A	Early A	GFB
H Clearcut-Coppice	0.0100	0.05	0.0005	I	MC-M	I.vos
J RX FIRE ONLY Low	0.0001	0.77	0.0001	B	Aspen	B.sc
J RX FIRE ONLY Low	0.0001	0.14	0.0000	D	MC-T	D.mcs
J RX FIRE ONLY Low	0.0001	0.09	0.0000	I	MC-M	I.vos
K RX FIRE ONLY Moderate	0.0100	0.05	0.0005	A	Early A	GFB
K RX FIRE ONLY Moderate	0.0100	0.77	0.0077	B	Aspen	B.sc
K RX FIRE ONLY Moderate	0.0100	0.05	0.0005	D	MC-T	D.mcs

OK Cancel Apply

Appendix B figure 31. Alternative A wet mixed conifer forest PNVTs' potentially management driven (10) and naturally driven (11) transitions for State B. Alternative A wet mixed conifer forest PNV State B transitions continued in Appendix B figure 31a

Class Properties for Class B: Aspen B.sc

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	B	Aspen	B.sc

Display Pathways

☒ From Class
☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
K RX FIRE ONLY Moderate	0.0100	0.05	0.0005	A	Early A	GFB
K RX FIRE ONLY Moderate	0.0100	0.05	0.0005	D	MC-T	D.mcs
K RX FIRE ONLY Moderate	0.0100	0.05	0.0005	H	MC-I	H.mos
K RX FIRE ONLY Moderate	0.0100	0.09	0.0009	I	MC-M	I.vos
L RX FIRE ONLY High	0.0001	0.18	0.0000	A	Early A	GFB
Mixed Severity Fire	0.0100	0.05	0.0005	A	Early A	GFB
Mixed Severity Fire	0.0100	0.05	0.0005	D	MC-T	D.mcs
Mixed Severity Fire	0.0100	0.05	0.0005	H	MC-I	H.mos
Mixed Severity Fire	0.0100	0.09	0.0009	I	MC-M	I.vos
Nonlethal Fire	0.0100	0.14	0.0014	D	MC-T	D.mcs
Nonlethal Fire	0.0100	0.09	0.0009	I	MC-M	I.vos
Stand-Replacing Fire	0.0100	0.18	0.0018	A	Early A	GFB

OK Cancel Apply

Appendix B figure 31a. Alternative A wet mixed conifer forest PNV State B transitions continued

Class Properties for Class C: MC-T C.sc

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	C	MC-T	C.sc

MC-T - Mixed Conifer Shade Tolerant
C.sc - C.Seed/Sap/Small_Closed

Display Pathways

☒ From Class
☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
2_B	0.0005	1.00	0.0005	B	Aspen	B.sc
2_D	0.0180	1.00	0.0180	D	MC-T	D.mcs
2_E	0.0003	1.00	0.0003	E	MC-T	E.vcs
2_F	0.0013	1.00	0.0013	F	MC-T	F.vcm
2_J	0.0003	1.00	0.0003	J	MC-M	J.vom
B Free thin all sizes to target	0.0001	0.14	0.0000	B	Aspen	B.sc
B Free thin all sizes to target	0.0001	0.14	0.0000	C	MC-T	C.sc
B Free thin all sizes to target	0.0001	0.14	0.0000	D	MC-T	D.mcs
B Free thin all sizes to target	0.0001	0.05	0.0000	G	MC-I	G.so
B Free thin all sizes to target	0.0001	0.32	0.0000	H	MC-I	H.mos
B Free thin all sizes to target	0.0001	0.23	0.0000	I	MC-M	I.vos
C Thin from below to target	0.0100	0.14	0.0014	B	Aspen	B.sc
C Thin from below to target	0.0100	0.36	0.0036	C	MC-T	C.sc

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☐ TSD
☐ Ages

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Appendix B figure 32. Alternative A wet mixed conifer forest PNVTs' potentially management driven (26) and naturally driven (21) transitions for State C. Alternative A wet mixed conifer forest PNV State C transitions continued in Appendix B figures 32a through 32c

Class Properties for Class C: MC-T C.sc

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	C	MC-T	C.sc

MC-T - Mixed Conifer Shade Tolerant
C.sc - C.Seed/Sap/Small_Closed

Display Pathways

☒ From Class
☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
C Thin from below to target	0.0001	0.18	0.0000	I	MC-M	I.vos
Insect/Disease	0.0300	1.00	0.0300	G	MC-I	G.so
J RX FIRE ONLY Low	0.0100	0.59	0.0059	D	MC-T	D.mcs
J RX FIRE ONLY Low	0.0100	0.09	0.0009	E	MC-T	E.vcs
J RX FIRE ONLY Low	0.0100	0.05	0.0005	F	MC-T	F.vcm
J RX FIRE ONLY Low	0.0100	0.05	0.0005	G	MC-I	G.so
J RX FIRE ONLY Low	0.0100	0.05	0.0005	J	MC-M	J.vom
K RX FIRE ONLY Moderate	0.0001	0.23	0.0000	D	MC-T	D.mcs
K RX FIRE ONLY Moderate	0.0001	0.09	0.0000	E	MC-T	E.vcs
K RX FIRE ONLY Moderate	0.0001	0.36	0.0000	G	MC-I	G.so
K RX FIRE ONLY Moderate	0.0001	0.23	0.0000	H	MC-I	H.mos
K RX FIRE ONLY Moderate	0.0001	0.05	0.0000	I	MC-M	I.vos
K RX FIRE ONLY Moderate	0.0001	0.05	0.0000	I	MC-M	I.vom

New Copy Delete

☐ TSD
☐ Ages

Sort...

OK Cancel Apply

Appendix B figure 32a. Alternative A wet mixed conifer forest PNV State C transitions continued

Class Properties for Class C: MC-T C.sc

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	C	MC-T	C.sc

**MC-T - Mixed Conifer Shade Tolerant
C.sc - C.Seed/Sap/Small_Closed**

Display Pathways
☒ From Class
☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	Stage
L RX FIRE ONLY High	0.0001	0.64	0.0001	A	Early A	GFB
L RX FIRE ONLY High	0.0001	0.05	0.0000	B	Aspen	B.sc
L RX FIRE ONLY High	0.0001	0.18	0.0000	G	MC-I	G.so
L RX FIRE ONLY High	0.0001	0.14	0.0000	H	MC-I	H.mos
M Thin under 9-inch diameter	0.0100	0.41	0.0041	D	MC-T	D.mcs
M Thin under 9-inch diameter	0.0100	0.05	0.0005	E	MC-T	E.vcs
Mixed Severity Fire	0.0100	0.23	0.0023	D	MC-T	D.mcs
Mixed Severity Fire	0.0100	0.09	0.0009	E	MC-T	E.vcs
Mixed Severity Fire	0.0100	0.36	0.0036	G	MC-I	G.so
Mixed Severity Fire	0.0100	0.23	0.0023	H	MC-I	H.mos
Mixed Severity Fire	0.0100	0.05	0.0005	I	MC-M	I.vos
Mixed Severity Fire	0.0100	0.05	0.0005	J	MC-M	J.vom
Nonlethal Fire	0.0100	0.59	0.0059	D	MC-T	D.mcs

☐ TSD
☐ Ages

Appendix B figure 32b. Alternative A wet mixed conifer forest PNVT State C transitions continued

Class Properties for Class C: MC-T C.sc

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	C	MC-T	C.sc

**MC-T - Mixed Conifer Shade Tolerant
C.sc - C.Seed/Sap/Small_Closed**

Display Pathways
☒ From Class
☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	Stage
Mixed Severity Fire	0.0100	0.23	0.0023	H	MC-I	H.mos
Mixed Severity Fire	0.0100	0.05	0.0005	I	MC-M	I.vos
Mixed Severity Fire	0.0100	0.05	0.0005	J	MC-M	J.vom
Nonlethal Fire	0.0100	0.59	0.0059	D	MC-T	D.mcs
Nonlethal Fire	0.0100	0.09	0.0009	E	MC-T	E.vcs
Nonlethal Fire	0.0100	0.05	0.0005	F	MC-T	F.vcm
Nonlethal Fire	0.0100	0.05	0.0005	G	MC-I	G.so
Nonlethal Fire	0.0100	0.05	0.0005	J	MC-M	J.vom
Stand-Replacing Fire	0.0100	0.64	0.0064	A	Early A	GFB
Stand-Replacing Fire	0.0100	0.05	0.0005	B	Aspen	B.sc
Stand-Replacing Fire	0.0100	0.18	0.0018	G	MC-I	G.so
Stand-Replacing Fire	0.0100	0.14	0.0014	H	MC-I	H.mos

☐ TSD
☐ Ages

Appendix B figure 32c. Alternative A wet mixed conifer forest PNVT State C transitions continued

Class Properties for Class D: MC-T D.mcs

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	D	MC-T	D.mcs

**MC-T - Mixed Conifer Shade Tolerant
D.mcs - D.Medium_Closed_Single**

Display Pathways
☒ From Class
☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class Stage
2_B	0.0005	1.00	0.0005	B	Aspen	B.sc
2_C	0.0059	1.00	0.0059	C	MC-T	C.sc
2_E	0.0030	1.00	0.0030	E	MC-T	E.vcs
2_F	0.0070	1.00	0.0070	F	MC-T	F.vcm
2_H	0.0002	1.00	0.0002	H	MC-I	H.mos
B Free thin all sizes to target	0.0001	0.05	0.0000	C	MC-T	C.sc
B Free thin all sizes to target	0.0001	0.10	0.0000	D	MC-T	D.mcs
B Free thin all sizes to target	0.0001	0.62	0.0001	H	MC-I	H.mos
B Free thin all sizes to target	0.0001	0.19	0.0000	I	MC-M	I.vos
B Free thin all sizes to target	0.0001	0.05	0.0000	J	MC-M	J.vom
C Thin from below to target	0.0001	0.05	0.0000	C	MC-T	C.sc
C Thin from below to target	0.0001	0.33	0.0000	D	MC-T	D.mcs
C Thin from below to target	0.0001	0.05	0.0000	F	MC-T	F.vcm

☐ TSD
 ☐ Ages

Appendix B figure 33. Alternative A wet mixed conifer forest PNVTs' potentially management driven (27) and naturally driven (13) transitions for State D. Alternative A wet mixed conifer forest PNV State D transitions continued in Appendix B figures 33a through 33c

Class Properties for Class D: MC-T D.mcs

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	D	MC-T	D.mcs

**MC-T - Mixed Conifer Shade Tolerant
D.mcs - D.Medium_Closed_Single**

Display Pathways
☒ From Class
☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class Stage
D Thin under	0.0100	0.05	0.0005	C	MC-T	C.sc
D Thin under	0.0100	0.05	0.0005	F	MC-T	F.vcm
D Thin under	0.0100	0.52	0.0052	H	MC-I	H.mos
D Thin under	0.0100	0.14	0.0014	I	MC-M	I.vos
D Thin under	0.0100	0.05	0.0005	J	MC-M	J.vom
E GroupSelect with matrix thin	0.0001	1.00	0.0001	J	MC-M	J.vom
F Shelterwood seed cut to	0.0001	0.48	0.0000	A	Early A	GFB
F Shelterwood seed cut to	0.0001	0.05	0.0000	B	Aspen	B.sc
F Shelterwood seed cut to	0.0001	0.24	0.0000	H	MC-I	H.mos
F Shelterwood seed cut to	0.0001	0.24	0.0000	I	MC-M	I.vos
H Clearcut-Coppice	0.0100	1.00	0.0100	A	Early A	GFB
Insect/Disease	0.0300	1.00	0.0300	H	MC-I	H.mos
L BY FIRE ONLY Low	0.0100	0.05	0.0005	F	MC-T	F.vcm

☐ TSD
 ☐ Ages

Appendix B figure 33a. Alternative A wet mixed conifer forest PNV State D transitions continued

Class Properties for Class D: MC-T D.mcs

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	D	MC-T	D.mcs

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
K RX FIRE ONLY Moderate	0.0100	0.05	0.0005	F	MC-T	F.vcm
K RX FIRE ONLY Moderate	0.0100	0.29	0.0029	H	MC-I	H.mos
L RX FIRE ONLY High	0.0001	0.57	0.0001	A	Early A	GFB
L RX FIRE ONLY High	0.0001	0.05	0.0000	B	Aspen	B.sc
L RX FIRE ONLY High	0.0001	0.05	0.0000	G	MC-I	G.so
L RX FIRE ONLY High	0.0001	0.29	0.0000	H	MC-I	H.mos
M Thin under 9-inch diameter	0.0100	1.00	0.0100	D	MC-T	D.mcs
Mixed Severity Fire	0.0100	0.05	0.0005	F	MC-T	F.vcm
Mixed Severity Fire	0.0100	0.29	0.0029	H	MC-I	H.mos
Nonlethal Fire	0.0100	0.05	0.0005	F	MC-T	F.vcm
Stand-Replacing Fire	0.0100	0.57	0.0057	A	Early A	GFB
Stand-Replacing Fire	0.0100	0.05	0.0005	B	Aspen	B.sc
Stand-Replacing Fire	0.0100	0.05	0.0005	G	MC-I	G.so

Display Pathways

☒ From Class

☐ To Class

MC-T - Mixed Conifer Shade Tolerant
D.mcs - D.Medium_Closed_Single

☐ TSD
☐ Ages

OK Cancel Apply

Appendix B figure 33b. Alternative A wet mixed conifer forest PNVT State D transitions continued

Class Properties for Class D: MC-T D.mcs

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	D	MC-T	D.mcs

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
L RX FIRE ONLY High	0.0001	0.57	0.0001	A	Early A	GFB
L RX FIRE ONLY High	0.0001	0.05	0.0000	B	Aspen	B.sc
L RX FIRE ONLY High	0.0001	0.05	0.0000	G	MC-I	G.so
L RX FIRE ONLY High	0.0001	0.29	0.0000	H	MC-I	H.mos
M Thin under 9-inch diameter	0.0100	1.00	0.0100	D	MC-T	D.mcs
Mixed Severity Fire	0.0100	0.05	0.0005	F	MC-T	F.vcm
Mixed Severity Fire	0.0100	0.29	0.0029	H	MC-I	H.mos
Nonlethal Fire	0.0100	0.05	0.0005	F	MC-T	F.vcm
Stand-Replacing Fire	0.0100	0.57	0.0057	A	Early A	GFB
Stand-Replacing Fire	0.0100	0.05	0.0005	B	Aspen	B.sc
Stand-Replacing Fire	0.0100	0.05	0.0005	G	MC-I	G.so
Stand-Replacing Fire	0.0100	0.29	0.0029	H	MC-I	H.mos

Display Pathways

☒ From Class

☐ To Class

MC-T - Mixed Conifer Shade Tolerant
D.mcs - D.Medium_Closed_Single

☐ TSD
☐ Ages

OK Cancel Apply

Appendix B figure 33c. Alternative A wet mixed conifer forest PNVT State D transitions continued

Class Properties for Class E: MC-T E.vcs

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	E	MC-T	E.vcs

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	Stage
2_C	0.0032	1.00	0.0032	C	MC-T	C.sc
2_D	0.0032	1.00	0.0032	D	MC-T	D.mcs
2_F	0.0354	1.00	0.0354	F	MC-T	F.vcm
2_I	0.0065	1.00	0.0065	I	MC-M	I.vos
2_J	0.0032	1.00	0.0032	J	MC-M	J.vom
B Free thin all sizes to target	0.0001	1.00	0.0001	I	MC-M	I.vos
C Thin from below to target	0.0001	1.00	0.0001	I	MC-M	I.vos
D Thin under	0.0100	0.10	0.0010	I	MC-M	I.vos
E GroupSelect with matrix thin	0.0001	1.00	0.0001	J	MC-M	J.vom
F Shelterwood seed cut to	0.0001	0.62	0.0001	A	Early A	GFB
F Shelterwood seed cut to	0.0001	0.38	0.0000	I	MC-M	I.vos
H Clearcut-Coppice	0.0001	1.00	0.0001	A	Early A	GFB
Insect/Disease	0.0300	1.00	0.0300	I	MC-M	I.vos

**MC-T - Mixed Conifer Shade Tolerant
E.vcs - E.VLarge_Closed_Single**

Display Pathways
☒ From Class
☐ To Class

☐ TSD
☐ Ages

OK Cancel Apply

Appendix B figure 34. Alternative A wet mixed conifer forest PNVTs' potentially management driven (13) and naturally driven (11) transitions for State E. Alternative A wet mixed conifer forest PNV State E transitions continued in Appendix B figure 34a

Class Properties for Class E: MC-T E.vcs

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	E	MC-T	E.vcs

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	Stage
Insect/Disease	0.0300	1.00	0.0300	I	MC-M	I.vos
J RX FIRE ONLY Low	0.0001	1.00	0.0001	E	MC-T	E.vcs
K RX FIRE ONLY Moderate	0.0001	0.02	0.0000	I	MC-M	I.vos
L RX FIRE ONLY High	0.0001	0.38	0.0000	A	Early A	GFB
L RX FIRE ONLY High	0.0001	0.02	0.0000	H	MC-I	H.mos
L RX FIRE ONLY High	0.0001	0.50	0.0001	I	MC-M	I.vos
M Thin under 9-inch diameter	0.0100	1.00	0.0100	E	MC-T	E.vcs
Mixed Severity Fire	0.0100	0.02	0.0002	I	MC-M	I.vos
Nonlethal Fire	0.0100	1.00	0.0100	E	MC-T	E.vcs
Stand-Replacing Fire	0.0100	0.38	0.0038	A	Early A	GFB
Stand-Replacing Fire	0.0100	0.02	0.0002	H	MC-I	H.mos
Stand-Replacing Fire	0.0100	0.50	0.0050	I	MC-M	I.vos

**MC-T - Mixed Conifer Shade Tolerant
E.vcs - E.VLarge_Closed_Single**

Display Pathways
☒ From Class
☐ To Class

☐ TSD
☐ Ages

OK Cancel Apply

Appendix B figure 34a. Alternative A wet mixed conifer forest PNV State E transitions continued

Class Properties for Class F: MC-T F.vcm

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	F	MC-T	F.vcm

MC-T - Mixed Conifer Shade Tolerant
F.vcm - F.VLarge_Closed_Multi

Display Pathways

☒ From Class
☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
2_B	0.0002	1.00	0.0002	B	Aspen	B.sc
2_C	0.0056	1.00	0.0056	C	MC-T	C.sc
2_D	0.0074	1.00	0.0074	D	MC-T	D.mcs
2_E	0.0030	1.00	0.0030	E	MC-T	E.vcs
2_J	0.0006	1.00	0.0006	J	MC-M	J.vom
B Free thin all sizes to target	0.0001	0.67	0.0001	B	Aspen	B.sc
B Free thin all sizes to target	0.0001	0.33	0.0000	I	MC-M	I.vos
C Thin from below to target	0.0100	0.67	0.0067	B	Aspen	B.sc
C Thin from below to target	0.0100	0.33	0.0033	I	MC-M	I.vos
D Thin under	0.0100	0.33	0.0033	E	MC-T	E.vcs
E GroupSelect with matrix thin	0.0001	1.00	0.0001	J	MC-M	J.vom
F Shelterwood seed cut to	0.0001	0.67	0.0001	A	Early A	GFB
F Shelterwood seed cut to	0.0001	0.33	0.0000	I	MC-M	I.vos

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Appendix B figure 35. Alternative A wet mixed conifer forest PNVTs' potentially management driven (14) and naturally driven (10) transitions for State F. Alternative A wet mixed conifer forest PNV State F transitions continued in Appendix B figure 35a

Class Properties for Class F: MC-T F.vcm

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	F	MC-T	F.vcm

MC-T - Mixed Conifer Shade Tolerant
F.vcm - F.VLarge_Closed_Multi

Display Pathways

☒ From Class
☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
F Shelterwood seed cut to	0.0001	0.33	0.0000	I	MC-M	I.vos
H Clearcut-Coppice	0.0001	1.00	0.0001	A	Early A	GFB
Insect/Disease	0.0300	1.00	0.0300	J	MC-M	J.vom
J RX FIRE ONLY Low	0.0001	0.33	0.0000	I	MC-M	I.vos
K RX FIRE ONLY Moderate	0.0001	0.33	0.0000	I	MC-M	I.vos
L RX FIRE ONLY High	0.0001	0.33	0.0000	A	Early A	GFB
L RX FIRE ONLY High	0.0001	0.67	0.0001	J	MC-M	J.vom
M Thin under 9-inch diameter	0.0100	0.33	0.0033	E	MC-T	E.vcs
Mixed Severity Fire	0.0100	0.33	0.0033	I	MC-M	I.vos
Nonlethal Fire	0.0100	0.33	0.0033	I	MC-M	I.vos
Stand-Replacing Fire	0.0100	0.33	0.0033	A	Early A	GFB
Stand-Replacing Fire	0.0100	0.67	0.0067	J	MC-M	J.vom

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☐ Ages
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Appendix B figure 35a. Alternative A wet mixed conifer forest PNV State F transitions continued

Class Properties for Class G: MC-I G.so

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	G	MC-I	G.so

**MC-I - Mixed Conifer Shade Intolerant
G.so - G.Seed/Sap/Small_Open**

Display Pathways

☒ From Class

☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	Stage
2_B	0.0145	1.00	0.0145	B	Aspen	B.sc
2_C	0.0643	1.00	0.0643	C	MC-T	C.sc
C Thin from below to target	0.0001	0.83	0.0001	G	MC-I	G.so
C Thin from below to target	0.0001	0.17	0.0000	I	MC-M	I.vos
J RX FIRE ONLY Low	0.0001	0.17	0.0000	A	Early A	GFB
J RX FIRE ONLY Low	0.0001	0.17	0.0000	H	MC-I	H.mos
K RX FIRE ONLY Moderate	0.0100	0.33	0.0033	A	Early A	GFB
K RX FIRE ONLY Moderate	0.0100	0.17	0.0017	H	MC-I	H.mos
L RX FIRE ONLY High	0.0001	0.83	0.0001	A	Early A	GFB
Mixed Severity Fire	0.0100	0.33	0.0033	A	Early A	GFB
Mixed Severity Fire	0.0100	0.17	0.0017	H	MC-I	H.mos
Nonlethal Fire	0.0100	0.17	0.0017	A	Early A	GFB
Nonlethal Fire	0.0100	0.17	0.0017	H	MC-I	H.mos

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☐ TSD

☐ Ages

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Appendix B figure 36. Alternative A wet mixed conifer forest PNVTs' potentially management driven (6) and naturally driven (7) transitions for State G. Alternative A wet mixed conifer forest PNVT State G transitions continued in Appendix B figure 36a

Class Properties for Class G: MC-I G.so

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	G	MC-I	G.so

**MC-I - Mixed Conifer Shade Intolerant
G.so - G.Seed/Sap/Small_Open**

Display Pathways

☒ From Class

☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	Stage
2_C	0.0643	1.00	0.0643	C	MC-T	C.sc
C Thin from below to target	0.0001	0.17	0.0000	I	MC-M	I.vos
J RX FIRE ONLY Low	0.0001	0.17	0.0000	A	Early A	GFB
J RX FIRE ONLY Low	0.0001	0.17	0.0000	H	MC-I	H.mos
K RX FIRE ONLY Moderate	0.0100	0.33	0.0033	A	Early A	GFB
K RX FIRE ONLY Moderate	0.0100	0.17	0.0017	H	MC-I	H.mos
L RX FIRE ONLY High	0.0001	0.83	0.0001	A	Early A	GFB
Mixed Severity Fire	0.0100	0.33	0.0033	A	Early A	GFB
Mixed Severity Fire	0.0100	0.17	0.0017	H	MC-I	H.mos
Nonlethal Fire	0.0100	0.17	0.0017	A	Early A	GFB
Nonlethal Fire	0.0100	0.17	0.0017	H	MC-I	H.mos
Stand-Replacing Fire	0.0001	0.83	0.0001	A	Early A	GFB

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☐ TSD

☐ Ages

Sort...

OK Cancel Apply

Appendix B figure 36a. Alternative A wet mixed conifer forest PNVT State G transitions continued

Class Properties for Class H: MC-I H.mos

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	H	MC-I	H.mos

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	Stage
2_C	0.0403	1.00	0.0403	C	MC-T	C.sc
2_D	0.0257	1.00	0.0257	D	MC-T	D.mcs
2_I	0.0123	1.00	0.0123	I	MC-M	I.vos
2_J	0.0257	1.00	0.0257	J	MC-M	J.vom
B Free thin all sizes to target	0.0100	0.25	0.0025	A	Early A	GFB
B Free thin all sizes to target	0.0100	0.50	0.0050	H	MC-I	H.mos
B Free thin all sizes to target	0.0100	0.13	0.0013	I	MC-M	I.vos
B Free thin all sizes to target	0.0100	0.13	0.0013	J	MC-M	J.vom
C Thin from below to target	0.0100	0.25	0.0025	A	Early A	GFB
C Thin from below to target	0.0100	0.63	0.0063	H	MC-I	H.mos
C Thin from below to target	0.0100	0.13	0.0013	I	MC-M	I.vos
D Thin under	0.0100	0.87	0.0087	H	MC-I	H.mos
D Thin under	0.0100	0.13	0.0013	I	MC-M	I.vos

**MC-I - Mixed Conifer Shade Intolerant
H.mos - H.Medium_Open_Single**

Display Pathways
☒ From Class
☐ To Class

☐ TSD
☐ Ages

OK Cancel Apply

Appendix B figure 37. Alternative A wet mixed conifer forest PNVTs' potentially management driven (15) and naturally driven (8) transitions for State H. Alternative A wet mixed conifer forest PNV State H transitions continued in Appendix B figure 37a

Class Properties for Class H: MC-I H.mos

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	H	MC-I	H.mos

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	Stage
F Shelterwood seed cut to	0.0100	0.13	0.0013	J	MC-M	J.vom
H Clearcut-Coppice	0.0100	1.00	0.0100	A	Early A	GFB
J RX FIRE ONLY Low	0.0001	0.13	0.0000	J	MC-M	J.vom
K RX FIRE ONLY Moderate	0.0100	0.25	0.0025	J	MC-M	J.vom
L RX FIRE ONLY High	0.0001	0.38	0.0000	A	Early A	GFB
L RX FIRE ONLY High	0.0001	0.13	0.0000	G	MC-I	G.so
L RX FIRE ONLY High	0.0001	0.13	0.0000	J	MC-M	J.vom
Mixed Severity Fire	0.0100	0.25	0.0025	J	MC-M	J.vom
Nonlethal Fire	0.0100	0.13	0.0013	J	MC-M	J.vom
Stand-Replacing Fire	0.0100	0.38	0.0038	A	Early A	GFB
Stand-Replacing Fire	0.0100	0.13	0.0013	G	MC-I	G.so
Stand-Replacing Fire	0.0100	0.13	0.0013	J	MC-M	J.vom

**MC-I - Mixed Conifer Shade Intolerant
H.mos - H.Medium_Open_Single**

Display Pathways
☒ From Class
☐ To Class

☐ TSD
☐ Ages

OK Cancel Apply

Appendix B figure 37a. Alternative A wet mixed conifer forest PNV State H transitions continued

Class Properties for Class I: MC-M I.vos

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	I	MC-M	I.vos

MC-M - Mixed Conifer Mixed Tolerant I.vos - I.VLarge_Open_Single

Display Pathways
☒ From Class
☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	Stage
2_B	0.0044	1.00	0.0044	B	Aspen	B.sc
2_G	0.0410	1.00	0.0410	G	MC-I	G.so
2_J	0.0044	1.00	0.0044	J	MC-M	J.vom
C Thin from below to target	0.0001	0.75	0.0001	A	Early A	GFB
C Thin from below to target	0.0001	0.75	0.0001	I	MC-M	I.vos
D Thin under	0.0100	1.00	0.0100	I	MC-M	I.vos
E GroupSelect with matrix thin	0.0100	0.75	0.0075	I	MC-M	I.vos
E GroupSelect with matrix thin	0.0100	0.25	0.0025	J	MC-M	J.vom
H Clearcut-Coppice	0.0100	1.00	0.0100	A	Early A	GFB
J RX FIRE ONLY Low	0.0001	1.00	0.0001	I	MC-M	I.vos
K RX FIRE ONLY Moderate	0.0001	1.00	0.0001	I	MC-M	I.vos
L RX FIRE ONLY High	0.0001	1.00	0.0001	I	MC-M	I.vos
Mixed Severity Fire	0.0100	1.00	0.0100	I	MC-M	I.vos

☐ TSD
 ☐ Ages

Appendix B figure 38. Alternative A wet mixed conifer forest PNVTs' potentially management driven (7) and naturally driven (6) transitions for State I. Alternative A wet mixed conifer forest PNVT State I transitions continued in Appendix B figure 38a

Class Properties for Class I: MC-M I.vos

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	I	MC-M	I.vos

MC-M - Mixed Conifer Mixed Tolerant I.vos - I.VLarge_Open_Single

Display Pathways
☒ From Class
☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	Stage
2_G	0.0410	1.00	0.0410	G	MC-I	G.so
2_J	0.0044	1.00	0.0044	J	MC-M	J.vom
C Thin from below to target	0.0100	0.75	0.0075	A	Early A	GFB
D Thin under	0.0100	1.00	0.0100	I	MC-M	I.vos
E GroupSelect with matrix thin	0.0100	1.00	0.0100	J	MC-M	J.vom
H Clearcut-Coppice	0.0100	1.00	0.0100	A	Early A	GFB
J RX FIRE ONLY Low	0.0001	1.00	0.0001	I	MC-M	I.vos
K RX FIRE ONLY Moderate	0.0001	1.00	0.0001	I	MC-M	I.vos
L RX FIRE ONLY High	0.0001	1.00	0.0001	I	MC-M	I.vos
Mixed Severity Fire	0.0100	1.00	0.0100	I	MC-M	I.vos
Nonlethal Fire	0.0100	1.00	0.0100	I	MC-M	I.vos
Stand-Replacing Fire	0.0001	1.00	0.0001	I	MC-M	I.vos

☐ TSD
 ☐ Ages

Appendix B figure 38a. Alternative A wet mixed conifer forest PNVT State I transitions continued

Class Properties for Class J: MC-M J.vom

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	J	MC-M	J.vom

MC-M - Mixed Conifer Mixed Tolerant
J.vom - J.VLarge_Open_Multi

Display Pathways

☒ From Class
☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
2_C	0.0328	1.00	0.0328	C	MC-T	C.sc
2_F	0.0155	1.00	0.0155	F	MC-T	F.vom
2_G	0.0155	1.00	0.0155	G	MC-I	G.so
2_H	0.0155	1.00	0.0155	H	MC-I	H.mos
2_I	0.0155	1.00	0.0155	I	MC-M	I.vos
C Thin from below to target	0.0100	0.83	0.0083	I	MC-M	I.vos
C Thin from below to target	0.0100	0.17	0.0017	J	MC-M	J.vom
D Thin under	0.0100	0.17	0.0017	F	MC-T	F.vom
D Thin under	0.0100	0.08	0.0008	I	MC-M	I.vos
D Thin under	0.0100	0.75	0.0075	J	MC-M	J.vom
E GroupSelect with matrix thin	0.0100	0.83	0.0083	I	MC-M	I.vos
E GroupSelect with matrix thin	0.0100	0.17	0.0017	J	MC-M	J.vom
H Clearcut-Coppice	0.0100	1.00	0.0100	A	Early A	GFB

New
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☐ TSD
☐ Ages

Sort...

OK Cancel Apply

Appendix B figure 39. Alternative A wet mixed conifer forest PNVTs' potentially management driven (10) and naturally driven (9) transitions for State J. Alternative A wet mixed conifer forest PNV State J transitions continued in Appendix B figure 39a

Class Properties for Class J: MC-M J.vom

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	J	MC-M	J.vom

MC-M - Mixed Conifer Mixed Tolerant
J.vom - J.VLarge_Open_Multi

Display Pathways

☒ From Class
☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
D Thin under	0.0100	0.08	0.0008	I	MC-M	I.vos
E GroupSelect with matrix thin	0.0001	1.00	0.0001	J	MC-M	J.vom
H Clearcut-Coppice	0.0100	1.00	0.0100	A	Early A	GFB
J RX FIRE ONLY Low	0.0001	0.08	0.0000	I	MC-M	I.vos
K RX FIRE ONLY Moderate	0.0001	0.17	0.0000	I	MC-M	I.vos
L RX FIRE ONLY High	0.0001	0.33	0.0000	A	Early A	GFB
L RX FIRE ONLY High	0.0001	0.17	0.0000	I	MC-M	I.vos
M Thin under 9-inch diameter	0.0100	1.00	0.0100	J	MC-M	J.vom
Mixed Severity Fire	0.0100	0.17	0.0017	I	MC-M	I.vos
Nonlethal Fire	0.0100	0.08	0.0008	I	MC-M	I.vos
Stand-Replacing Fire	0.0001	0.33	0.0000	A	Early A	GFB
Stand-Replacing Fire	0.0001	0.17	0.0000	I	MC-M	I.vos

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☐ TSD
☐ Ages

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OK Cancel Apply

Appendix B figure 39a. Alternative A wet mixed conifer forest PNV State J transitions continued

Class Properties for Class K: Early K GFB

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	K	Early K	GFB

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
2_P	0.3333	1.00	0.3333	P	MC-In	P.sc
I Plant Seedlings	0.0100	0.65	0.0065	C	MC-T	C.sc
I Plant Seedlings	0.0100	0.20	0.0020	G	MC-I	G.sc
Mixed Severity Fire	0.0001	1.00	0.0001	K	Early K	GFB
Nonlethal Fire	0.0100	1.00	0.0100	K	Early K	GFB
Stand-Replacing Fire	0.0001	1.00	0.0001	K	Early K	GFB

**Early K - Early State with elk
GFB - Grass-Forb-Brush**

Display Pathways
☒ From Class
☐ To Class

☐ TSD
☐ Ages

Sort...

OK Cancel Apply

Appendix B figure 40. Alternative A wet mixed conifer forest PNVTs' potentially management driven (2) and naturally driven (4) transitions for State K

Class Properties for Class L: MC-In L.sc

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	L	MC-In	L.sc

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
2_M	0.0267	1.00	0.0267	M	MC-To	M.mcs
2_O	0.0030	1.00	0.0030	O	MC-To	O.vcm
B Free thin all sizes to target	0.0100	0.12	0.0012	C	MC-T	C.sc
B Free thin all sizes to target	0.0100	0.04	0.0004	D	MC-T	D.mcs
B Free thin all sizes to target	0.0100	0.08	0.0008	H	MC-I	H.mos
B Free thin all sizes to target	0.0100	0.01	0.0001	I	MC-M	I.vos
B Free thin all sizes to target	0.0100	0.12	0.0012	M	MC-To	M.mcs
B Free thin all sizes to target	0.0100	0.28	0.0028	Q	MC-In	Q.mos
B Free thin all sizes to target	0.0100	0.04	0.0004	R	MC-Mi	R.vos
C Thin from below to target	0.0100	0.13	0.0013	C	MC-T	C.sc
C Thin from below to target	0.0100	0.08	0.0008	D	MC-T	D.mcs
C Thin from below to target	0.0100	0.04	0.0004	H	MC-I	H.mos
C Thin from below to target	0.0100	0.24	0.0024	M	MC-To	M.mcs

**MC-In - Mixed-Conifer-Shade-Intolerant
L.sc - L.Seed/Sap/Small_Closed**

Display Pathways
☒ From Class
☐ To Class

☐ TSD
☐ Ages

Sort...

OK Cancel Apply

Appendix B figure 41. Alternative A wet mixed conifer forest PNVTs' potentially management driven (35) and naturally driven (24) transitions for State L. Alternative A wet mixed conifer forest PNVT State L transitions continued in Appendix B figures 41a through 41d

Class Properties for Class L: MC-In L.sc

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	L	MC-In	L.sc

**MC-In - Mixed-Conifer-Shade-Intolerant
L.sc - L.Seed/Sap/Small_Closed**

Display Pathways
☒ From Class
☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
C Thin from below to target	0.0100	0.12	0.0012	Q	MC-In	Q.mos
Insect/Disease	0.0300	1.00	0.0300	P	MC-In	P.so
J RX FIRE ONLY Low	0.0100	0.13	0.0013	C	MC-T	C.sc
J RX FIRE ONLY Low	0.0100	0.09	0.0009	D	MC-T	D.mcs
J RX FIRE ONLY Low	0.0100	0.01	0.0001	F	MC-T	F.vcm
J RX FIRE ONLY Low	0.0100	0.01	0.0001	H	MC-I	H.mos
J RX FIRE ONLY Low	0.0100	0.28	0.0028	M	MC-To	M.mcs
J RX FIRE ONLY Low	0.0100	0.04	0.0004	O	MC-To	O.vcm
J RX FIRE ONLY Low	0.0100	0.04	0.0004	Q	MC-In	Q.mos
K RX FIRE ONLY Moderate	0.0001	0.08	0.0000	C	MC-T	C.sc
K RX FIRE ONLY Moderate	0.0001	0.04	0.0000	D	MC-T	D.mcs
K RX FIRE ONLY Moderate	0.0001	0.09	0.0000	G	MC-I	G.so
K RX FIRE ONLY Moderate	0.0001	0.04	0.0000	H	MC-I	H.mos

OK Cancel Apply

Appendix B figure 41a. Alternative A wet mixed conifer forest PNVT State L transitions continued

Class Properties for Class L: MC-In L.sc

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	L	MC-In	L.sc

**MC-In - Mixed-Conifer-Shade-Intolerant
L.sc - L.Seed/Sap/Small_Closed**

Display Pathways
☒ From Class
☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
K RX FIRE ONLY Moderate	0.0001	0.12	0.0000	M	MC-To	M.mcs
K RX FIRE ONLY Moderate	0.0001	0.28	0.0000	P	MC-In	P.so
K RX FIRE ONLY Moderate	0.0001	0.12	0.0000	Q	MC-In	Q.mos
L RX FIRE ONLY High	0.0001	0.03	0.0000	A	Early A	GFB
L RX FIRE ONLY High	0.0001	0.01	0.0000	C	MC-T	C.sc
L RX FIRE ONLY High	0.0001	0.13	0.0000	G	MC-I	G.so
L RX FIRE ONLY High	0.0001	0.08	0.0000	H	MC-I	H.mos
L RX FIRE ONLY High	0.0001	0.08	0.0000	K	Early K	GFB
L RX FIRE ONLY High	0.0001	0.39	0.0000	P	MC-In	P.so
L RX FIRE ONLY High	0.0001	0.24	0.0000	Q	MC-In	Q.mos
M Thin under 9-inch diameter	0.0100	0.25	0.0025	C	MC-T	C.sc
M Thin under 9-inch diameter	0.0100	0.75	0.0075	L	MC-In	L.sc
Mixed Severity Fire	0.0100	0.08	0.0008	C	MC-T	C.sc

OK Cancel Apply

Appendix B figure 41b. Alternative A wet mixed conifer forest PNVT State L transitions continued

Class Properties for Class L: MC-In L.sc

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	L	MC-In	L.sc

**MC-In - Mixed-Conifer-Shade-Intolerant
L.sc - L.Seed/Sap/Small_Closed**

Display Pathways
☒ From Class
☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
Mixed Severity Fire	0.0100	0.04	0.0004	D	MC-T	D.mcs
Mixed Severity Fire	0.0100	0.09	0.0009	G	MC-I	G.so
Mixed Severity Fire	0.0100	0.04	0.0004	H	MC-I	H.mos
Mixed Severity Fire	0.0100	0.12	0.0012	M	MC-To	M.mcs
Mixed Severity Fire	0.0100	0.28	0.0028	P	MC-In	P.so
Mixed Severity Fire	0.0100	0.12	0.0012	Q	MC-In	Q.mos
Nonlethal Fire	0.0100	0.13	0.0013	C	MC-T	C.sc
Nonlethal Fire	0.0100	0.09	0.0009	D	MC-T	D.mcs
Nonlethal Fire	0.0100	0.01	0.0001	F	MC-T	F.vcm
Nonlethal Fire	0.0100	0.01	0.0001	H	MC-I	H.mos
Nonlethal Fire	0.0100	0.28	0.0028	M	MC-To	M.mcs
Nonlethal Fire	0.0100	0.04	0.0004	O	MC-To	O.vcm
Nonlethal Fire	0.0100	0.04	0.0004	Q	MC-In	Q.mos

OK Cancel Apply

Appendix B figure 41c. Alternative A wet mixed conifer forest PNV State L transitions continued

Class Properties for Class L: MC-In L.sc

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	L	MC-In	L.sc

**MC-In - Mixed-Conifer-Shade-Intolerant
L.sc - L.Seed/Sap/Small_Closed**

Display Pathways
☒ From Class
☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
Nonlethal Fire	0.0100	0.01	0.0001	F	MC-T	F.vcm
Nonlethal Fire	0.0100	0.01	0.0001	H	MC-I	H.mos
Nonlethal Fire	0.0100	0.28	0.0028	M	MC-To	M.mcs
Nonlethal Fire	0.0100	0.04	0.0004	O	MC-To	O.vcm
Nonlethal Fire	0.0100	0.04	0.0004	Q	MC-In	Q.mos
Stand-Replacing Fire	0.0100	0.03	0.0003	A	Early A	GFB
Stand-Replacing Fire	0.0100	0.01	0.0001	C	MC-T	C.sc
Stand-Replacing Fire	0.0100	0.13	0.0013	G	MC-I	G.so
Stand-Replacing Fire	0.0100	0.08	0.0008	H	MC-I	H.mos
Stand-Replacing Fire	0.0100	0.08	0.0008	K	Early K	GFB
Stand-Replacing Fire	0.0100	0.39	0.0039	P	MC-In	P.so
Stand-Replacing Fire	0.0100	0.24	0.0024	Q	MC-In	Q.mos

OK Cancel Apply

Appendix B figure 41d. Alternative A wet mixed conifer forest PNV State L transitions continued

Class Properties for Class M: MC-To M.mcs

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	M	MC-To	M.mcs

MC-To - Mixed-Conifer-Shade-Tolerant
M.mcs - M.Medium_Closed_Single

Display Pathways

☒ From Class

☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
2_L	0.0029	1.00	0.0029	L	MC-In	L.sc
2_N	0.0023	1.00	0.0023	N	MC-To	N.vcs
2_O	0.0091	1.00	0.0091	O	MC-To	O.vcm
2_Q	0.0004	1.00	0.0004	Q	MC-In	Q.mos
2_S	0.0001	1.00	0.0001	S	MC-Mi	S.vom
B Free thin all sizes to target	0.0001	0.05	0.0000	D	MC-T	D.mcs
B Free thin all sizes to target	0.0001	0.13	0.0000	H	MC-I	H.mos
B Free thin all sizes to target	0.0001	0.04	0.0000	I	MC-M	I.vos
B Free thin all sizes to target	0.0001	0.03	0.0000	J	MC-M	J.vom
B Free thin all sizes to target	0.0001	0.39	0.0000	Q	MC-In	Q.mos
B Free thin all sizes to target	0.0001	0.12	0.0000	R	MC-Mi	R.vos
B Free thin all sizes to target	0.0001	0.10	0.0000	S	MC-Mi	S.vom
C Thin from below to target	0.0001	0.01	0.0000	C	MC-T	C.sc

OK Cancel Apply

Appendix B figure 42. Alternative A wet mixed conifer forest PNVTs' potentially management driven (76) and naturally driven (31) transitions for State M. Alternative A wet mixed conifer forest PNVT State M transitions continued in Appendix B figures 42a through 42h

Class Properties for Class M: MC-To M.mcs

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	M	MC-To	M.mcs

MC-To - Mixed-Conifer-Shade-Tolerant
M.mcs - M.Medium_Closed_Single

Display Pathways

☒ From Class

☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
C Thin from below to target	0.0001	0.10	0.0000	D	MC-T	D.mcs
C Thin from below to target	0.0001	0.09	0.0000	H	MC-I	H.mos
C Thin from below to target	0.0001	0.04	0.0000	I	MC-M	I.vos
C Thin from below to target	0.0001	0.01	0.0000	J	MC-M	J.vom
C Thin from below to target	0.0001	0.02	0.0000	L	MC-In	L.sc
C Thin from below to target	0.0001	0.28	0.0000	Q	MC-In	Q.mos
C Thin from below to target	0.0001	0.12	0.0000	R	MC-Mi	R.vos
C Thin from below to target	0.0001	0.04	0.0000	S	MC-Mi	S.vom
D Thin under	0.0100	0.01	0.0001	C	MC-T	C.sc
D Thin under	0.0100	0.11	0.0011	D	MC-T	D.mcs
D Thin under	0.0100	0.01	0.0001	F	MC-T	F.vcm
D Thin under	0.0100	0.09	0.0009	H	MC-I	H.mos
D Thin under	0.0100	0.02	0.0002	I	MC-M	I.vos

OK Cancel Apply

Appendix B figure 42a. Alternative A wet mixed conifer forest PNVT State M transitions continued

Class Properties for Class M: MC-To M.mcs

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	M	MC-To	M.mcs

**MC-To - Mixed-Conifer-Shade-Tolerant
M.mcs - M.Medium_Closed_Single**

Display Pathways
☒ From Class
☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
D Thin under	0.0100	0.02	0.0002	J	MC-M	J.vom
D Thin under	0.0100	0.02	0.0002	L	MC-In	L.sc
D Thin under	0.0100	0.02	0.0002	O	MC-To	O.vcm
D Thin under	0.0100	0.26	0.0026	Q	MC-In	Q.mos
D Thin under	0.0100	0.06	0.0006	R	MC-Mi	R.vos
D Thin under	0.0100	0.06	0.0006	S	MC-Mi	S.vom
E GroupSelect with matrix thin	0.0001	0.09	0.0000	D	MC-T	D.mcs
E GroupSelect with matrix thin	0.0001	0.09	0.0000	H	MC-I	H.mos
E GroupSelect with matrix thin	0.0001	0.01	0.0000	I	MC-M	I.vos
E GroupSelect with matrix thin	0.0001	0.06	0.0000	J	MC-M	J.vom
E GroupSelect with matrix thin	0.0001	0.28	0.0000	Q	MC-In	Q.mos
E GroupSelect with matrix thin	0.0001	0.04	0.0000	R	MC-Mi	R.vos
E GroupSelect with matrix thin	0.0001	0.18	0.0000	S	MC-Mi	S.vom

OK Cancel Apply

Appendix B figure 42b. Alternative A wet mixed conifer forest PNVT State M transitions continued

Class Properties for Class M: MC-To M.mcs

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	M	MC-To	M.mcs

**MC-To - Mixed-Conifer-Shade-Tolerant
M.mcs - M.Medium_Closed_Single**

Display Pathways
☒ From Class
☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
F Shelterwood seed cut to	0.0001	0.05	0.0000	A	Early A	GFB
F Shelterwood seed cut to	0.0001	0.03	0.0000	G	MC-I	G.so
F Shelterwood seed cut to	0.0001	0.14	0.0000	H	MC-I	H.mos
F Shelterwood seed cut to	0.0001	0.02	0.0000	I	MC-M	I.vos
F Shelterwood seed cut to	0.0001	0.01	0.0000	J	MC-M	J.vom
F Shelterwood seed cut to	0.0001	0.16	0.0000	K	Early K	GFB
F Shelterwood seed cut to	0.0001	0.08	0.0000	P	MC-In	P.so
F Shelterwood seed cut to	0.0001	0.41	0.0000	Q	MC-In	Q.mos
F Shelterwood seed cut to	0.0001	0.06	0.0000	R	MC-Mi	R.vos
F Shelterwood seed cut to	0.0001	0.02	0.0000	S	MC-Mi	S.vom
G Clearcut with legacy trees	0.0001	0.24	0.0000	A	Early A	GFB
G Clearcut with legacy trees	0.0001	0.01	0.0000	H	MC-I	H.mos
G Clearcut with legacy trees	0.0001	0.73	0.0001	K	Early K	GFB

OK Cancel Apply

Appendix B figure 42c. Alternative A wet mixed conifer forest PNVT State M transitions continued

Class Properties for Class M: MC-To M.mcs

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	M	MC-To	M.mcs

**MC-To - Mixed-Conifer-Shade-Tolerant
M.mcs - M.Medium_Closed_Single**

Display Pathways
☒ From Class
☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	Stage
G Clearcut with legacy trees	0.0001	0.02	0.0000	Q	MC-In	Q.mos
Insect/Disease	0.0300	1.00	0.0300	Q	MC-In	Q.mos
J RX FIRE ONLY Low	0.0100	0.01	0.0001	C	MC-T	C.sc
J RX FIRE ONLY Low	0.0100	0.23	0.0023	D	MC-T	D.mcs
J RX FIRE ONLY Low	0.0100	0.01	0.0001	E	MC-T	E.vcs
J RX FIRE ONLY Low	0.0100	0.01	0.0001	F	MC-T	F.vcm
J RX FIRE ONLY Low	0.0100	0.02	0.0002	L	MC-In	L.sc
J RX FIRE ONLY Low	0.0100	0.02	0.0002	N	MC-To	N.vcs
J RX FIRE ONLY Low	0.0100	0.02	0.0002	O	MC-To	O.vcm
K RX FIRE ONLY Moderate	0.0100	0.16	0.0016	D	MC-T	D.mcs
K RX FIRE ONLY Moderate	0.0100	0.01	0.0001	E	MC-T	E.vcs
K RX FIRE ONLY Moderate	0.0100	0.01	0.0001	F	MC-T	F.vcm
K RX FIRE ONLY Moderate	0.0100	0.07	0.0007	H	MC-T	H.mcs

OK Cancel Apply

Appendix B figure 42d. Alternative A wet mixed conifer forest PNVT State M transitions continued

Class Properties for Class M: MC-To M.mcs

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	M	MC-To	M.mcs

**MC-To - Mixed-Conifer-Shade-Tolerant
M.mcs - M.Medium_Closed_Single**

Display Pathways
☒ From Class
☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	Stage
K RX FIRE ONLY Moderate	0.0100	0.01	0.0001	J	MC-M	J.vom
K RX FIRE ONLY Moderate	0.0100	0.02	0.0002	N	MC-To	N.vcs
K RX FIRE ONLY Moderate	0.0100	0.02	0.0002	O	MC-To	O.vcm
K RX FIRE ONLY Moderate	0.0100	0.22	0.0022	Q	MC-In	Q.mos
K RX FIRE ONLY Moderate	0.0100	0.02	0.0002	S	MC-Mi	S.vom
L RX FIRE ONLY High	0.0001	0.09	0.0000	A	Early A	GFB
L RX FIRE ONLY High	0.0001	0.02	0.0000	D	MC-T	D.mcs
L RX FIRE ONLY High	0.0001	0.12	0.0000	H	MC-I	H.mcs
L RX FIRE ONLY High	0.0001	0.01	0.0000	I	MC-M	I.vcs
L RX FIRE ONLY High	0.0001	0.01	0.0000	J	MC-M	J.vom
L RX FIRE ONLY High	0.0001	0.28	0.0000	K	Early K	GFB
L RX FIRE ONLY High	0.0001	0.36	0.0000	Q	MC-In	Q.mos
L RX FIRE ONLY High	0.0001	0.02	0.0000	R	MC-Mi	R.vcs

OK Cancel Apply

Appendix B figure 42e. Alternative A wet mixed conifer forest PNVT State M transitions continued

Class Properties for Class M: MC-To M.mcs

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	M	MC-To	M.mcs

**MC-To - Mixed-Conifer-Shade-Tolerant
M.mcs - M.Medium_Closed_Single**

Display Pathways
☒ From Class
☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
L RX FIRE ONLY High	0.0001	0.04	0.0000	S	MC-Mi	S.vom
M Thin under 9-inch diameter	0.0100	0.01	0.0001	C	MC-T	C.sc
M Thin under 9-inch diameter	0.0100	0.24	0.0024	D	MC-T	D.mcs
M Thin under 9-inch diameter	0.0100	0.02	0.0002	L	MC-In	L.sc
Mixed Severity Fire	0.0100	0.16	0.0016	D	MC-T	D.mcs
Mixed Severity Fire	0.0100	0.01	0.0001	E	MC-T	E.vcs
Mixed Severity Fire	0.0100	0.01	0.0001	F	MC-T	F.vcm
Mixed Severity Fire	0.0100	0.07	0.0007	H	MC-I	H.mos
Mixed Severity Fire	0.0100	0.01	0.0001	J	MC-M	J.vom
Mixed Severity Fire	0.0100	0.02	0.0002	N	MC-To	N.vcs
Mixed Severity Fire	0.0100	0.02	0.0002	O	MC-To	O.vcm
Mixed Severity Fire	0.0100	0.22	0.0022	Q	MC-In	Q.mos
Mixed Severity Fire	0.0100	0.02	0.0002	S	MC-Mi	S.vom

Appendix B figure 42f. Alternative A wet mixed conifer forest PNV State M transitions continued

Class Properties for Class M: MC-To M.mcs

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	M	MC-To	M.mcs

**MC-To - Mixed-Conifer-Shade-Tolerant
M.mcs - M.Medium_Closed_Single**

Display Pathways
☒ From Class
☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
Nonlethal Fire	0.0100	0.01	0.0001	C	MC-T	C.sc
Nonlethal Fire	0.0100	0.23	0.0023	D	MC-T	D.mcs
Nonlethal Fire	0.0100	0.01	0.0001	E	MC-T	E.vcs
Nonlethal Fire	0.0100	0.01	0.0001	F	MC-T	F.vcm
Nonlethal Fire	0.0100	0.02	0.0002	L	MC-In	L.sc
Nonlethal Fire	0.0100	0.02	0.0002	N	MC-To	N.vcs
Nonlethal Fire	0.0100	0.02	0.0002	O	MC-To	O.vcm
Stand-Replacing Fire	0.0100	0.09	0.0009	A	Early A	GFB
Stand-Replacing Fire	0.0100	0.02	0.0002	D	MC-T	D.mcs
Stand-Replacing Fire	0.0100	0.12	0.0012	H	MC-I	H.mos
Stand-Replacing Fire	0.0100	0.01	0.0001	I	MC-M	I.vos
Stand-Replacing Fire	0.0100	0.01	0.0001	J	MC-M	J.vom
Stand-Replacing Fire	0.0100	0.28	0.0028	K	Early K	GFB

Appendix B figure 42g. Alternative A wet mixed conifer forest PNV State M transitions continued

Class Properties for Class M: MC-To M.mcs

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	M	MC-To	M.mcs

**MC-To - Mixed-Conifer-Shade-Tolerant
M.mcs - M.Medium_Closed_Single**

Display Pathways
☒ From Class
☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
Nonlethal Fire	0.0100	0.02	0.0002	L	MC-In	L.sc
Nonlethal Fire	0.0100	0.02	0.0002	N	MC-To	N.vcs
Nonlethal Fire	0.0100	0.02	0.0002	O	MC-To	O.vcm
Stand-Replacing Fire	0.0100	0.09	0.0009	A	Early A	GFB
Stand-Replacing Fire	0.0100	0.02	0.0002	D	MC-T	D.mcs
Stand-Replacing Fire	0.0100	0.12	0.0012	H	MC-I	H.mos
Stand-Replacing Fire	0.0100	0.01	0.0001	I	MC-M	I.vos
Stand-Replacing Fire	0.0100	0.01	0.0001	J	MC-M	J.vom
Stand-Replacing Fire	0.0100	0.28	0.0028	K	Early K	GFB
Stand-Replacing Fire	0.0100	0.36	0.0036	Q	MC-In	Q.mos
Stand-Replacing Fire	0.0100	0.02	0.0002	R	MC-Mi	R.vos
Stand-Replacing Fire	0.0100	0.04	0.0004	S	MC-Mi	S.vom

☐ TSD
☐ Ages

Appendix B figure 42h. Alternative A wet mixed conifer forest PNVT State M transitions continued

Class Properties for Class N: MC-To N.vcs

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	N	MC-To	N.vcs

**MC-To - Mixed-Conifer-Shade-Tolerant
N.vcs - N.VLarge_Closed_Single**

Display Pathways
☒ From Class
☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
2_L	0.0019	1.00	0.0019	L	MC-In	L.sc
2_M	0.0009	1.00	0.0009	M	MC-To	M.mcs
2_O	0.0270	1.00	0.0270	O	MC-To	O.vcm
2_R	0.0067	1.00	0.0067	R	MC-Mi	R.vos
2_S	0.0028	1.00	0.0028	S	MC-Mi	S.vom
B Free thin all sizes to target	0.0001	0.06	0.0000	G	MC-I	G.so
B Free thin all sizes to target	0.0001	0.19	0.0000	I	MC-M	I.vos
B Free thin all sizes to target	0.0001	0.19	0.0000	P	MC-In	P.so
B Free thin all sizes to target	0.0001	0.56	0.0001	R	MC-Mi	R.vos
C Thin from below to target	0.0100	0.25	0.0025	I	MC-M	I.vos
C Thin from below to target	0.0100	0.75	0.0075	R	MC-Mi	R.vos
D Thin under	0.0100	0.06	0.0006	E	MC-T	E.vcs
D Thin under	0.0100	0.19	0.0019	I	MC-M	I.vos

☐ TSD
☐ Ages

Appendix B figure 43. Alternative A wet mixed conifer forest PNVTs' potentially management driven (34) and naturally driven (16) transitions for State N. Alternative A Wet mixed conifer forest PNVT State N transitions continued in Appendix B figures 43a through 43c

Class Properties for Class N: MC-To N.vcs

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	N	MC-To	N.vcs

**MC-To - Mixed-Conifer-Shade-Tolerant
N.vcs - N.VLarge_Closed_Single**

Display Pathways
☒ From Class
☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
D Thin under	0.0100	0.56	0.0056	R	MC-Mi	R.vos
E GroupSelect with matrix thin	0.0001	0.13	0.0000	E	MC-T	E.vcs
E GroupSelect with matrix thin	0.0001	0.06	0.0000	H	MC-I	H.mos
E GroupSelect with matrix thin	0.0001	0.06	0.0000	I	MC-M	I.vos
E GroupSelect with matrix thin	0.0001	0.19	0.0000	Q	MC-In	Q.mos
E GroupSelect with matrix thin	0.0001	0.19	0.0000	R	MC-Mi	R.vos
F Shelterwood seed cut to	0.0001	0.06	0.0000	A	Early A	GFB
F Shelterwood seed cut to	0.0001	0.06	0.0000	G	MC-I	G.so
F Shelterwood seed cut to	0.0001	0.13	0.0000	I	MC-M	I.vos
F Shelterwood seed cut to	0.0001	0.19	0.0000	K	Early K	GFB
F Shelterwood seed cut to	0.0001	0.19	0.0000	P	MC-In	P.so
F Shelterwood seed cut to	0.0001	0.38	0.0000	R	MC-Mi	R.vos
G Clearcut with legacy trees	0.0001	0.25	0.0000	A	Early A	GFB

OK Cancel Apply

Appendix B figure 43a. Alternative A wet mixed conifer forest PNV State N transitions continued

Class Properties for Class N: MC-To N.vcs

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	N	MC-To	N.vcs

**MC-To - Mixed-Conifer-Shade-Tolerant
N.vcs - N.VLarge_Closed_Single**

Display Pathways
☒ From Class
☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
G Clearcut with legacy trees	0.0001	0.75	0.0001	K	Early K	GFB
Insect/Disease	0.0300	1.00	0.0300	R	MC-Mi	R.vos
J RX FIRE ONLY Low	0.0001	0.13	0.0000	E	MC-T	E.vcs
J RX FIRE ONLY Low	0.0001	0.13	0.0000	I	MC-M	I.vos
J RX FIRE ONLY Low	0.0001	0.38	0.0000	R	MC-Mi	R.vos
K RX FIRE ONLY Moderate	0.0001	0.13	0.0000	E	MC-T	E.vcs
K RX FIRE ONLY Moderate	0.0001	0.13	0.0000	I	MC-M	I.vos
K RX FIRE ONLY Moderate	0.0001	0.38	0.0000	R	MC-Mi	R.vos
L RX FIRE ONLY High	0.0001	0.19	0.0000	A	Early A	GFB
L RX FIRE ONLY High	0.0001	0.06	0.0000	I	MC-M	I.vos
L RX FIRE ONLY High	0.0001	0.56	0.0001	K	Early K	GFB
L RX FIRE ONLY High	0.0001	0.19	0.0000	R	MC-Mi	R.vos
M Thin under 9-inch diameter	0.0100	0.25	0.0025	E	MC-T	E.vcs

OK Cancel Apply

Appendix B figure 43b. Alternative A wet mixed conifer forest PNV State N transitions continued

Class Properties for Class N: MC-To N.vcs

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	N	MC-To	N.vcs

**MC-To - Mixed-Conifer-Shade-Tolerant
N.vcs - N.VLarge_Closed_Single**

Display Pathways
☒ From Class
☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
M Thin under 9-inch diameter	0.0100	0.25	0.0025	E	MC-T	E.vcs
M Thin under 9-inch diameter	0.0100	0.75	0.0075	N	MC-To	N.vcs
Mixed Severity Fire	0.0100	0.13	0.0013	E	MC-T	E.vcs
Mixed Severity Fire	0.0100	0.13	0.0013	I	MC-M	I.vos
Mixed Severity Fire	0.0100	0.38	0.0038	R	MC-Mi	R.vos
Nonlethal Fire	0.0100	0.13	0.0013	E	MC-T	E.vcs
Nonlethal Fire	0.0100	0.13	0.0013	I	MC-M	I.vos
Nonlethal Fire	0.0100	0.38	0.0038	R	MC-Mi	R.vos
Stand-Replacing Fire	0.0100	0.19	0.0019	A	Early A	GFB
Stand-Replacing Fire	0.0100	0.06	0.0006	I	MC-M	I.vos
Stand-Replacing Fire	0.0100	0.56	0.0056	K	Early K	GFB
Stand-Replacing Fire	0.0100	0.19	0.0019	R	MC-Mi	R.vos

☐ TSD
☐ Ages

Appendix B figure 43c. Alternative A wet mixed conifer forest PNVT State N transitions continued

Class Properties for Class O: MC-To O.vcm

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	O	MC-To	O.vcm

**MC-To - Mixed-Conifer-Shade-Tolerant
O.vcm - O.VLarge_Closed_Multi**

Display Pathways
☒ From Class
☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
2_L	0.0043	1.00	0.0043	L	MC-In	L.sc
2_M	0.0110	1.00	0.0110	M	MC-To	M.mcs
2_N	0.0011	1.00	0.0011	N	MC-To	N.vcs
2_Q	0.0003	1.00	0.0003	Q	MC-In	Q.mos
2_S	0.0005	1.00	0.0005	S	MC-Mi	S.vom
B Free thin all sizes to target	0.0001	0.17	0.0000	H	MC-I	H.mos
B Free thin all sizes to target	0.0001	0.08	0.0000	J	MC-M	J.vom
B Free thin all sizes to target	0.0001	0.50	0.0001	Q	MC-In	Q.mos
B Free thin all sizes to target	0.0001	0.25	0.0000	S	MC-Mi	S.vom
C Thin from below to target	0.0001	0.08	0.0000	D	MC-T	D.mcs
C Thin from below to target	0.0001	0.08	0.0000	E	MC-T	E.vcs
C Thin from below to target	0.0001	0.08	0.0000	F	MC-T	F.vcm
C Thin from below to target	0.0001	0.25	0.0000	M	MC-To	M.mcs

☐ TSD
☐ Ages

Appendix B figure 44. Alternative A wet mixed conifer forest PNVTs' potentially management driven (33) and naturally driven (15) transitions for State O. Alternative A wet mixed conifer forest PNVT State O transitions continued in Appendix B figures 44a through 44c

Class Properties for Class O: MC-To O.vcm

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	O	MC-To	O.vcm

MC-To - Mixed-Conifer-Shade-Tolerant
O.vcm - O.VLarge_Closed_Multi

Display Pathways

☒ From Class

☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
C Thin from below to target	0.0001	0.25	0.0000	N	MC-To	N.vcs
D Thin under	0.0100	0.25	0.0025	F	MC-T	F.vcm
E GroupSelect with matrix thin	0.0001	0.08	0.0000	H	MC-I	H.mos
E GroupSelect with matrix thin	0.0001	0.17	0.0000	J	MC-M	J.vom
E GroupSelect with matrix thin	0.0001	0.25	0.0000	Q	MC-In	Q.mos
E GroupSelect with matrix thin	0.0001	0.50	0.0001	S	MC-Mi	S.vom
F Shelterwood seed cut to	0.0001	0.08	0.0000	A	Early A	GFB
F Shelterwood seed cut to	0.0001	0.08	0.0000	I	MC-M	I.vos
F Shelterwood seed cut to	0.0001	0.08	0.0000	J	MC-M	J.vom
F Shelterwood seed cut to	0.0001	0.25	0.0000	K	Early K	GFB
F Shelterwood seed cut to	0.0001	0.25	0.0000	R	MC-Mi	R.vos
F Shelterwood seed cut to	0.0001	0.25	0.0000	S	MC-Mi	S.vom
G Clearcut with legacy trees	0.0001	0.25	0.0000	A	Early A	GFB

OK Cancel Apply

Appendix B figure 44a. Alternative A wet mixed conifer forest PNVT State O transitions continued

Class Properties for Class O: MC-To O.vcm

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	O	MC-To	O.vcm

MC-To - Mixed-Conifer-Shade-Tolerant
O.vcm - O.VLarge_Closed_Multi

Display Pathways

☒ From Class

☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
G Clearcut with legacy trees	0.0001	0.75	0.0001	K	Early K	GFB
Insect/Disease	0.0300	1.00	0.0300	S	MC-Mi	S.vom
J RX FIRE ONLY Low	0.0001	0.25	0.0000	F	MC-T	F.vcm
J RX FIRE ONLY Low	0.0001	0.75	0.0001	O	MC-To	O.vcm
K RX FIRE ONLY Moderate	0.0001	0.25	0.0000	F	MC-T	F.vcm
K RX FIRE ONLY Moderate	0.0001	0.75	0.0001	O	MC-To	O.vcm
L RX FIRE ONLY High	0.0001	0.08	0.0000	E	MC-T	E.vcs
L RX FIRE ONLY High	0.0001	0.08	0.0000	F	MC-T	F.vcm
L RX FIRE ONLY High	0.0001	0.08	0.0000	J	MC-M	J.vom
L RX FIRE ONLY High	0.0001	0.25	0.0000	N	MC-To	N.vcs
L RX FIRE ONLY High	0.0001	0.25	0.0000	S	MC-Mi	S.vom
M Thin under 9-inch diameter	0.0100	0.25	0.0025	F	MC-T	F.vcm
M Thin under 9-inch diameter	0.0100	0.75	0.0075	O	MC-To	O.vcm

OK Cancel Apply

Appendix B figure 44b. Alternative A wet mixed conifer forest PNVT State O transitions continued

Class Properties for Class O: MC-To O.vcm

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	O	MC-To	O.vcm

MC-To - Mixed-Conifer-Shade-Tolerant
O.vcm - O.VLarge_Closed_Multi

Display Pathways

☒ From Class
☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
L RX FIRE ONLY High	0.0001	0.25	0.0000	S	MC-Mi	S.vcm
M Thin under 9-inch diameter	0.0100	0.25	0.0025	F	MC-T	F.vcm
M Thin under 9-inch diameter	0.0100	0.75	0.0075	O	MC-To	O.vcm
Mixed Severity Fire	0.0100	0.25	0.0025	F	MC-T	F.vcm
Mixed Severity Fire	0.0100	0.75	0.0075	O	MC-To	O.vcm
Nonlethal Fire	0.0100	0.25	0.0025	F	MC-T	F.vcm
Nonlethal Fire	0.0100	0.75	0.0075	O	MC-To	O.vcm
Stand-Replacing Fire	0.0100	0.08	0.0008	E	MC-T	E.vcs
Stand-Replacing Fire	0.0100	0.08	0.0008	F	MC-T	F.vcm
Stand-Replacing Fire	0.0100	0.08	0.0008	J	MC-M	J.vcm
Stand-Replacing Fire	0.0100	0.25	0.0025	N	MC-To	N.vcs
Stand-Replacing Fire	0.0100	0.25	0.0025	S	MC-Mi	S.vcm

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☐ TSD
☐ Ages
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OK Cancel Apply

Appendix B figure 44c. Alternative A wet mixed conifer forest PNVT State O transitions continued

Class Properties for Class P: MC-In P.so

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	P	MC-In	P.so

MC-In - Mixed-Conifer-Shade-Intolerant
P.so - P.Seed/Sap/Small_Open

Display Pathways

☒ From Class
☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
2_L	0.0855	1.00	0.0855	L	MC-In	L.sc
B Free thin all sizes to target	0.0100	0.05	0.0005	G	MC-I	G.so
B Free thin all sizes to target	0.0100	0.95	0.0095	P	MC-In	P.so
C Thin from below to target	0.0100	0.05	0.0005	G	MC-I	G.so
C Thin from below to target	0.0100	0.95	0.0095	P	MC-In	P.so
J RX FIRE ONLY Low	0.0001	0.08	0.0000	A	Early A	GFB
J RX FIRE ONLY Low	0.0001	0.17	0.0000	G	MC-I	G.so
J RX FIRE ONLY Low	0.0001	0.25	0.0000	K	Early K	GFB
K RX FIRE ONLY Moderate	0.0100	0.08	0.0008	A	Early A	GFB
K RX FIRE ONLY Moderate	0.0100	0.08	0.0008	G	MC-I	G.so
K RX FIRE ONLY Moderate	0.0100	0.08	0.0008	H	MC-I	H.mos
K RX FIRE ONLY Moderate	0.0100	0.25	0.0025	K	Early K	GFB
K RX FIRE ONLY Moderate	0.0100	0.25	0.0025	O	MC-In	O.vcm

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☐ TSD
☐ Ages
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OK Cancel Apply

Appendix B figure 45. Alternative A wet mixed conifer forest PNVTs' potentially management driven (13) and naturally driven (11) transitions for State P. Alternative A wet mixed conifer forest PNVT State P transitions continued in Appendix B figures 45a

Class Properties for Class P: MC-In P.so

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	P	MC-In	P.so

**MC-In - Mixed-Conifer-Shade-Intolerant
P.so - P.Seed/Sap/Small_Open**

Display Pathways
☒ From Class
☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	Stage
L RX FIRE ONLY High	0.0001	0.75	0.0001	K	Early K	GFB
M Thin under 9-inch diameter	0.0001	1.00	0.0001	P	MC-In	P.so
Mixed Severity Fire	0.0100	0.08	0.0008	A	Early A	GFB
Mixed Severity Fire	0.0100	0.08	0.0008	G	MC-I	G.so
Mixed Severity Fire	0.0100	0.08	0.0008	H	MC-I	H.mos
Mixed Severity Fire	0.0100	0.25	0.0025	K	Early K	GFB
Mixed Severity Fire	0.0100	0.25	0.0025	Q	MC-In	Q.mos
Nonlethal Fire	0.0100	0.08	0.0008	A	Early A	GFB
Nonlethal Fire	0.0100	0.17	0.0017	G	MC-I	G.so
Nonlethal Fire	0.0100	0.25	0.0025	K	Early K	GFB
Stand-Replacing Fire	0.0001	0.25	0.0000	A	Early A	GFB
Stand-Replacing Fire	0.0001	0.75	0.0001	K	Early K	GFB

☐ TSD
☐ Ages

Appendix B figure 45a. Alternative A wet mixed conifer forest PNV State P transitions continued

Class Properties for Class Q: MC-In Q.mos

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	Q	MC-In	Q.mos

**MC-In - Mixed-Conifer-Shade-Intolerant
Q.mos - Q.Medium_Open_Single**

Display Pathways
☒ From Class
☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	Stage
2_M	0.0324	1.00	0.0324	M	MC-To	M.mcs
2_O	0.0153	1.00	0.0153	O	MC-To	O.vcm
2_P	0.0074	1.00	0.0074	P	MC-In	P.so
2_R	0.0074	1.00	0.0074	R	MC-Mi	R.vos
2_S	0.0153	1.00	0.0153	S	MC-Mi	S.vom
B Free thin all sizes to target	0.0100	0.02	0.0002	A	Early A	GFB
B Free thin all sizes to target	0.0100	0.02	0.0002	G	MC-I	G.so
B Free thin all sizes to target	0.0100	0.17	0.0017	H	MC-I	H.mos
B Free thin all sizes to target	0.0100	0.02	0.0002	I	MC-M	I.vos
B Free thin all sizes to target	0.0100	0.02	0.0002	J	MC-M	J.vom
B Free thin all sizes to target	0.0100	0.06	0.0006	K	Early K	GFB
B Free thin all sizes to target	0.0100	0.06	0.0006	P	MC-In	P.so
B Free thin all sizes to target	0.0100	0.06	0.0006	R	MC-Mi	R.vos

☐ TSD
☐ Ages

Appendix B figure 46. Alternative A wet mixed conifer forest PNVs' potentially management driven (50) and naturally driven (12) transitions for State Q. Alternative A wet mixed conifer forest PNV State Q transitions continued in Appendix B figures 46a through 46d

Class Properties for Class Q: MC-In Q.mos

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	Q	MC-In	Q.mos

MC-In - Mixed-Conifer-Shade-Intolerant
Q.mos - Q.Medium_Open_Single

Display Pathways

☒ From Class

☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
B Free thin all sizes to target	0.0100	0.06	0.0006	S	MC-Mi	S.vom
C Thin from below to target	0.0100	0.02	0.0002	A	Early A	GFB
C Thin from below to target	0.0100	0.02	0.0002	G	MC-I	G.so
C Thin from below to target	0.0100	0.02	0.0002	I	MC-M	I.vos
C Thin from below to target	0.0100	0.02	0.0002	J	MC-M	J.vom
C Thin from below to target	0.0100	0.06	0.0006	K	Early K	GFB
C Thin from below to target	0.0100	0.06	0.0006	P	MC-In	P.so
C Thin from below to target	0.0100	0.06	0.0006	R	MC-Mi	R.vos
C Thin from below to target	0.0100	0.06	0.0006	S	MC-Mi	S.vom
D Thin under	0.0100	0.02	0.0002	G	MC-I	G.so
D Thin under	0.0100	0.17	0.0017	H	MC-I	H.mos
D Thin under	0.0100	0.02	0.0002	I	MC-M	I.vos
D Thin under	0.0100	0.04	0.0004	I	MC-M	I.vom

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☐ Ages

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Appendix B figure 46a. Alternative A wet mixed conifer forest PNVT State Q transitions continued

Class Properties for Class Q: MC-In Q.mos

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	Q	MC-In	Q.mos

MC-In - Mixed-Conifer-Shade-Intolerant
Q.mos - Q.Medium_Open_Single

Display Pathways

☒ From Class

☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
D Thin under	0.0100	0.06	0.0006	P	MC-In	P.so
D Thin under	0.0100	0.06	0.0006	R	MC-Mi	R.vos
D Thin under	0.0100	0.13	0.0013	S	MC-Mi	S.vom
E GroupSelect with matrix thin	0.0100	0.06	0.0006	G	MC-I	G.so
E GroupSelect with matrix thin	0.0100	0.13	0.0013	H	MC-I	H.mos
E GroupSelect with matrix thin	0.0100	0.06	0.0006	J	MC-M	J.vom
E GroupSelect with matrix thin	0.0100	0.19	0.0019	P	MC-In	P.so
E GroupSelect with matrix thin	0.0100	0.19	0.0019	S	MC-Mi	S.vom
F Shelterwood seed cut to	0.0001	0.06	0.0000	A	Early A	GFB
F Shelterwood seed cut to	0.0001	0.15	0.0000	H	MC-I	H.mos
F Shelterwood seed cut to	0.0001	0.02	0.0000	I	MC-M	I.vos
F Shelterwood seed cut to	0.0001	0.02	0.0000	J	MC-M	J.vom
F Shelterwood seed cut to	0.0001	0.19	0.0000	K	Early K	GFB

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Appendix B figure 46b. Alternative A wet mixed conifer forest PNVT State Q transitions continued

Class Properties for Class Q: MC-In Q.mos

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	Q	MC-In	Q.mos

**MC-In - Mixed-Conifer-Shade-Intolerant
Q.mos - Q.Medium_Open_Single**

Display Pathways

☒ From Class

☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	Stage
F Shelterwood seed cut to	0.0001	0.06	0.0000	R	MC-Mi	R.vos
F Shelterwood seed cut to	0.0001	0.06	0.0000	S	MC-Mi	S.vom
G Clearcut with legacy trees	0.0100	0.25	0.0025	A	Early A	GFB
G Clearcut with legacy trees	0.0100	0.75	0.0075	K	Early K	GFB
J RX FIRE ONLY Low	0.0001	0.25	0.0000	H	MC-I	H.mos
J RX FIRE ONLY Low	0.0001	0.75	0.0001	Q	MC-In	Q.mos
K RX FIRE ONLY Moderate	0.0100	0.25	0.0025	H	MC-I	H.mos
K RX FIRE ONLY Moderate	0.0100	0.75	0.0075	Q	MC-In	Q.mos
L RX FIRE ONLY High	0.0001	0.13	0.0000	A	Early A	GFB
L RX FIRE ONLY High	0.0001	0.13	0.0000	H	MC-I	H.mos
L RX FIRE ONLY High	0.0001	0.38	0.0000	K	Early K	GFB
M Thin under 9-inch diameter	0.0100	0.02	0.0002	D	MC-T	D.mcs
M Thin under 9-inch diameter	0.0100	0.02	0.0002	G	MC-I	G.so

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Appendix B figure 46c. Alternative A wet mixed conifer forest PNVT State Q transitions continued

Class Properties for Class Q: MC-In Q.mos

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	Q	MC-In	Q.mos

**MC-In - Mixed-Conifer-Shade-Intolerant
Q.mos - Q.Medium_Open_Single**

Display Pathways

☒ From Class

☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	Stage
M Thin under 9-inch diameter	0.0100	0.02	0.0002	D	MC-T	D.mcs
M Thin under 9-inch diameter	0.0100	0.02	0.0002	G	MC-I	G.so
M Thin under 9-inch diameter	0.0100	0.21	0.0021	H	MC-I	H.mos
M Thin under 9-inch diameter	0.0100	0.06	0.0006	M	MC-To	M.mcs
M Thin under 9-inch diameter	0.0100	0.06	0.0006	P	MC-In	P.so
Mixed Severity Fire	0.0100	0.25	0.0025	H	MC-I	H.mos
Mixed Severity Fire	0.0100	0.75	0.0075	Q	MC-In	Q.mos
Nonlethal Fire	0.0100	0.25	0.0025	H	MC-I	H.mos
Nonlethal Fire	0.0100	0.75	0.0075	Q	MC-In	Q.mos
Stand-Replacing Fire	0.0100	0.13	0.0013	A	Early A	GFB
Stand-Replacing Fire	0.0100	0.13	0.0013	H	MC-I	H.mos
Stand-Replacing Fire	0.0100	0.38	0.0038	K	Early K	GFB

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Appendix B figure 46d. Alternative A wet mixed conifer forest PNVT State Q transitions continued

Class Properties for Class R: MC-Mi R.vos

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	R	MC-Mi	R.vos

MC-Mi - Mixed-Conifer-Mixed-Tolerant
R.vos - R.VLarge_Open_Single

Display Pathways

☒ From Class
☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class Stage
2_N	0.0045	1.00	0.0045	N	MC-To	N.vcs
2_P	0.0139	1.00	0.0139	P	MC-In	P.so
2_Q	0.0045	1.00	0.0045	Q	MC-In	Q.mcs
2_S	0.0188	1.00	0.0188	S	MC-Mi	S.vom
C Thin from below to target	0.0100	0.25	0.0025	I	MC-M	I.vos
C Thin from below to target	0.0100	0.75	0.0075	R	MC-Mi	R.vos
D Thin under	0.0100	0.25	0.0025	I	MC-M	I.vos
D Thin under	0.0100	0.75	0.0075	R	MC-Mi	R.vos
E GroupSelect with matrix thin	0.0100	0.08	0.0008	D	MC-T	D.mcs
E GroupSelect with matrix thin	0.0100	0.08	0.0008	I	MC-M	I.vos
E GroupSelect with matrix thin	0.0100	0.08	0.0008	J	MC-M	J.vom
E GroupSelect with matrix thin	0.0100	0.25	0.0025	M	MC-To	M.mcs
E GroupSelect with matrix thin	0.0100	0.25	0.0025	S	MC-Mi	S.vom

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Appendix B figure 47. Alternative A wet mixed conifer forest PNVTs' potentially management driven (22) and naturally driven (11) transitions for State R. Alternative A wet mixed conifer forest PNV State R transitions continued in Appendix B figures 47a and 47b

Class Properties for Class R: MC-Mi R.vos

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	R	MC-Mi	R.vos

MC-Mi - Mixed-Conifer-Mixed-Tolerant
R.vos - R.VLarge_Open_Single

Display Pathways

☒ From Class
☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class Stage
F Shelterwood seed cut to	0.0001	0.17	0.0000	A	Early A	GFB
F Shelterwood seed cut to	0.0001	0.08	0.0000	I	MC-M	I.vos
F Shelterwood seed cut to	0.0001	0.50	0.0001	K	Early K	GFB
G Clearcut with legacy trees	0.0100	0.17	0.0017	A	Early A	GFB
G Clearcut with legacy trees	0.0100	0.08	0.0008	I	MC-M	I.vos
G Clearcut with legacy trees	0.0100	0.50	0.0050	K	Early K	GFB
J RX FIRE ONLY Low	0.0001	0.25	0.0000	I	MC-M	I.vos
J RX FIRE ONLY Low	0.0001	0.75	0.0001	R	MC-Mi	R.vos
K RX FIRE ONLY Moderate	0.0001	0.25	0.0000	I	MC-M	I.vos
K RX FIRE ONLY Moderate	0.0001	0.75	0.0001	R	MC-Mi	R.vos
L RX FIRE ONLY High	0.0001	0.08	0.0000	A	Early A	GFB
L RX FIRE ONLY High	0.0001	0.17	0.0000	I	MC-M	I.vos
L RX FIRE ONLY High	0.0001	0.25	0.0000	K	Early K	GFB

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Appendix B figure 47a. Alternative A wet mixed conifer forest PNV State R transitions continued

Class Properties for Class R: MC-Mi R.vos

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	R	MC-Mi	R.vos

MC-Mi - Mixed-Conifer-Mixed-Tolerant
R.vos - R.VLarge_Open_Single

Display Pathways

☒ From Class

☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
K RX FIRE ONLY Moderate	0.0001	0.25	0.0000	I	MC-M	I.vos
K RX FIRE ONLY Moderate	0.0001	0.75	0.0001	R	MC-Mi	R.vos
L RX FIRE ONLY High	0.0001	0.08	0.0000	A	Early A	GFB
L RX FIRE ONLY High	0.0001	0.17	0.0000	I	MC-M	I.vos
L RX FIRE ONLY High	0.0001	0.25	0.0000	K	Early K	GFB
Mixed Severity Fire	0.0100	0.25	0.0025	I	MC-M	I.vos
Mixed Severity Fire	0.0100	0.75	0.0075	R	MC-Mi	R.vos
Nonlethal Fire	0.0100	0.25	0.0025	I	MC-M	I.vos
Nonlethal Fire	0.0100	0.75	0.0075	R	MC-Mi	R.vos
Stand-Replacing Fire	0.0001	0.08	0.0000	A	Early A	GFB
Stand-Replacing Fire	0.0001	0.17	0.0000	I	MC-M	I.vos
Stand-Replacing Fire	0.0001	0.25	0.0000	K	Early K	GFB

OK Cancel Apply

Appendix B figure 47b. Alternative A wet mixed conifer forest PNVT State R transitions continued

Class Properties for Class S: MC-Mi S.vom

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	S	MC-Mi	S.vom

MC-Mi - Mixed-Conifer-Mixed-Tolerant
S.vom - S.VLarge_Open_Multi

Display Pathways

☒ From Class

☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
2_L	0.0220	1.00	0.0220	L	MC-In	L.sc
2_M	0.0041	1.00	0.0041	M	MC-To	M.mcs
2_N	0.0084	1.00	0.0084	N	MC-To	N.vcs
2_O	0.0174	1.00	0.0174	O	MC-To	O.vcm
2_P	0.0084	1.00	0.0084	P	MC-In	P.so
2_Q	0.0041	1.00	0.0041	Q	MC-In	Q.mcs
2_R	0.0084	1.00	0.0084	R	MC-Mi	R.vos
C Thin from below to target	0.0100	0.06	0.0006	A	Early A	GFB
C Thin from below to target	0.0100	0.17	0.0017	I	MC-M	I.vos
C Thin from below to target	0.0100	0.03	0.0003	J	MC-M	J.vom
C Thin from below to target	0.0100	0.17	0.0017	K	Early K	GFB
C Thin from below to target	0.0100	0.50	0.0050	R	MC-Mi	R.vos
D Thin under	0.0100	0.04	0.0004	I	MC-M	I.vos

OK Cancel Apply

Appendix B figure 48. Alternative A wet mixed conifer forest PNVTs' potentially management driven (23) and naturally driven (14) transitions for State S. Alternative A wet mixed conifer forest PNVT State S transitions continued in Appendix B figures 48a and 48b

Class Properties for Class S: MC-Mi S.vom

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	S	MC-Mi	S.vom

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
D Thin under	0.0100	0.21	0.0021	J	MC-M	J.vom
D Thin under	0.0100	0.13	0.0013	R	MC-Mi	R.vos
E GroupSelect with matrix thin	0.0100	0.17	0.0017	I	MC-M	I.vos
E GroupSelect with matrix thin	0.0100	0.08	0.0008	J	MC-M	J.vom
E GroupSelect with matrix thin	0.0100	0.50	0.0050	R	MC-Mi	R.vos
G Clearcut with legacy trees	0.0001	0.25	0.0000	A	Early A	GFB
G Clearcut with legacy trees	0.0001	0.75	0.0001	K	Early K	GFB
J RX FIRE ONLY Low	0.0001	0.25	0.0000	J	MC-M	J.vom
J RX FIRE ONLY Low	0.0001	0.75	0.0001	S	MC-Mi	S.vom
K RX FIRE ONLY Moderate	0.0001	0.25	0.0000	J	MC-M	J.vom
K RX FIRE ONLY Moderate	0.0001	0.75	0.0001	S	MC-Mi	S.vom
L RX FIRE ONLY High	0.0001	0.06	0.0000	A	Early A	GFB
L RX FIRE ONLY High	0.0001	0.19	0.0000	I	MC-M	I.vom

Display Pathways

☒ From Class
☐ To Class

**MC-Mi - Mixed-Conifer-Mixed-Tolerant
S.vom - S.VLarge_Open_Multi**

☐ TSD
☐ Ages

OK Cancel Apply

Appendix B figure 48a. Alternative A wet mixed conifer forest PNVT State S transitions continued

Class Properties for Class S: MC-Mi S.vom

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	S	MC-Mi	S.vom

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
L RX FIRE ONLY High	0.0001	0.19	0.0000	J	MC-M	J.vom
L RX FIRE ONLY High	0.0001	0.17	0.0000	K	Early K	GFB
M Thin under 9-inch diameter	0.0100	0.01	0.0001	H	MC-I	H.mos
M Thin under 9-inch diameter	0.0100	0.24	0.0024	J	MC-M	J.vom
M Thin under 9-inch diameter	0.0100	0.04	0.0004	Q	MC-In	Q.mos
Mixed Severity Fire	0.0100	0.25	0.0025	J	MC-M	J.vom
Mixed Severity Fire	0.0100	0.75	0.0075	S	MC-Mi	S.vom
Nonlethal Fire	0.0100	0.25	0.0025	J	MC-M	J.vom
Nonlethal Fire	0.0100	0.75	0.0075	S	MC-Mi	S.vom
Stand-Replacing Fire	0.0001	0.06	0.0000	A	Early A	GFB
Stand-Replacing Fire	0.0001	0.19	0.0000	J	MC-M	J.vom
Stand-Replacing Fire	0.0001	0.17	0.0000	K	Early K	GFB

Display Pathways

☒ From Class
☐ To Class

**MC-Mi - Mixed-Conifer-Mixed-Tolerant
S.vom - S.VLarge_Open_Multi**

☐ TSD
☐ Ages

OK Cancel Apply

Appendix B figure 48b. Alternative A wet mixed conifer forest PNVT State S transitions continued

Dry Mixed Conifer Forest PNVT

Appendix B table 9. Dry mixed conifer forest (AKA - *Mixed conifer with frequent fire PNVT (MCD)*) PNVT crosswalks developed by Region 3 (19 March 2010) used in the determination of departure from HRV and DCs. DCs were provided by the Regional Office, and HRV was derived from LANDFIRE (2007a)

Current Trends Model			R3 Mid-scale Existing Vegetation Mapping		Reference Condition				Baseline Desired Conditions	
source	state	description		dominance unit - size/cover	source	state	historic mean ¹ (%)	description	structural stage (%)	description
USFS R3 model MCD	A, N	GFB/SHR	=	NON-TREE: Recently burned, grass, forb, and shrub types - N/A	LANDFIRE National 1510510 - Southern Rocky Mountain Dry-Mesic Montane Mixed Conifer	A	20	Early development, all structures	9	Reference condition, and conditions indicative of even-aged stand dynamics and the development of Mexican spotted owl (MSO) habitat ¹
	B, F	SSC, SSO	=	All tree types - Seedling/sapling - open canopy, seedling/sapling - closed canopy		C	10	Mid development, open	3	Reference condition, and conditions indicative of even-aged stand dynamics and the development of MSO habitat ²
	C	SMO - Shade intolerant	=	All shade intolerant tree types - Small - open canopy		D	60	Late development, open	60	Based on reference condition, and the predominance of uneven-aged dynamics and open forest. The plurality of stands on low-productivity sites likely to occur as state J, versus high-productivity sites where state K is more likely ²
	D, J	MOS, MOM - Shade intolerant	=	All shade intolerant tree types - Medium - open canopy		B	5	Mid development, closed	3	Reference condition, and conditions indicative of even-aged stand dynamics and the development of MSO habitat ²
	E, K	VOS, VOM - Shade intolerant	=	All shade intolerant tree types - Very large - open canopy		E	5	Late development, closed	25	Conditions indicative of MSO habitat, and occasional even-aged dynamics that occurred in the reference condition (Romme et al., 2010), particularly on north facing slopes and canyons. The plurality of stands on low-productivity sites likely to occur as state H/L, versus high-productivity sites where state I/M is more likely
	G	SMC - Mixed shade tolerant	=	All shade tolerant tree types and mixed-tolerant tree types (e.g., ponderosa pine_Douglas-fir) - Small - closed canopy						
	H, L	MCS, MCM - Mixed shade tolerant	=	All shade tolerant tree types and mixed-tolerant tree types (e.g., ponderosa pine_Douglas-fir) - Medium - closed canopy						
	I, M	VCS, VCM - Mixed shade tolerant	=	All shade tolerant tree types and mixed-tolerant tree types (e.g., ponderosa pine_Douglas-fir) - Very large - closed canopy						

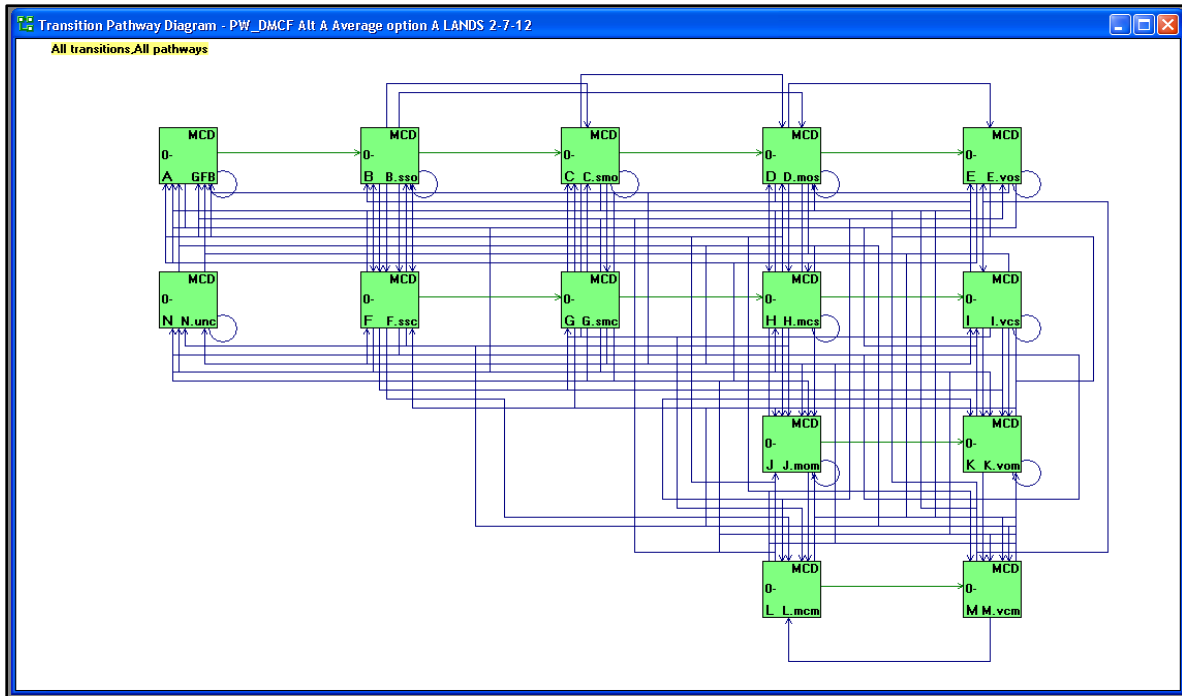
¹Based on 15.6-year fire interval

¹Based on necessary level of even-aged management (4% per decade) to maintain 25% mature closed forest condition (10"+ DBH), tempered by reference condition (20%). The remaining available percentage, after accounting for sustenance of MSO habitat and 60% late-open, was included here

²Reflects percentage of seral forests necessary to sustain at least 25% MSO habitat in mature closed forest

Dry Mixed Conifer Forest (AKA –“Mixed Conifer with Frequent Fire”) PNVT State and Transition Models:

See discussion and VDDT modeling under ponderosa pine forest PNVT. Appendix B figures 49 through 63 display the actual VDDT model for dry mixed conifer forest, developed by the USDA FS Southwestern Region 3, and utilized during the planning effort on the A-SNFs to determine future departure conditions and assessment of trends.



Appendix B figure 49. Actual Alternative A VDDT state and transition model used for assessing trends in the dry mixed conifer forest PNVT on the A-SNFs

Class Properties for Class A: MCD GFB

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	B	MCD	B.sso

- Mixed Conifer Dry aka MC Frequent Fire
GFB - Grass-Forb-Brush

Display Pathways

☒ From Class
☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
2_F	0.3333	1.00	0.3333	F	MCD	F.ssc
Nonlethal Fire	0.0100	1.00	0.0100	A	MCD	GFB

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Appendix B figure 50. Alternative A dry mixed conifer forest PNVTs' potentially management driven (0) and naturally driven (2) transitions for State A

Class Properties for Class B: MCD B.sso

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	C	MCD	C.smo

- Mixed Conifer Dry aka MC Frequent Fire
B.sso - B.Seedling/Sapling_Open

Display Pathways

☒ From Class
☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
2_F	0.3333	1.00	0.3333	F	MCD	F.ssc
J RX FIRE ONLY Low	0.0100	0.25	0.0025	C	MCD	C.smo
J RX FIRE ONLY Low	0.0100	0.25	0.0025	D	MCD	D.mos
J RX FIRE ONLY Low	0.0100	0.25	0.0025	J	MCD	J.mom
K RX FIRE ONLY Moderate	0.0001	0.50	0.0001	A	MCD	GFB
K RX FIRE ONLY Moderate	0.0001	0.25	0.0000	D	MCD	D.mos
K RX FIRE ONLY Moderate	0.0001	0.25	0.0000	J	MCD	J.mom
L RX FIRE ONLY High	0.0001	1.00	0.0001	A	MCD	GFB
Mixed Severity Fire	0.0001	0.50	0.0001	A	MCD	GFB
Mixed Severity Fire	0.0001	0.25	0.0000	D	MCD	D.mos
Mixed Severity Fire	0.0001	0.25	0.0000	J	MCD	J.mom
Nonlethal Fire	0.0100	0.25	0.0025	B	MCD	B.sso
Nonlethal Fire	0.0100	0.25	0.0025	D	MCD	D.mos

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Appendix B figure 51. Alternative A dry mixed conifer forest PNVTs' potentially management driven (7) and naturally driven (8) transitions for State B. Alternative A dry mixed conifer forest PNVT State B transitions continued in Appendix B figure 51a

Class Properties for Class B: MCD B.sso

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	C	MCD	C.smo

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
J RX FIRE ONLY Low	0.0100	0.25	0.0025	J	MCD	J.mom
K RX FIRE ONLY Moderate	0.0001	0.50	0.0001	A	MCD	GFB
K RX FIRE ONLY Moderate	0.0001	0.25	0.0000	D	MCD	D.mos
K RX FIRE ONLY Moderate	0.0001	0.25	0.0000	J	MCD	J.mom
L RX FIRE ONLY High	0.0001	1.00	0.0001	A	MCD	GFB
Mixed Severity Fire	0.0001	0.50	0.0001	A	MCD	GFB
Mixed Severity Fire	0.0001	0.25	0.0000	D	MCD	D.mos
Mixed Severity Fire	0.0001	0.25	0.0000	J	MCD	J.mom
Nonlethal Fire	0.0100	0.25	0.0025	B	MCD	B.sso
Nonlethal Fire	0.0100	0.25	0.0025	D	MCD	D.mos
Nonlethal Fire	0.0100	0.25	0.0025	J	MCD	J.mom
Stand-Replacing Fire	0.0001	1.00	0.0001	A	MCD	GFB

Display Pathways

☒ From Class
☐ To Class

☐ TSD
☐ Ages

OK Cancel Apply

Appendix B figure 51a. Alternative A dry mixed conifer forest PNVT State B transitions continued

Class Properties for Class C: MCD C.smo

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	D	MCD	D.mos

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
2_F	0.3333	1.00	0.3333	F	MCD	F.ssc
B Free thin all sizes to target	0.0100	1.00	0.0100	C	MCD	C.smo
C Thin from below to target	0.0100	1.00	0.0100	C	MCD	C.smo
J RX FIRE ONLY Low	0.0100	0.14	0.0014	D	MCD	D.mos
K RX FIRE ONLY Moderate	0.0100	0.29	0.0029	D	MCD	D.mos
K RX FIRE ONLY Moderate	0.0100	0.14	0.0014	J	MCD	J.mom
L RX FIRE ONLY High	0.0001	0.86	0.0001	A	MCD	GFB
Mixed Severity Fire	0.0001	0.29	0.0000	D	MCD	D.mos
Mixed Severity Fire	0.0001	0.14	0.0000	J	MCD	J.mom
Nonlethal Fire	0.0100	0.14	0.0014	D	MCD	D.mos
Stand-Replacing Fire	0.0001	0.86	0.0001	A	MCD	GFB

Display Pathways

☒ From Class
☐ To Class

☐ TSD
☐ Ages

OK Cancel Apply

Appendix B figure 52. Alternative A dry mixed conifer forest PNVTs' potentially management driven (6) and naturally driven (5) transitions for State C.

Class Properties for Class D: MCD D.mos

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	E	MCD	E.vos

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
2_F	0.0544	1.00	0.0544	F	MCD	F.ssc
2_H	0.0452	1.00	0.0452	H	MCD	H.mcs
B Free thin all sizes to target	0.0100	1.00	0.0100	D	MCD	D.mos
C Thin from below to target	0.0100	1.00	0.0100	D	MCD	D.mos
D Thin under	0.0100	1.00	0.0100	E	MCD	E.vos
E GroupSelect with matrix thin	0.0100	1.00	0.0100	J	MCD	J.mom
F Shelterwood seed cut to	0.0100	0.38	0.0038	A	MCD	GFB
J RX FIRE ONLY Low	0.0100	1.00	0.0100	D	MCD	D.mos
K RX FIRE ONLY Moderate	0.0100	0.25	0.0025	A	MCD	GFB
L RX FIRE ONLY High	0.0001	0.88	0.0001	A	MCD	GFB
Mixed Severity Fire	0.0001	0.25	0.0000	A	MCD	GFB
Nonlethal Fire	0.0100	1.00	0.0100	D	MCD	D.mos
Stand-Replacing Fire	0.0001	0.88	0.0001	A	MCD	GFB

- Mixed Conifer Dry aka MC Frequent Fire D.mos - D.Medium_Open_Single

Display Pathways
☒ From Class
☐ To Class

☐ TSD
☐ Ages

OK Cancel Apply

Appendix B figure 53. Alternative A dry mixed conifer forest PNVTs' potentially management driven (8) and naturally driven (5) transitions for State D. Alternative A dry mixed conifer forest PNVT State D transitions continued in Appendix B figure 53a

Class Properties for Class D: MCD D.mos

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	E	MCD	E.vos

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
2_H	0.0452	1.00	0.0452	H	MCD	H.mcs
B Free thin all sizes to target	0.0100	1.00	0.0100	D	MCD	D.mos
C Thin from below to target	0.0100	1.00	0.0100	D	MCD	D.mos
D Thin under	0.0100	1.00	0.0100	E	MCD	E.vos
E GroupSelect with matrix thin	0.0100	1.00	0.0100	J	MCD	J.mom
F Shelterwood seed cut to	0.0100	0.38	0.0038	A	MCD	GFB
J RX FIRE ONLY Low	0.0100	1.00	0.0100	D	MCD	D.mos
K RX FIRE ONLY Moderate	0.0100	0.25	0.0025	A	MCD	GFB
L RX FIRE ONLY High	0.0001	0.88	0.0001	A	MCD	GFB
Mixed Severity Fire	0.0001	0.25	0.0000	A	MCD	GFB
Nonlethal Fire	0.0100	1.00	0.0100	D	MCD	D.mos
Stand-Replacing Fire	0.0001	0.88	0.0001	A	MCD	GFB

- Mixed Conifer Dry aka MC Frequent Fire D.mos - D.Medium_Open_Single

Display Pathways
☒ From Class
☐ To Class

☐ TSD
☐ Ages

OK Cancel Apply

Appendix B figure 53a. Alternative A dry mixed conifer forest PNVT State D transitions continued

Class Properties for Class E: MCD E.vos

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	E	MCD	E.vos

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
2_B	0.0107	1.00	0.0107	B	MCD	B.sso
2_F	0.0175	1.00	0.0175	F	MCD	F.ssc
2_K	0.0107	1.00	0.0107	K	MCD	K.vom
B Free thin all sizes to target	0.0100	0.33	0.0033	A	MCD	GFB
C Thin from below to target	0.0100	1.00	0.0100	E	MCD	E.vos
D Thin under	0.0100	1.00	0.0100	E	MCD	E.vos
E GroupSelect with matrix thin	0.0100	1.00	0.0100	K	MCD	K.vom
F Shelterwood seed cut to	0.0100	0.67	0.0067	A	MCD	GFB
J RX FIRE ONLY Low	0.0100	1.00	0.0100	E	MCD	E.vos
K RX FIRE ONLY Moderate	0.0100	1.00	0.0100	E	MCD	E.vos
L RX FIRE ONLY High	0.0001	1.00	0.0001	A	MCD	GFB
Mixed Severity Fire	0.0001	1.00	0.0001	E	MCD	E.vos
Nonlethal Fire	0.0100	1.00	0.0100	E	MCD	E.vos

Display Pathways

☒ From Class
☐ To Class

Buttons: New, Copy, Delete, TSD, Ages, Sort...

OK Cancel Apply

Appendix B figure 54. Alternative A dry mixed conifer forest PNVTs' potentially management driven (8) and naturally driven (6) transitions for State E. Alternative A dry mixed conifer forest PNV State E transitions continued in Appendix B figure 54a

Class Properties for Class E: MCD E.vos

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	E	MCD	E.vos

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
2_K	0.0107	1.00	0.0107	K	MCD	K.vom
B Free thin all sizes to target	0.0100	0.33	0.0033	A	MCD	GFB
C Thin from below to target	0.0100	1.00	0.0100	E	MCD	E.vos
D Thin under	0.0100	1.00	0.0100	E	MCD	E.vos
E GroupSelect with matrix thin	0.0100	1.00	0.0100	K	MCD	K.vom
F Shelterwood seed cut to	0.0100	0.67	0.0067	A	MCD	GFB
J RX FIRE ONLY Low	0.0100	1.00	0.0100	E	MCD	E.vos
K RX FIRE ONLY Moderate	0.0100	1.00	0.0100	E	MCD	E.vos
L RX FIRE ONLY High	0.0001	1.00	0.0001	A	MCD	GFB
Mixed Severity Fire	0.0001	1.00	0.0001	E	MCD	E.vos
Nonlethal Fire	0.0100	1.00	0.0100	E	MCD	E.vos
Stand-Replacing Fire	0.0001	1.00	0.0001	A	MCD	GFB

Display Pathways

☒ From Class
☐ To Class

Buttons: New, Copy, Delete, TSD, Ages, Sort...

OK Cancel Apply

Appendix B figure 54a. Alternative A dry mixed conifer forest PNV State E transitions continued

Class Properties for Class F: MCD F.ssc

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	G	MCD	G.smc

- Mixed Conifer Dry aka MC Frequent Fire F.ssc - F.Seedling/Sapling_Closed

Display Pathways

☒ From Class

☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
2_G	0.0239	1.00	0.0239	G	MCD	G.smc
2_H	0.0006	1.00	0.0006	H	MCD	H.mcs
2_L	0.0045	1.00	0.0045	L	MCD	L.mcm
2_M	0.0009	1.00	0.0009	M	MCD	M.vcm
B Free thin all sizes to target	0.0100	0.09	0.0009	B	MCD	B.sso
B Free thin all sizes to target	0.0100	0.05	0.0005	C	MCD	C.smo
B Free thin all sizes to target	0.0100	0.05	0.0005	D	MCD	D.mos
B Free thin all sizes to target	0.0100	0.09	0.0009	E	MCD	E.vos
B Free thin all sizes to target	0.0100	0.23	0.0023	G	MCD	G.smc
B Free thin all sizes to target	0.0100	0.09	0.0009	J	MCD	J.mom
C Thin from below to target	0.0100	0.09	0.0009	G	MCD	G.smc
C Thin from below to target	0.0100	0.05	0.0005	J	MCD	J.mom
C Thin from below to target	0.0100	0.05	0.0005	K	MCD	K.vom

OK Cancel Apply

Appendix B figure 55. Alternative A dry mixed conifer forest PNVTs' potentially management driven (29) and naturally driven (21) transitions for State F. Alternative A dry mixed conifer forest PNV State F transitions continued in Appendix B figures 55a through 55c

Class Properties for Class F: MCD F.ssc

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	G	MCD	G.smc

- Mixed Conifer Dry aka MC Frequent Fire F.ssc - F.Seedling/Sapling_Closed

Display Pathways

☒ From Class

☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
C Thin from below to target	0.0100	0.09	0.0009	L	MCD	L.mcm
J RX FIRE ONLY Low	0.0100	0.14	0.0014	B	MCD	B.sso
J RX FIRE ONLY Low	0.0100	0.23	0.0023	G	MCD	G.smc
J RX FIRE ONLY Low	0.0100	0.23	0.0023	L	MCD	L.mcm
J RX FIRE ONLY Low	0.0100	0.09	0.0009	M	MCD	M.vcm
K RX FIRE ONLY Moderate	0.0100	0.18	0.0018	B	MCD	B.sso
K RX FIRE ONLY Moderate	0.0100	0.09	0.0009	C	MCD	C.smo
K RX FIRE ONLY Moderate	0.0100	0.05	0.0005	G	MCD	G.smc
K RX FIRE ONLY Moderate	0.0100	0.18	0.0018	J	MCD	J.mom
K RX FIRE ONLY Moderate	0.0100	0.05	0.0005	K	MCD	K.vom
K RX FIRE ONLY Moderate	0.0100	0.09	0.0009	L	MCD	L.mcm
K RX FIRE ONLY Moderate	0.0100	0.09	0.0009	M	MCD	M.vcm
L RX FIRE ONLY High	0.0100	0.15	0.0015	A	MCD	A.ssc

OK Cancel Apply

Appendix B figure 55a. Alternative A dry mixed conifer forest PNV State F transitions continued

Class Properties for Class F: MCD F.ssc

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	G	MCD	G.smc

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
L RX FIRE ONLY High	0.0100	0.55	0.0055	B	MCD	B.sso
L RX FIRE ONLY High	0.0100	0.09	0.0009	C	MCD	C.smo
L RX FIRE ONLY High	0.0100	0.09	0.0009	D	MCD	D.mos
L RX FIRE ONLY High	0.0100	0.05	0.0005	E	MCD	E.vos
L RX FIRE ONLY High	0.0100	0.08	0.0008	N	MCD	N.unc
M Thin under 9-inch diameter	0.0100	0.05	0.0005	G	MCD	G.smc
M Thin under 9-inch diameter	0.0100	0.05	0.0005	M	MCD	M.vcm
Mixed Severity Fire	0.0100	0.18	0.0018	B	MCD	B.sso
Mixed Severity Fire	0.0100	0.05	0.0005	G	MCD	G.smc
Mixed Severity Fire	0.0100	0.18	0.0018	J	MCD	J.mom
Mixed Severity Fire	0.0100	0.09	0.0009	K	MCD	K.vom
Mixed Severity Fire	0.0100	0.05	0.0005	K	MCD	K.vom
Mixed Severity Fire	0.0100	0.09	0.0009	L	MCD	L.mcm

Display Pathways

☒ From Class
☐ To Class

☐ TSD
☐ Ages

OK Cancel Apply

Appendix B figure 55b. Alternative A dry mixed conifer forest PNVT State F transitions continued

Class Properties for Class F: MCD F.ssc

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	G	MCD	G.smc

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
Mixed Severity Fire	0.0100	0.09	0.0009	L	MCD	L.mcm
Mixed Severity Fire	0.0100	0.09	0.0009	M	MCD	M.vcm
Nonlethal Fire	0.0100	0.14	0.0014	B	MCD	B.sso
Nonlethal Fire	0.0100	0.23	0.0023	G	MCD	G.smc
Nonlethal Fire	0.0100	0.23	0.0023	L	MCD	L.mcm
Nonlethal Fire	0.0100	0.09	0.0009	M	MCD	M.vcm
Stand-Replacing Fire	0.0100	0.15	0.0015	A	MCD	GFB
Stand-Replacing Fire	0.0100	0.55	0.0055	B	MCD	B.sso
Stand-Replacing Fire	0.0100	0.09	0.0009	C	MCD	C.smo
Stand-Replacing Fire	0.0100	0.09	0.0009	D	MCD	D.mos
Stand-Replacing Fire	0.0100	0.05	0.0005	E	MCD	E.vos
Stand-Replacing Fire	0.0100	0.08	0.0008	N	MCD	N.unc

Display Pathways

☒ From Class
☐ To Class

☐ TSD
☐ Ages

OK Cancel Apply

Appendix B figure 55c. Alternative A dry mixed conifer forest PNVT State F transitions continued

Class Properties for Class G: MCD G.smc

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	H	MCD	H.mcs

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class Stage
2_F	0.0051	1.00	0.0051	F	MCD	F.ssc
2_H	0.0037	1.00	0.0037	H	MCD	H.mcs
2_L	0.0181	1.00	0.0181	L	MCD	L.mcm
2_M	0.0028	1.00	0.0028	M	MCD	M.vcm
B Free thin all sizes to target	0.0100	0.03	0.0003	B	MCD	B.sso
B Free thin all sizes to target	0.0100	0.20	0.0020	C	MCD	C.smo
B Free thin all sizes to target	0.0100	0.31	0.0031	D	MCD	D.mos
B Free thin all sizes to target	0.0100	0.03	0.0003	E	MCD	E.vos
B Free thin all sizes to target	0.0100	0.03	0.0003	H	MCD	H.mcs
B Free thin all sizes to target	0.0100	0.11	0.0011	J	MCD	J.mom
B Free thin all sizes to target	0.0100	0.06	0.0006	K	MCD	K.vom
C Thin from below to target	0.0100	0.03	0.0003	C	MCD	C.smo
C Thin from below to target	0.0100	0.09	0.0009	D	MCD	D.mos

Display Pathways

☒ From Class
☐ To Class

Buttons: New, Copy, Delete, TSD, Ages, Sort...

OK Cancel Apply

Appendix B figure 56. Alternative A dry mixed conifer forest PNVTs' potentially management driven (36) and naturally driven (24) transitions for State G. Alternative A dry mixed conifer forest PNVT State G transitions continued in Appendix B figures 56a through 56d

Class Properties for Class G: MCD G.smc

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	H	MCD	H.mcs

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class Stage
C Thin from below to target	0.0100	0.03	0.0003	E	MCD	E.vos
C Thin from below to target	0.0100	0.03	0.0003	F	MCD	F.ssc
C Thin from below to target	0.0100	0.06	0.0006	H	MCD	H.mcs
C Thin from below to target	0.0100	0.06	0.0006	J	MCD	J.mom
C Thin from below to target	0.0100	0.03	0.0003	K	MCD	K.vom
C Thin from below to target	0.0100	0.03	0.0003	L	MCD	L.mcm
Insect/Disease	0.0100	1.00	0.0100	C	MCD	C.smo
J RX FIRE ONLY Low	0.0100	0.09	0.0009	C	MCD	C.smo
J RX FIRE ONLY Low	0.0100	0.03	0.0003	D	MCD	D.mos
J RX FIRE ONLY Low	0.0100	0.03	0.0003	H	MCD	H.mcs
J RX FIRE ONLY Low	0.0100	0.20	0.0020	L	MCD	L.mcm
J RX FIRE ONLY Low	0.0100	0.03	0.0003	M	MCD	M.vcm
K RX FIRE ONLY Moderate	0.0100	0.03	0.0003	B	MCD	B.sso

Display Pathways

☒ From Class
☐ To Class

Buttons: New, Copy, Delete, TSD, Ages, Sort...

OK Cancel Apply

Appendix B figure 56a. Alternative A dry mixed conifer forest PNVT State G transitions continued

Class Properties for Class G: MCD G.smc

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	H	MCD	H.mcs

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class Stage
K RX FIRE ONLY Moderate	0.0100	0.03	0.0003	C	MCD	C.smo
K RX FIRE ONLY Moderate	0.0100	0.14	0.0014	D	MCD	D.mos
K RX FIRE ONLY Moderate	0.0100	0.03	0.0003	H	MCD	H.mcs
K RX FIRE ONLY Moderate	0.0100	0.06	0.0006	J	MCD	J.mom
K RX FIRE ONLY Moderate	0.0100	0.03	0.0003	K	MCD	K.vom
K RX FIRE ONLY Moderate	0.0100	0.14	0.0014	L	MCD	L.mcm
L RX FIRE ONLY High	0.0100	0.13	0.0013	A	MCD	GFB
L RX FIRE ONLY High	0.0100	0.06	0.0006	B	MCD	B.sso
L RX FIRE ONLY High	0.0100	0.49	0.0049	C	MCD	C.smo
L RX FIRE ONLY High	0.0100	0.06	0.0006	D	MCD	D.mos
L RX FIRE ONLY High	0.0100	0.11	0.0011	J	MCD	J.mom
L RX FIRE ONLY High	0.0100	0.06	0.0006	K	MCD	K.vom
L RX FIRE ONLY High	0.0100	0.07	0.0007	N	MCD	N.mcs

Display Pathways

☒ From Class
☐ To Class

Buttons: New, Copy, Delete, TSD, Ages, Sort...

OK Cancel Apply

Appendix B figure 56b. Alternative A dry mixed conifer forest PNVT State G transitions continued

Class Properties for Class G: MCD G.smc

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	H	MCD	H.mcs

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class Stage
M Thin under 9-inch diameter	0.0100	0.03	0.0003	L	MCD	L.mcm
M Thin under 9-inch diameter	0.0100	0.03	0.0003	M	MCD	M.vcm
Mixed Severity Fire	0.0100	0.03	0.0003	B	MCD	B.sso
Mixed Severity Fire	0.0100	0.31	0.0031	C	MCD	C.smo
Mixed Severity Fire	0.0100	0.14	0.0014	D	MCD	D.mos
Mixed Severity Fire	0.0100	0.03	0.0003	H	MCD	H.mcs
Mixed Severity Fire	0.0100	0.06	0.0006	J	MCD	J.mom
Mixed Severity Fire	0.0100	0.03	0.0003	K	MCD	K.vom
Mixed Severity Fire	0.0100	0.14	0.0014	L	MCD	L.mcm
Nonlethal Fire	0.0100	0.09	0.0009	C	MCD	C.smo
Nonlethal Fire	0.0100	0.03	0.0003	D	MCD	D.mos
Nonlethal Fire	0.0100	0.03	0.0003	H	MCD	H.mcs
Nonlethal Fire	0.0100	0.20	0.0020	I	MCD	I.mcm

Display Pathways

☒ From Class
☐ To Class

Buttons: New, Copy, Delete, TSD, Ages, Sort...

OK Cancel Apply

Appendix B figure 56c. Alternative A dry mixed conifer forest PNVT State G transitions continued

Class Properties for Class G: MCD G.smc

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	H	MCD	H.mcs

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
Nonlethal Fire	0.0100	0.09	0.0009	C	MCD	C.smo
Nonlethal Fire	0.0100	0.03	0.0003	D	MCD	D.mos
Nonlethal Fire	0.0100	0.03	0.0003	H	MCD	H.mcs
Nonlethal Fire	0.0100	0.20	0.0020	L	MCD	L.mcm
Nonlethal Fire	0.0100	0.03	0.0003	M	MCD	M.vcm
Stand-Replacing Fire	0.0100	0.13	0.0013	A	MCD	GFB
Stand-Replacing Fire	0.0100	0.06	0.0006	B	MCD	B.sso
Stand-Replacing Fire	0.0100	0.49	0.0049	C	MCD	C.smo
Stand-Replacing Fire	0.0100	0.06	0.0006	D	MCD	D.mos
Stand-Replacing Fire	0.0100	0.11	0.0011	J	MCD	J.mom
Stand-Replacing Fire	0.0100	0.06	0.0006	K	MCD	K.vom
Stand-Replacing Fire	0.0100	0.07	0.0007	N	MCD	N.unc

Display Pathways

☒ From Class
☐ To Class

Buttons: New, Copy, Delete, TSD, Ages, Sort...

OK Cancel Apply

Appendix B figure 56d. Alternative A dry mixed conifer forest PNVT State G transitions continued

Class Properties for Class H: MCD H.mcs

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	I	MCD	I.vcs

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
2_F	0.0016	1.00	0.0016	F	MCD	F.ssc
2_I	0.0129	1.00	0.0129	I	MCD	I.vcs
2_L	0.0093	1.00	0.0093	L	MCD	L.mcm
B Free thin all sizes to target	0.0100	0.06	0.0006	C	MCD	C.smo
B Free thin all sizes to target	0.0100	0.47	0.0047	D	MCD	D.mos
B Free thin all sizes to target	0.0100	0.35	0.0035	E	MCD	E.vos
C Thin from below to target	0.0100	0.29	0.0029	D	MCD	D.mos
C Thin from below to target	0.0100	0.18	0.0018	E	MCD	E.vos
C Thin from below to target	0.0100	0.12	0.0012	G	MCD	G.smc
C Thin from below to target	0.0100	0.06	0.0006	L	MCD	L.mcm
D Thin under	0.0100	1.00	0.0100	E	MCD	E.vos
E GroupSelect with matrix thin	0.0100	1.00	0.0100	J	MCD	J.mom
F Shelterwood seed cut to	0.0100	0.35	0.0035	A	MCD	GFB

Display Pathways

☒ From Class
☐ To Class

Buttons: New, Copy, Delete, TSD, Ages, Sort...

OK Cancel Apply

Appendix B figure 57. Alternative A dry mixed conifer forest PNVTs' potentially management driven (21) and naturally driven (12) transitions for State H. Alternative A dry mixed conifer forest PNVT State H transitions continued in Appendix B figures 57a and 57b

Class Properties for Class H: MCD H.mcs

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	I	MCD	I.vcs

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class Stage
F Shelterwood seed cut to	0.0100	0.59	0.0059	D	MCD	D.mos
F Shelterwood seed cut to	0.0100	0.06	0.0006	J	MCD	J.mom
Insect/Disease	0.0100	1.00	0.0100	D	MCD	D.mos
J RX FIRE ONLY Low	0.0100	0.18	0.0018	D	MCD	D.mos
K RX FIRE ONLY Moderate	0.0100	0.41	0.0041	D	MCD	D.mos
K RX FIRE ONLY Moderate	0.0100	0.06	0.0006	E	MCD	E.vos
L RX FIRE ONLY High	0.0001	0.23	0.0000	A	MCD	GFB
L RX FIRE ONLY High	0.0001	0.06	0.0000	B	MCD	B.sso
L RX FIRE ONLY High	0.0001	0.53	0.0001	D	MCD	D.mos
L RX FIRE ONLY High	0.0001	0.06	0.0000	E	MCD	E.vos
L RX FIRE ONLY High	0.0001	0.12	0.0000	N	MCD	N.unc
M Thin under 9-inch diameter	0.0100	1.00	0.0100	H	MCD	H.mcs
Mixed Severity Fire	0.0100	0.41	0.0041	D	MCD	D.mos

Display Pathways

☒ From Class
☐ To Class

Buttons: New, Copy, Delete, TSD, Ages, Sort...

OK Cancel Apply

Appendix B figure 57a. Alternative A dry mixed conifer forest PNVT State H transitions continued

Class Properties for Class H: MCD H.mcs

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	I	MCD	I.vcs

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class Stage
L RX FIRE ONLY High	0.0001	0.53	0.0001	D	MCD	D.mos
L RX FIRE ONLY High	0.0001	0.06	0.0000	E	MCD	E.vos
L RX FIRE ONLY High	0.0001	0.12	0.0000	N	MCD	N.unc
M Thin under 9-inch diameter	0.0100	1.00	0.0100	H	MCD	H.mcs
Mixed Severity Fire	0.0100	0.41	0.0041	D	MCD	D.mos
Mixed Severity Fire	0.0100	0.06	0.0006	E	MCD	E.vos
Nonlethal Fire	0.0100	0.18	0.0018	D	MCD	D.mos
Stand-Replacing Fire	0.0100	0.23	0.0023	A	MCD	GFB
Stand-Replacing Fire	0.0100	0.06	0.0006	B	MCD	B.sso
Stand-Replacing Fire	0.0100	0.53	0.0053	D	MCD	D.mos
Stand-Replacing Fire	0.0100	0.06	0.0006	E	MCD	E.vos
Stand-Replacing Fire	0.0100	0.12	0.0012	N	MCD	N.unc

Display Pathways

☒ From Class
☐ To Class

Buttons: New, Copy, Delete, TSD, Ages, Sort...

OK Cancel Apply

Appendix B figure 57b. Alternative A dry mixed conifer forest PNVT State H transitions continued

Class Properties for Class I: MCD I.vcs

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	I	MCD	I.vcs

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	Stage
2_E	0.0028	1.00	0.0028	E	MCD	E.vos
2_F	0.0013	1.00	0.0013	F	MCD	F.ssc
2_M	0.0068	1.00	0.0068	M	MCD	M.vcm
B Free thin all sizes to target	0.0100	1.00	0.0100	E	MCD	E.vos
C Thin from below to target	0.0100	1.00	0.0100	E	MCD	E.vos
D Thin under	0.0100	1.00	0.0100	E	MCD	E.vos
E GroupSelect with matrix thin	0.0100	1.00	0.0100	K	MCD	K.vom
F Shelterwood seed cut to	0.0100	1.00	0.0100	A	MCD	GFB
Insect/Disease	0.0100	1.00	0.0100	E	MCD	E.vos
J RX FIRE ONLY Low	0.0100	0.08	0.0008	E	MCD	E.vos
J RX FIRE ONLY Low	0.0100	0.91	0.0091	I	MCD	I.vcs
J RX FIRE ONLY Low	0.0100	0.02	0.0002	M	MCD	M.vcm
K RX FIRE ONLY Moderate	0.0100	0.10	0.0010	E	MCD	E.vos

- Mixed Conifer Dry aka MC Frequent Fire I.vcs - I.VLarge_Closed_Single

Display Pathways
☒ From Class
☐ To Class

☐ TSD
☐ Ages

OK Cancel Apply

Appendix B figure 58. Alternative A dry mixed conifer forest PNVTs' potentially management driven (20) and naturally driven (18) transitions for State I. Alternative A dry mixed conifer forest PNV State I transitions continued in Appendix B figures 58a and 58b

Class Properties for Class I: MCD I.vcs

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	I	MCD	I.vcs

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	Stage
K RX FIRE ONLY Moderate	0.0100	0.88	0.0088	I	MCD	I.vcs
K RX FIRE ONLY Moderate	0.0100	0.02	0.0002	M	MCD	M.vcm
L RX FIRE ONLY High	0.0001	0.20	0.0000	A	MCD	GFB
L RX FIRE ONLY High	0.0001	0.01	0.0000	B	MCD	B.sso
L RX FIRE ONLY High	0.0001	0.32	0.0000	E	MCD	E.vos
L RX FIRE ONLY High	0.0001	0.30	0.0000	I	MCD	I.vcs
L RX FIRE ONLY High	0.0001	0.01	0.0000	J	MCD	J.mom
L RX FIRE ONLY High	0.0001	0.06	0.0000	K	MCD	K.vom
L RX FIRE ONLY High	0.0001	0.01	0.0000	M	MCD	M.vcm
L RX FIRE ONLY High	0.0001	0.10	0.0000	N	MCD	N.unc
M Thin under 9-inch diameter	0.0100	1.00	0.0100	I	MCD	I.vcs
Mixed Severity Fire	0.0100	0.10	0.0010	E	MCD	E.vos
Mixed Severity Fire	0.0100	0.88	0.0088	I	MCD	I.vcs

- Mixed Conifer Dry aka MC Frequent Fire I.vcs - I.VLarge_Closed_Single

Display Pathways
☒ From Class
☐ To Class

☐ TSD
☐ Ages

OK Cancel Apply

Appendix B figure 58a. Alternative A dry mixed conifer forest PNV State I transitions continued

Class Properties for Class I: MCD I.vcs

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	I	MCD	I.vcs

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class Stage
Mixed Severity Fire	0.0100	0.02	0.0002	M	MCD	M.vcm
Nonlethal Fire	0.0100	0.08	0.0008	E	MCD	E.vos
Nonlethal Fire	0.0100	0.91	0.0091	I	MCD	I.vcs
Nonlethal Fire	0.0100	0.02	0.0002	M	MCD	M.vcm
Stand-Replacing Fire	0.0100	0.20	0.0020	A	MCD	GFB
Stand-Replacing Fire	0.0100	0.01	0.0001	B	MCD	B.sso
Stand-Replacing Fire	0.0100	0.32	0.0032	E	MCD	E.vos
Stand-Replacing Fire	0.0100	0.30	0.0030	I	MCD	I.vcs
Stand-Replacing Fire	0.0100	0.01	0.0001	J	MCD	J.mom
Stand-Replacing Fire	0.0100	0.06	0.0006	K	MCD	K.vom
Stand-Replacing Fire	0.0100	0.01	0.0001	M	MCD	M.vcm
Stand-Replacing Fire	0.0100	0.10	0.0010	N	MCD	N.unc

Display Pathways

☒ From Class
☐ To Class

Buttons: New, Copy, Delete, TSD, Ages, Sort...

OK Cancel Apply

Appendix B figure 58b. Alternative A dry mixed conifer forest PNVT State I transitions continued

Class Properties for Class J: MCD J.mom

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	K	MCD	K.vom

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class Stage
2_F	0.0523	1.00	0.0523	F	MCD	F.ssc
2_L	0.0352	1.00	0.0352	L	MCD	L.mcm
B Free thin all sizes to target	0.0100	0.10	0.0010	E	MCD	E.vos
B Free thin all sizes to target	0.0100	0.10	0.0010	K	MCD	K.vom
C Thin from below to target	0.0100	0.10	0.0010	D	MCD	D.mos
D Thin under	0.0100	1.00	0.0100	E	MCD	E.vos
E GroupSelect with matrix thin	0.0100	1.00	0.0100	J	MCD	J.mom
F Shelterwood seed cut to	0.0100	0.30	0.0030	A	MCD	GFB
F Shelterwood seed cut to	0.0100	0.10	0.0010	B	MCD	B.sso
F Shelterwood seed cut to	0.0100	0.20	0.0020	D	MCD	D.mos
J RX FIRE ONLY Low	0.0100	0.20	0.0020	D	MCD	D.mos
K RX FIRE ONLY Moderate	0.0100	0.50	0.0050	D	MCD	D.mos
K RX FIRE ONLY Moderate	0.0100	0.10	0.0010	E	MCD	E.vos

Display Pathways

☒ From Class
☐ To Class

Buttons: New, Copy, Delete, TSD, Ages, Sort...

OK Cancel Apply

Appendix B figure 59. Alternative A dry mixed conifer forest PNVTs' potentially management driven (15) and naturally driven (9) transitions for State J. Alternative A dry mixed conifer forest PNVT State J transitions continued in Appendix B figure 59a

Class Properties for Class J: MCD J.mom

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	K	MCD	K.vom

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
K RX FIRE ONLY Moderate	0.0100	0.50	0.0050	D	MCD	D.mos
K RX FIRE ONLY Moderate	0.0100	0.10	0.0010	E	MCD	E.vos
L RX FIRE ONLY High	0.0001	0.80	0.0001	A	MCD	GFB
L RX FIRE ONLY High	0.0001	0.10	0.0000	D	MCD	D.mos
L RX FIRE ONLY High	0.0001	0.10	0.0000	K	MCD	K.vom
M Thin under 9-inch diameter	0.0001	1.00	0.0001	J	MCD	J.mom
Mixed Severity Fire	0.0001	0.50	0.0001	D	MCD	D.mos
Mixed Severity Fire	0.0001	0.10	0.0000	E	MCD	E.vos
Nonlethal Fire	0.0100	0.29	0.0029	D	MCD	D.mos
Stand-Replacing Fire	0.0001	0.80	0.0001	A	MCD	GFB
Stand-Replacing Fire	0.0001	0.10	0.0000	D	MCD	D.mos
Stand-Replacing Fire	0.0001	0.10	0.0000	K	MCD	K.vom

Display Pathways

☒ From Class
☐ To Class

☐ TSD
☐ Ages

OK Cancel Apply

Appendix B figure 59a. Alternative A dry mixed conifer forest PNVT State J transitions continued

Class Properties for Class K: MCD K.vom

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	K	MCD	K.vom

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
2_M	0.0342	1.00	0.0342	M	MCD	M.vcm
B Free thin all sizes to target	0.0100	0.25	0.0025	A	MCD	GFB
B Free thin all sizes to target	0.0100	0.50	0.0050	E	MCD	E.vos
C Thin from below to target	0.0100	0.25	0.0025	E	MCD	E.vos
D Thin under	0.0100	1.00	0.0100	E	MCD	E.vos
E GroupSelect with matrix thin	0.0100	1.00	0.0100	K	MCD	K.vom
F Shelterwood seed cut to	0.0100	0.75	0.0075	A	MCD	GFB
J RX FIRE ONLY Low	0.0100	0.25	0.0025	E	MCD	E.vos
K RX FIRE ONLY Moderate	0.0100	0.25	0.0025	A	MCD	GFB
K RX FIRE ONLY Moderate	0.0100	0.25	0.0025	E	MCD	E.vos
L RX FIRE ONLY High	0.0001	0.75	0.0001	A	MCD	GFB
M Thin under 9-inch diameter	0.0001	1.00	0.0001	K	MCD	K.vom
Mixed Severity Fire	0.0001	0.25	0.0000	A	MCD	GFB

Display Pathways

☒ From Class
☐ To Class

☐ TSD
☐ Ages

OK Cancel Apply

Appendix B figure 60. Alternative A dry mixed conifer forest PNVTs' potentially management driven (11) and naturally driven (5) transitions for State K. Alternative A dry mixed conifer forest PNVT State K transitions continued in Appendix B figure 60a

Class Properties for Class K: MCD K.vom

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	K	MCD	K.vom

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
D Thin under	0.0100	1.00	0.0100	E	MCD	E.vos
E GroupSelect with matrix thin	0.0100	1.00	0.0100	K	MCD	K.vom
F Shelterwood seed cut to	0.0100	0.75	0.0075	A	MCD	GFB
J RX FIRE ONLY Low	0.0100	0.25	0.0025	E	MCD	E.vos
K RX FIRE ONLY Moderate	0.0100	0.25	0.0025	A	MCD	GFB
K RX FIRE ONLY Moderate	0.0100	0.25	0.0025	E	MCD	E.vos
L RX FIRE ONLY High	0.0001	0.75	0.0001	A	MCD	GFB
M Thin under 9-inch diameter	0.0001	1.00	0.0001	K	MCD	K.vom
Mixed Severity Fire	0.0001	0.25	0.0000	A	MCD	GFB
Mixed Severity Fire	0.0001	0.25	0.0000	E	MCD	E.vos
Nonlethal Fire	0.0100	0.25	0.0025	E	MCD	E.vos
Stand-Replacing Fire	0.0001	0.75	0.0001	A	MCD	GFB

Display Pathways

☒ From Class
☐ To Class

Buttons: New, Copy, Delete, TSD, Ages, Sort...

OK Cancel Apply

Appendix B figure 60a. Alternative A dry mixed conifer forest PNVT State K transitions continued

Class Properties for Class L: MCD L.mcm

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	M	MCD	M.vcm

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
2_F	0.0029	1.00	0.0029	F	MCD	F.ssc
2_G	0.0025	1.00	0.0025	G	MCD	G.smc
2_H	0.0031	1.00	0.0031	H	MCD	H.mcs
2_I	0.0006	1.00	0.0006	I	MCD	I.vcs
2_M	0.0093	1.00	0.0093	M	MCD	M.vcm
B Free thin all sizes to target	0.0100	0.02	0.0002	A	MCD	GFB
B Free thin all sizes to target	0.0100	0.05	0.0005	C	MCD	C.smo
B Free thin all sizes to target	0.0100	0.31	0.0031	D	MCD	D.mos
B Free thin all sizes to target	0.0100	0.23	0.0023	E	MCD	E.vos
B Free thin all sizes to target	0.0100	0.02	0.0002	F	MCD	F.ssc
B Free thin all sizes to target	0.0100	0.02	0.0002	H	MCD	H.mcs
B Free thin all sizes to target	0.0100	0.30	0.0030	J	MCD	J.mom
B Free thin all sizes to target	0.0100	0.07	0.0007	K	MCD	K.vom

Display Pathways

☒ From Class
☐ To Class

Buttons: New, Copy, Delete, TSD, Ages, Sort...

OK Cancel Apply

Appendix B figure 61. Alternative A dry mixed conifer forest PNVTs' potentially management driven (45) and naturally driven (25) transitions for State L. Alternative A dry mixed conifer forest PNVT State L transitions continued in Appendix B figures 61a through 61e

Class Properties for Class L: MCD L.mcm

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	M	MCD	M.vcm

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
C Thin from below to target	0.0100	0.20	0.0020	D	MCD	D.mos
C Thin from below to target	0.0100	0.05	0.0005	E	MCD	E.vos
C Thin from below to target	0.0100	0.02	0.0002	F	MCD	F.ssc
C Thin from below to target	0.0100	0.16	0.0016	H	MCD	H.mcs
C Thin from below to target	0.0100	0.10	0.0010	J	MCD	J.mom
C Thin from below to target	0.0100	0.18	0.0018	K	MCD	K.vom
D Thin under	0.0100	1.00	0.0100	E	MCD	E.vos
E GroupSelect with matrix thin	0.0100	1.00	0.0100	K	MCD	K.vom
F Shelterwood seed cut to	0.0100	0.54	0.0054	A	MCD	GFB
F Shelterwood seed cut to	0.0100	0.03	0.0003	B	MCD	B.sso
F Shelterwood seed cut to	0.0100	0.03	0.0003	C	MCD	C.smo
F Shelterwood seed cut to	0.0100	0.31	0.0031	D	MCD	D.mos
F Shelterwood seed cut to	0.0100	0.03	0.0003	E	MCD	E.vos

Display Pathways

☒ From Class
☐ To Class

Buttons: New, Copy, Delete, TSD, Ages, Sort...

OK Cancel Apply

Appendix B figure 61a. Alternative A dry mixed conifer forest PNVT State L transitions continued

Class Properties for Class L: MCD L.mcm

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	M	MCD	M.vcm

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
F Shelterwood seed cut to	0.0100	0.02	0.0002	J	MCD	J.mom
F Shelterwood seed cut to	0.0100	0.03	0.0003	K	MCD	K.vom
Insect/Disease	0.0100	1.00	0.0100	J	MCD	J.mom
J RX FIRE ONLY Low	0.0100	0.02	0.0002	D	MCD	D.mos
J RX FIRE ONLY Low	0.0100	0.08	0.0008	H	MCD	H.mcs
J RX FIRE ONLY Low	0.0100	0.16	0.0016	J	MCD	J.mom
J RX FIRE ONLY Low	0.0100	0.05	0.0005	K	MCD	K.vom
J RX FIRE ONLY Low	0.0100	0.02	0.0002	M	MCD	M.vcm
K RX FIRE ONLY Moderate	0.0100	0.02	0.0002	B	MCD	B.sso
K RX FIRE ONLY Moderate	0.0100	0.03	0.0003	C	MCD	C.smo
K RX FIRE ONLY Moderate	0.0100	0.10	0.0010	D	MCD	D.mos
K RX FIRE ONLY Moderate	0.0100	0.05	0.0005	H	MCD	H.mcs
K RX FIRE ONLY Moderate	0.0100	0.26	0.0026	I	MCD	I.mom

Display Pathways

☒ From Class
☐ To Class

Buttons: New, Copy, Delete, TSD, Ages, Sort...

OK Cancel Apply

Appendix B figure 61b. Alternative A dry mixed conifer forest PNVT State L transitions continued

Class Properties for Class L: MCD L.mcm

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	M	MCD	M.vcm

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
K RX FIRE ONLY Moderate	0.0100	0.11	0.0011	K	MCD	K.vom
L RX FIRE ONLY High	0.0001	0.34	0.0000	A	MCD	GFB
L RX FIRE ONLY High	0.0001	0.07	0.0000	B	MCD	B.sso
L RX FIRE ONLY High	0.0001	0.03	0.0000	C	MCD	C.smo
L RX FIRE ONLY High	0.0001	0.08	0.0000	D	MCD	D.mos
L RX FIRE ONLY High	0.0001	0.02	0.0000	E	MCD	E.vos
L RX FIRE ONLY High	0.0001	0.23	0.0000	J	MCD	J.mom
L RX FIRE ONLY High	0.0001	0.05	0.0000	K	MCD	K.vom
L RX FIRE ONLY High	0.0001	0.17	0.0000	N	MCD	N.unc
M Thin under 9-inch diameter	0.0100	0.02	0.0002	F	MCD	F.ssc
M Thin under 9-inch diameter	0.0100	0.02	0.0002	G	MCD	G.smc
M Thin under 9-inch diameter	0.0100	0.07	0.0007	H	MCD	H.mcs
Mixed Severity Fire	0.0100	0.02	0.0002	R	MCD	R.sso

Display Pathways

☒ From Class
☐ To Class

Buttons: New, Copy, Delete, TSD, Ages, Sort...

OK Cancel Apply

Appendix B figure 61c. Alternative A dry mixed conifer forest PNVT State L transitions continued

Class Properties for Class L: MCD L.mcm

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	M	MCD	M.vcm

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
Mixed Severity Fire	0.0100	0.03	0.0003	C	MCD	C.smo
Mixed Severity Fire	0.0100	0.10	0.0010	D	MCD	D.mos
Mixed Severity Fire	0.0100	0.50	0.0050	H	MCD	H.mcs
Mixed Severity Fire	0.0100	0.26	0.0026	J	MCD	J.mom
Mixed Severity Fire	0.0100	0.11	0.0011	K	MCD	K.vom
Nonlethal Fire	0.0100	0.02	0.0002	D	MCD	D.mos
Nonlethal Fire	0.0100	0.08	0.0008	H	MCD	H.mcs
Nonlethal Fire	0.0100	0.16	0.0016	J	MCD	J.mom
Nonlethal Fire	0.0100	0.05	0.0005	K	MCD	K.vom
Nonlethal Fire	0.0100	0.02	0.0002	M	MCD	M.vcm
Stand-Replacing Fire	0.0100	0.34	0.0034	A	MCD	GFB
Stand-Replacing Fire	0.0100	0.07	0.0007	B	MCD	B.sso
Stand-Replacing Fire	0.0100	0.03	0.0003	C	MCD	C.smo

Display Pathways

☒ From Class
☐ To Class

Buttons: New, Copy, Delete, TSD, Ages, Sort...

OK Cancel Apply

Appendix B figure 61d. Alternative A dry mixed conifer forest PNVT State L transitions continued

Class Properties for Class L: MCD L.mcm

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	M	MCD	M.vcm

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
Nonlethal Fire	0.0100	0.08	0.0008	H	MCD	H.mcs
Nonlethal Fire	0.0100	0.16	0.0016	J	MCD	J.mom
Nonlethal Fire	0.0100	0.05	0.0005	K	MCD	K.vom
Nonlethal Fire	0.0100	0.02	0.0002	M	MCD	M.vcm
Stand-Replacing Fire	0.0100	0.34	0.0034	A	MCD	GFB
Stand-Replacing Fire	0.0100	0.07	0.0007	B	MCD	B.sso
Stand-Replacing Fire	0.0100	0.03	0.0003	C	MCD	C.smo
Stand-Replacing Fire	0.0100	0.08	0.0008	D	MCD	D.mos
Stand-Replacing Fire	0.0100	0.02	0.0002	E	MCD	E.vos
Stand-Replacing Fire	0.0100	0.23	0.0023	J	MCD	J.mom
Stand-Replacing Fire	0.0100	0.05	0.0005	K	MCD	K.vom
Stand-Replacing Fire	0.0100	0.17	0.0017	N	MCD	N.unc

Display Pathways

☒ From Class
☐ To Class

Buttons: New, Copy, Delete, TSD, Ages, Sort...

OK Cancel Apply

Appendix B figure 61e. Alternative A dry mixed conifer forest PNVT State L transitions continued

Class Properties for Class M: MCD M.vcm

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	M	MCD	M.vcm

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
2_F	0.0017	1.00	0.0017	F	MCD	F.ssc
2_G	0.0012	1.00	0.0012	G	MCD	G.smc
2_I	0.0061	1.00	0.0061	I	MCD	I.vcs
2_K	0.0004	1.00	0.0004	K	MCD	K.vom
2_L	0.0051	1.00	0.0051	L	MCD	L.mcm
B Free thin all sizes to target	0.0100	0.13	0.0013	A	MCD	GFB
B Free thin all sizes to target	0.0100	0.06	0.0006	B	MCD	B.sso
B Free thin all sizes to target	0.0100	0.63	0.0063	E	MCD	E.vos
B Free thin all sizes to target	0.0100	0.19	0.0019	K	MCD	K.vom
C Thin from below to target	0.0100	0.31	0.0031	E	MCD	E.vos
C Thin from below to target	0.0100	0.06	0.0006	F	MCD	F.ssc
C Thin from below to target	0.0100	0.06	0.0006	J	MCD	J.mom
C Thin from below to target	0.0100	0.28	0.0028	K	MCD	K.vom

Display Pathways

☒ From Class
☐ To Class

Buttons: New, Copy, Delete, TSD, Ages, Sort...

OK Cancel Apply

Appendix B figure 62. Alternative A dry mixed conifer forest PNVTs' potentially management driven (26) and naturally driven (17) transitions for State M. Alternative A dry mixed conifer forest PNVT State M transitions continued in Appendix B figures 62a through 62c

Class Properties for Class M: MCD M.vcm

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	M	MCD	M.vcm

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
D Thin under	0.0100	1.00	0.0100	E	MCD	E.vos
E GroupSelect with matrix thin	0.0100	1.00	0.0100	K	MCD	K.vom
F Shelterwood seed cut to	0.0100	0.88	0.0088	A	MCD	GFB
F Shelterwood seed cut to	0.0100	0.06	0.0006	B	MCD	B.sso
F Shelterwood seed cut to	0.0100	0.06	0.0006	E	MCD	E.vos
Insect/Disease	0.0100	1.00	0.0100	K	MCD	K.vom
J RX FIRE ONLY Low	0.0100	0.06	0.0006	E	MCD	E.vos
J RX FIRE ONLY Low	0.0100	0.13	0.0013	I	MCD	I.vcs
J RX FIRE ONLY Low	0.0100	0.19	0.0019	K	MCD	K.vom
K RX FIRE ONLY Moderate	0.0100	0.06	0.0006	B	MCD	B.sso
K RX FIRE ONLY Moderate	0.0100	0.06	0.0006	E	MCD	E.vos
K RX FIRE ONLY Moderate	0.0100	0.13	0.0013	I	MCD	I.vcs
K RX FIRE ONLY Moderate	0.0100	0.44	0.0044	K	MCD	K.vom

Display Pathways

☒ From Class
☐ To Class

Buttons: New, Copy, Delete, TSD, Ages, Sort...

OK Cancel Apply

Appendix B figure 62a. Alternative A dry mixed conifer forest PNVT State M transitions continued

Class Properties for Class M: MCD M.vcm

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	M	MCD	M.vcm

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
L RX FIRE ONLY High	0.0001	0.33	0.0000	A	MCD	GFB
L RX FIRE ONLY High	0.0001	0.13	0.0000	E	MCD	E.vos
L RX FIRE ONLY High	0.0001	0.38	0.0000	K	MCD	K.vom
L RX FIRE ONLY High	0.0001	0.17	0.0000	N	MCD	N.unc
M Thin under 9-inch diameter	0.0100	0.06	0.0006	I	MCD	I.vcs
M Thin under 9-inch diameter	0.0100	0.06	0.0006	K	MCD	K.vom
Mixed Severity Fire	0.0100	0.06	0.0006	B	MCD	B.sso
Mixed Severity Fire	0.0100	0.06	0.0006	E	MCD	E.vos
Mixed Severity Fire	0.0100	0.13	0.0013	I	MCD	I.vcs
Mixed Severity Fire	0.0100	0.44	0.0044	K	MCD	K.vom
Nonlethal Fire	0.0100	0.13	0.0013	E	MCD	E.vos
Nonlethal Fire	0.0100	0.06	0.0006	E	MCD	E.vos
Nonlethal Fire	0.0100	0.19	0.0019	K	MCD	K.vom

Display Pathways

☒ From Class
☐ To Class

Buttons: New, Copy, Delete, TSD, Ages, Sort...

OK Cancel Apply

Appendix B figure 62b. Alternative A dry mixed conifer forest PNVT State M transitions continued

Class Properties for Class M: MCD M.vcm

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	M	MCD	M.vcm

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	To Class		
				Box	Cover	Stage
M Thin under 9-inch diameter	0.0100	0.06	0.0006	K	MCD	K.vom
Mixed Severity Fire	0.0100	0.06	0.0006	B	MCD	B.sso
Mixed Severity Fire	0.0100	0.06	0.0006	E	MCD	E.vos
Mixed Severity Fire	0.0100	0.13	0.0013	I	MCD	I.vcs
Mixed Severity Fire	0.0100	0.44	0.0044	K	MCD	K.vom
Nonlethal Fire	0.0100	0.13	0.0013	E	MCD	E.vos
Nonlethal Fire	0.0100	0.06	0.0006	E	MCD	E.vos
Nonlethal Fire	0.0100	0.19	0.0019	K	MCD	K.vom
Stand-Replacing Fire	0.0100	0.33	0.0033	A	MCD	GFB
Stand-Replacing Fire	0.0100	0.13	0.0013	E	MCD	E.vos
Stand-Replacing Fire	0.0100	0.38	0.0038	K	MCD	K.vom
Stand-Replacing Fire	0.0100	0.17	0.0017	N	MCD	N.unc

Display Pathways

☒ From Class
☐ To Class

Buttons: New, Copy, Delete, TSD, Ages, Sort...

OK Cancel Apply

Appendix B figure 62c. Alternative A dry mixed conifer forest PNVT State M transitions continued

Class Properties for Class N: MCD N.unc

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	N	MCD	N.unc

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	To Class		
				Box	Cover	Stage
I Plant Seedlings	0.0100	1.00	0.0100	B	MCD	B.sso
Natural Regeneration	0.0900	1.00	0.0900	A	MCD	GFB
Nonlethal Fire	0.0100	1.00	0.0100	N	MCD	N.unc

Display Pathways

☒ From Class
☐ To Class

Buttons: New, Copy, Delete, TSD, Ages, Sort...

OK Cancel Apply

Appendix B figure 63. Alternative A dry mixed conifer forest PNVTs' potentially management driven (1) and naturally driven (2) transitions for State N

Spruce-Fir Forest PNVT

Appendix B table 10. Spruce-fir forest (with and without aspen) PNVT crosswalks developed by Region 3 (10 December 2010) used in the determination of departure from HRV and DCs. DCs were provided by the Regional Office, and HRV was derived from the Nature Conservancy (Smith, 2006c)

														INPUT PROPORTION OF SFM/SFP HERE		100	Area or proportion of landscape in SFM (Lower)					
																0	Area or proportion of landscape in SFP (Upper)					
Current Trend Model				R3 Mid-scale Existing Vegetation Mapping				Reference Condition				Desired Conditions - Spruce-Fir Forest Mix - Lower Elevation		Desired Conditions - Spruce-Fir Forest Pure - Upper Elevation		Desired Conditions - All -Spruce-Fir Forest Mix - Lower Elevation and Spruce-Fir Forest Pure - Upper Elevation						
source	state ^{1, 2}	description		dominance unit - size/cover		source	TNC state	historic mean ¹ (%)	description		structural stage (%)	description		structural stage (%)	description		structural stage (%)	description				
USFS R3 model SFF	A, K	GFB/SHR (all)		=	NON-TREED: Recently burned, grass, forb, and shrub types - N/A		TNC "Spruce-Fir High and Low Elevation" (2005)	A	21	Grass/forb seedling/sapling with quaking aspen, Douglas-fir, spruce, fir	9	Reference condition including systems with no quaking aspen succession ¹		9	Reference condition including systems with no quaking aspen succession ¹		9	Grass/forb with quaking aspen or oak ramets, 10 - 40% tree cover: based on reference condition for 'mixed conifer with quaking aspen				
	B	Aspen/mixed deciduous (all size and cover classes)		=	All quaking aspen, deciduous tree mix, and evergreen - deciduous mix tree types (e.g., quaking aspen_Douglas-fir) - Seedling/sapling, small, medium, and very large all cover classes						13	Quaking aspen/mixed - quaking aspen early forest, 10 - 20%: based on reference condition including systems with no quaking aspen succession ¹ ; corroborated by Forest Inventory Data		5	Quaking aspen/mixed - quaking aspen early forest, 0 - 10%: based on reference condition including systems with no quaking aspen succession ¹ ; corroborated by Forest Inventory Data		13	Quaking aspen/mixed - quaking aspen early forest, 0 - 10%: based on cover constancy of aspen in spruce-fir forest-upper associations; corroborated by Forest Inventory Data				
	C ³	SSC, SMC shade tolerant/mixed shade tolerant conifer (SSO, SMO shade tolerant also included here) ⁴		=	Shade tolerant and mixed shade tolerant tree types (e.g., ponderosa pine_Douglas-fir) - Seedling/sapling, small, all cover classes						20	Reference condition including systems with no aspen succession ¹ ; corroborated by Forest Inventory Data		23	Reference condition including systems with no aspen succession ¹ ; corroborated by Forest Inventory Data		20	Conifer early forest, 10 - 20%: based on remaining proportion of early forest not including quaking aspen/mixed - quaking aspen cover types				
	G, P	SSO, SMO shade intolerant conifer		=	Shade intolerant tree types - Seedling/sapling - open, small - open canopy						B	33	Young forest with regeneration	14	Reference condition including systems with no aspen succession ¹		15	Reference condition including systems with no quaking aspen succession ¹		14	Based on reference condition	
	L	SSC, SMC shade intolerant conifer		=	All shade intolerant tree types - Seedling/sapling - closed canopy, small - closed canopy			C	46	Mature/old forest with regeneration				44	Reference condition including systems with no quaking aspen succession ¹		48	Reference condition including systems with no quaking aspen succession ¹		44	Based on reference condition	
	D, M	MC shade tolerant/mixed shade tolerant conifer (MO shade tolerant also included here) ⁴		=	Shade tolerant and mixed shade tolerant tree types (e.g., ponderosa pine_Douglas-fir) - Medium, all cover classes																	
	H, Q	MO shade intolerant conifer (MC shade intolerant also included here) ⁴		=	All shade intolerant tree types - Medium, all cover classes																	
	E, N	VCS shade tolerant conifer (VCS shade intolerant also included here) ⁴		=	Shade tolerant and shade intolerant tree types - Very large - closed canopy																	
	F, O	VCM shade tolerant conifer (VCM shade intolerant also included here) ⁴		=																		
	I, R	VOS shade tolerant conifer (VOS shade intolerant conifers include here) ⁴		=																		
J, S	VOM shade tolerant conifer (VOM shade intolerant conifers include here) ⁴		=	All shade tolerant and shade intolerant tree types - Very large - open canopy																		

¹ States with elk and no or limited quaking aspen regeneration are indicated in **bold** and *italic*, and are found on contemporary landscapes only and were not part of the historic conditions

² Initial conditions are proportioned for A-K, D-M, E-N, F-O, G-P, H-Q, I-R, and J-S according to the proportion of the landscape outside and inside elk summer range, respectively

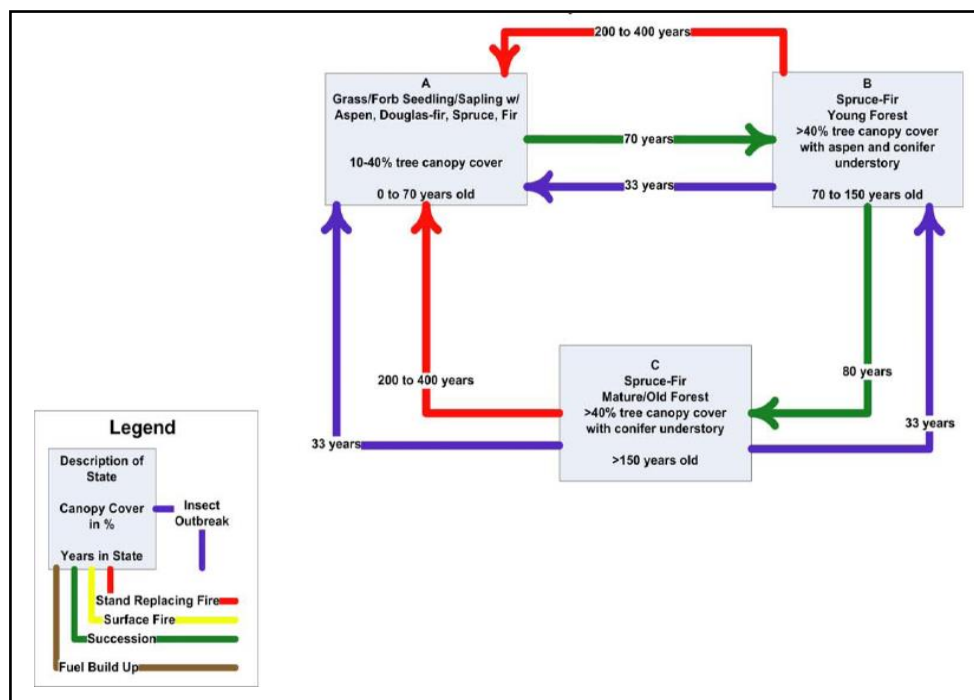
³ R3 model state C has only partial overlap in theme with TNC states C and F, but provides a better cross-reference than other options

⁴ Atypical type without a model state, included with the next most similar state

Spruce-Fir Forest State and Transition Models

The following is Smith's (2006d) discussion concerning the current modeling results for spruce-fir forest.

Appendix B figure 64 displays a conceptual current state and transition model for the spruce-fir with wet mixed conifer forest- vegetation type (Smith 2006d) used in VDDT modeling. In table 11³¹, Smith (2006d) describes the parameters included or not included within the current VDDT models (Schussman and Smith, 2006a and 2006b), as well as the sources of information and any assumptions used to create the model parameters.



Appendix B figure 64. Conceptual current state and transition model for both low and high elevation spruce-fir forest vegetation type. Frequency of transitions are noted when this information is supported by published sources, where no or conflicting information exists on the frequency of transitions, unknown is the notation (Schussman and Smith, 2006a and 2006b; Smith, 2006d)

Based on Smith's understanding of vegetation dynamics, they created state and transition models depicting historic (pre-1880) and current (1880 to present) vegetation dynamics within this forest type. Additionally, they used information from the state and transition models to develop quantitative VDDT models. The VDDT software allows the user to model succession as a series of vegetation states that differ in structure, composition, and cover and to specify the amount of time it takes to move from one vegetation state to another in the absence of disturbance. Various disturbance agents affecting the movement of vegetation between states can then be incorporated (e.g., surface fires, stand-replacing fires, grazing, insect outbreaks). By varying the types and rates of disturbance across the landscape, the effects of different management treatments, such as wildland fire use, fire suppression, prescribed burning, grazing practices, and mechanical fuel

³¹ See Smith, 2006d

treatments, on future vegetation can be investigated. While VDDT models can be used to “game play” with different management scenarios, the models we ran in this analysis only include states and transitions for which there is published information to support their inclusion within the model. We discuss model parameters, output, and analysis below.

Results for the current spruce-fir low and high elevation models, which were run for 120 years following development of the Historic conditions, were very similar to results from the Historic models. For example, under a stand replacing fire return interval of 300 years, average landscape proportion of the historic low elevation spruce-fir was 39.8%, for high elevation spruce-fir it was 40.5%, and for the current model for both high and low elevation spruce-fir it was 45.4%.

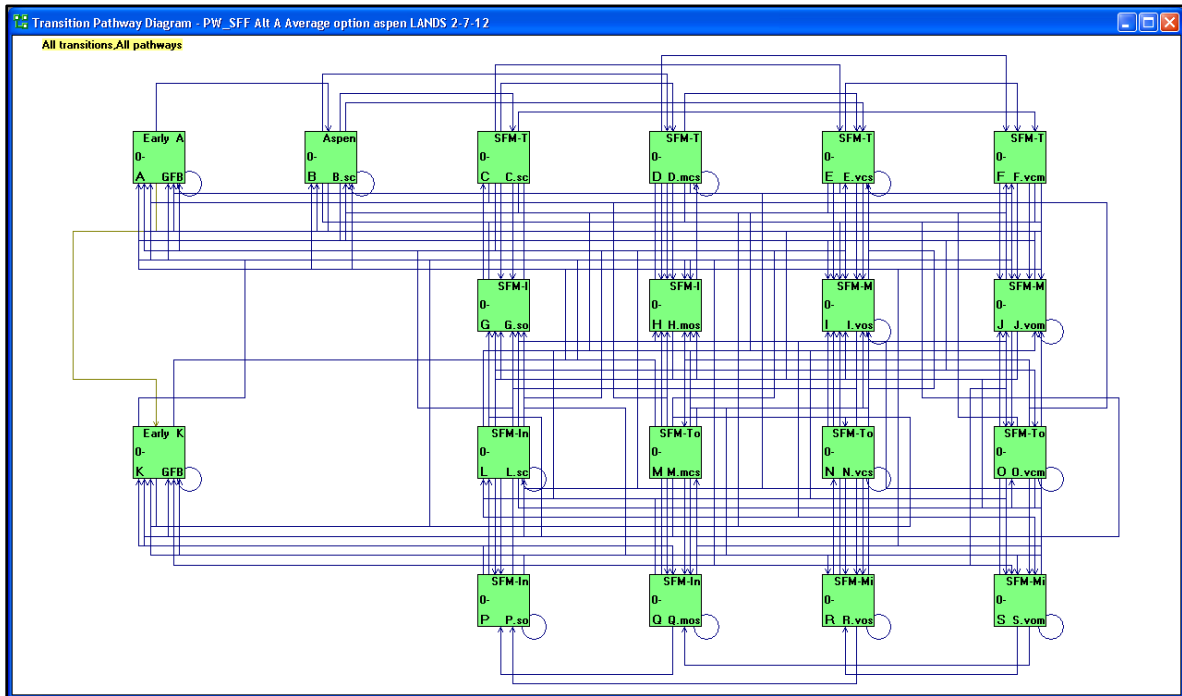
These modeled scenarios indicate that although there may be large differences in canopy and understory composition due to differences in elevation and moisture regimes, the resulting difference in disturbance regime (surface plus canopy versus strictly canopy fire) has a minor effect on the relative proportion of the landscape in the three model states (regeneration, young, and old forest). Also, elimination of a relatively long-rotation surface fire regime (31 years) has had minimal effect on the relative proportion of model states over 120 years. This is in concurrence with other authors’ contention that spruce-fir forest conditions in many areas of the Southwest may be within its historic range of variation, and that insufficient time has elapsed since the last crown fire for us to have experienced crown fire in contemporary time (Koprowski et al., 2005; Swetnam et al., 2005; Vankat, 2006).

Appendix B figures 65 through 84 display the actual VDDT model for spruce-fir forest, developed by the USDA FS Southwestern Region 3, and utilized during the planning effort on the A-SNFs to determine future departure conditions and assessment of trends.

Appendix B table 11. TNC’s identification of current transitions, frequency of transitions, sources of information and assumptions used to develop the frequency of transitions and their effects on vegetation states included in the VDDT model for spruce-fir high elevation with stand replacing fire. A major assumption here is that historic and current conditions are sufficiently similar for the spruce-fir high elevation vegetation type that current forests are within their HRV, because the time elapsed since the last crown fire is within the range of their historic fire frequency. Current conditions for the spruce-fir wet forest vegetation type were assumed to reflect the current conditions of the dry spruce-fir forest type because the surface fire regime, which is the only difference between the two (from a disturbance standpoint), has been extinguished (adapted from Smith, 2006d¹)

Transition Type	Transition Frequency or Length	Information Sources	Assumptions
Plant growth	70 to 80 years between states	Transitions among model states were taken from data developed by Veblen et al. (1994) and Vankat, (2006)	Smith assumed that transition from seedling/sapling to young forest takes approximately 70 years, and from young to old/mature forest takes approximately 80 years.
Regeneration from seed	Unknown, not used in model	Seed production and seedling recruitment is highly variable in both space and time, and there is insufficient information to assign a probability for this transition across the entire region	Due to the lack of data on seedling recruitment, this transition is not included in the model, and hence the proportion of this seedling/sapling class of vegetation is presumed to be underestimated in the model.
Stand replacing fire	Once every 200 to 400 years	Stand replacing fire was reported to occur in small patches throughout spruce-fir’s range, but relatively infrequent (Dieterich, 1983; Moir, 1993; Fulé et al., 2003; Vankat, 2006)	Stand replacing fire occurred in small patches across all spruce-fir forests, returning the forest to the seedling/sapling stage.
Insect outbreak	Once every 33 years for young forests; once every 100 years for old/mature forests	Spruce beetle outbreaks have been documented for the northern portion of the range (northern New Mexico and Kaibab Plateau, Arizona) and for the Pinaleno Mountains in southern Arizona (Baker and Veblen, 1990; Koprowski et al., 2005)	Smith assumed that insect outbreaks occurred at a lower frequency for young forest than for old/mature forest, returning young forest to regeneration state “A”, and returning old/mature forest to equal proportions of regeneration and young forest.
Silvicultural activities	Not used in model		Spruce-fir forests were too high in elevation, too inaccessible, or of too low value to have been significantly affected by timber harvest.

¹ See Smith, 2006d



Appendix B figure 65. Actual Alternative A VDDT state and transition model used for assessing trends in the spruce-fir forest PNVT on the A-SNFs

Class Properties for Class A: Early A GFB

Deterministic transitions

Timing	To Class			
Start Age	End Age	Box	Cover	Stage
0	1000	A	Early A	GFB

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
2_B	0.3333	1.00	0.3333	B	Aspen	B.sc
Herbivory Elk	0.5000	1.00	0.5000	K	Early K	GFB
Mixed Severity Fire	0.0001	1.00	0.0001	A	Early A	GFB
Nonlethal Fire	0.0100	1.00	0.0100	A	Early A	GFB
Stand-Replacing Fire	0.0001	1.00	0.0001	A	Early A	GFB

Early A - Early State with no elk
GFB - Grass-Forb-Brush

Display Pathways:
☒ From Class
☐ To Class

☐ TSD
☐ Ages

Appendix B figure 66. Alternative A spruce-fir forest PNVTs' potentially management driven (0) and naturally driven (5) transitions for State A

Class Properties for Class B: Aspen B.sc

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	B	Aspen	B.sc

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	Stage	To Class
2_C	0.0075	1.00	0.0075	C	SFM-T	C.sc	
2_D	0.0029	1.00	0.0029	D	SFM-T	D.mcs	
2_E	0.0006	1.00	0.0006	E	SFM-T	E.vcs	
B Free thin all sizes to target	0.0100	1.00	0.0100	B	Aspen	B.sc	
H Clearcut-Coppice	0.0100	1.00	0.0100	B	Aspen	B.sc	
J RX FIRE ONLY Low	0.0001	0.14	0.0000	D	SFM-T	D.mcs	
J RX FIRE ONLY Low	0.0001	0.09	0.0000	I	SFM-M	I.vos	
K RX FIRE ONLY Moderate	0.0001	0.05	0.0000	A	Early A	GFB	
K RX FIRE ONLY Moderate	0.0001	0.05	0.0000	D	SFM-T	D.mcs	
K RX FIRE ONLY Moderate	0.0001	0.05	0.0000	H	SFM-I	H.mcs	
K RX FIRE ONLY Moderate	0.0001	0.09	0.0000	I	SFM-M	I.vos	
L RX FIRE ONLY High	0.0001	0.18	0.0000	A	Early A	GFB	
Mixed Severity Fire	0.0100	0.05	0.0005	A	Early A	GFB	

Display Pathways

☒ From Class

☐ To Class

OK Cancel Apply

Appendix B figure 67. Alternative A spruce-fir forest PNVTs' potentially management driven (10) and naturally driven (10) transitions for State B. Alternative B spruce-fir forest PNV State B transitions continued in Appendix A figure 67a

Class Properties for Class B: Aspen B.sc

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	B	Aspen	B.sc

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	Stage	To Class
K RX FIRE ONLY Moderate	0.0001	0.05	0.0000	A	Early A	GFB	
K RX FIRE ONLY Moderate	0.0001	0.05	0.0000	D	SFM-T	D.mcs	
K RX FIRE ONLY Moderate	0.0001	0.05	0.0000	H	SFM-I	H.mcs	
K RX FIRE ONLY Moderate	0.0001	0.09	0.0000	I	SFM-M	I.vos	
L RX FIRE ONLY High	0.0001	0.18	0.0000	A	Early A	GFB	
Mixed Severity Fire	0.0100	0.05	0.0005	A	Early A	GFB	
Mixed Severity Fire	0.0100	0.05	0.0005	D	SFM-T	D.mcs	
Mixed Severity Fire	0.0100	0.05	0.0005	H	SFM-I	H.mcs	
Mixed Severity Fire	0.0100	0.09	0.0009	I	SFM-M	I.vos	
Nonlethal Fire	0.0100	0.14	0.0014	D	SFM-T	D.mcs	
Nonlethal Fire	0.0100	0.09	0.0009	I	SFM-M	I.vos	
Stand-Replacing Fire	0.0100	0.18	0.0018	A	Early A	GFB	

Display Pathways

☒ From Class

☐ To Class

OK Cancel Apply

Appendix B figure 67a. Alternative A spruce-fir forest PNV State B transitions continued

Class Properties for Class C: SFM-T C.sc

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	C	SFM-T	C.sc

SFM-T - Spruce-Fir Mix Shade Tolerant
C.sc - C.Seed/Sap/Small_Closed

Display Pathways

☒ From Class
☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
2_B	0.0008	1.00	0.0008	B	Aspen	B.sc
2_D	0.0185	1.00	0.0185	D	SFM-T	D.mcs
2_F	0.0014	1.00	0.0014	F	SFM-T	F.vcm
B Free thin all sizes to target	0.0100	0.14	0.0014	B	Aspen	B.sc
B Free thin all sizes to target	0.0100	0.14	0.0014	D	SFM-T	D.mcs
B Free thin all sizes to target	0.0100	0.05	0.0005	G	SFM-I	G.so
B Free thin all sizes to target	0.0100	0.32	0.0032	H	SFM-I	H.mos
B Free thin all sizes to target	0.0100	0.23	0.0023	I	SFM-M	I.vos
C Thin from below to target	0.0100	0.14	0.0014	B	Aspen	B.sc
C Thin from below to target	0.0100	0.14	0.0014	D	SFM-T	D.mcs
C Thin from below to target	0.0100	0.18	0.0018	H	SFM-I	H.mos
C Thin from below to target	0.0100	0.18	0.0018	I	SFM-M	I.vos
Insert/Disease	0.0300	1.00	0.0300	G	SFM-I	G.so

New
Copy
Delete

☐ TSD
☐ Ages
Sort...

OK Cancel Apply

Appendix B figure 68. Alternative A spruce-fir forest PNVTs' potentially management driven (28) and naturally driven (19) transitions for State C. Alternative B spruce-fir forest PNV State C transitions continued in Appendix A figures 68a through 68c

Class Properties for Class C: SFM-T C.sc

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	C	SFM-T	C.sc

SFM-T - Spruce-Fir Mix Shade Tolerant
C.sc - C.Seed/Sap/Small_Closed

Display Pathways

☒ From Class
☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
J RX FIRE ONLY Low	0.0001	0.59	0.0001	D	SFM-T	D.mcs
J RX FIRE ONLY Low	0.0001	0.09	0.0000	E	SFM-T	E.vcs
J RX FIRE ONLY Low	0.0001	0.05	0.0000	F	SFM-T	F.vcm
J RX FIRE ONLY Low	0.0001	0.05	0.0000	G	SFM-I	G.so
J RX FIRE ONLY Low	0.0001	0.05	0.0000	J	SFM-M	J.vom
K RX FIRE ONLY Moderate	0.0001	0.23	0.0000	D	SFM-T	D.mcs
K RX FIRE ONLY Moderate	0.0001	0.09	0.0000	E	SFM-T	E.vcs
K RX FIRE ONLY Moderate	0.0001	0.36	0.0000	G	SFM-I	G.so
K RX FIRE ONLY Moderate	0.0001	0.23	0.0000	H	SFM-I	H.mos
K RX FIRE ONLY Moderate	0.0001	0.05	0.0000	I	SFM-M	I.vos
K RX FIRE ONLY Moderate	0.0001	0.05	0.0000	J	SFM-M	J.vom
L RX FIRE ONLY High	0.0001	0.64	0.0001	A	Early A	GFB
L RX FIRE ONLY High	0.0001	0.05	0.0000	B	Aspen	B.sc

New
Copy
Delete

☐ TSD
☐ Ages
Sort...

OK Cancel Apply

Appendix B figure 68a. Alternative A spruce-fir forest PNV State C transitions continued

Class Properties for Class C: SFM-T C.sc

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	C	SFM-T	C.sc

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
L RX FIRE ONLY High	0.0001	0.14	0.0000	H	SFM-I	H.mos
M Thin under 9-inch diameter	0.0100	0.41	0.0041	D	SFM-T	D.mcs
M Thin under 9-inch diameter	0.0100	0.41	0.0041	D	SFM-T	D.mcs
M Thin under 9-inch diameter	0.0100	0.05	0.0005	E	SFM-T	E.vcs
M Thin under 9-inch diameter	0.0100	0.05	0.0005	E	SFM-T	E.vcs
Mixed Severity Fire	0.0100	0.23	0.0023	D	SFM-T	D.mcs
Mixed Severity Fire	0.0100	0.09	0.0009	E	SFM-T	E.vcs
Mixed Severity Fire	0.0100	0.36	0.0036	G	SFM-I	G.so
Mixed Severity Fire	0.0100	0.23	0.0023	H	SFM-I	H.mos
Mixed Severity Fire	0.0100	0.05	0.0005	I	SFM-M	I.vos
Mixed Severity Fire	0.0100	0.05	0.0005	J	SFM-M	J.vom
Nonlethal Fire	0.0100	0.59	0.0059	D	SFM-T	D.mcs
Nonlethal Fire	0.0100	0.09	0.0009	E	SFM-T	E.vcs

**SFM-T - Spruce-Fir Mix Shade Tolerant
C.sc - C.Seed/Sap/Small_Closed**

Display Pathways
☒ From Class
☐ To Class

☐ TSD
☐ Ages

OK Cancel Apply

Appendix B figure 68b. Alternative A spruce-fir forest PNVT State C transitions continued

Class Properties for Class C: SFM-T C.sc

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	C	SFM-T	C.sc

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
Mixed Severity Fire	0.0100	0.23	0.0023	H	SFM-I	H.mos
Mixed Severity Fire	0.0100	0.05	0.0005	I	SFM-M	I.vos
Mixed Severity Fire	0.0100	0.05	0.0005	J	SFM-M	J.vom
Nonlethal Fire	0.0100	0.59	0.0059	D	SFM-T	D.mcs
Nonlethal Fire	0.0100	0.09	0.0009	E	SFM-T	E.vcs
Nonlethal Fire	0.0100	0.05	0.0005	F	SFM-T	F.vcm
Nonlethal Fire	0.0100	0.05	0.0005	G	SFM-I	G.so
Nonlethal Fire	0.0100	0.05	0.0005	J	SFM-M	J.vom
Stand-Replacing Fire	0.0100	0.64	0.0064	A	Early A	GFB
Stand-Replacing Fire	0.0100	0.05	0.0005	B	Aspen	B.sc
Stand-Replacing Fire	0.0100	0.18	0.0018	G	SFM-I	G.so
Stand-Replacing Fire	0.0100	0.14	0.0014	H	SFM-I	H.mos

**SFM-T - Spruce-Fir Mix Shade Tolerant
C.sc - C.Seed/Sap/Small_Closed**

Display Pathways
☒ From Class
☐ To Class

☐ TSD
☐ Ages

OK Cancel Apply

Appendix B figure 68c. Alternative A spruce-fir forest PNVT State C transitions continued

Class Properties for Class D: SFM-T D.mcs

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	D	SFM-T	D.mcs

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
2_B	0.0012	1.00	0.0012	B	Aspen	B.sc
2_C	0.0042	1.00	0.0042	C	SFM-T	C.sc
2_E	0.0034	1.00	0.0034	E	SFM-T	E.vcs
2_F	0.0070	1.00	0.0070	F	SFM-T	F.vcm
2_H	0.0005	1.00	0.0005	H	SFM-I	H.mos
C Thin from below to target	0.0100	0.05	0.0005	C	SFM-T	C.sc
C Thin from below to target	0.0100	0.05	0.0005	F	SFM-T	F.vcm
C Thin from below to target	0.0100	0.43	0.0043	H	SFM-I	H.mos
C Thin from below to target	0.0100	0.14	0.0014	I	SFM-M	I.vos
D Thin under	0.0100	0.05	0.0005	C	SFM-T	C.sc
D Thin under	0.0100	0.05	0.0005	F	SFM-T	F.vcm
D Thin under	0.0100	0.52	0.0052	H	SFM-I	H.mos
D Thin under	0.0100	0.14	0.0014	I	SFM-M	I.vos

Display Pathways

☒ From Class
☐ To Class

☐ TSD
☐ Ages

OK Cancel Apply

Appendix B figure 69. Alternative A spruce-fir forest PNVTs' potentially management driven (19) and naturally driven (13) transitions for State D. Alternative A spruce-fir forest PNV State D transitions continued in Appendix B figures 69a and 69b

Class Properties for Class D: SFM-T D.mcs

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	D	SFM-T	D.mcs

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
D Thin under	0.0100	0.05	0.0005	J	SFM-M	J.vom
E GroupSelect with matrix thin	0.0001	1.00	0.0001	J	SFM-M	J.vom
H Clearcut-Coppice	0.0001	1.00	0.0001	A	Early A	GFB
Insect/Disease	0.0300	1.00	0.0300	H	SFM-I	H.mos
J RX FIRE ONLY Low	0.0001	0.05	0.0000	F	SFM-T	F.vcm
K RX FIRE ONLY Moderate	0.0001	0.05	0.0000	F	SFM-T	F.vcm
K RX FIRE ONLY Moderate	0.0001	0.29	0.0000	H	SFM-I	H.mos
L RX FIRE ONLY High	0.0001	0.57	0.0001	A	Early A	GFB
L RX FIRE ONLY High	0.0001	0.05	0.0000	B	Aspen	B.sc
L RX FIRE ONLY High	0.0001	0.05	0.0000	G	SFM-I	G.so
L RX FIRE ONLY High	0.0001	0.29	0.0000	H	SFM-I	H.mos
M Thin under 9-inch diameter	0.0100	1.00	0.0100	D	SFM-T	D.mcs
Mixed Severely Fire	0.0100	0.05	0.0005	F	SFM-T	F.vcm

Display Pathways

☒ From Class
☐ To Class

☐ TSD
☐ Ages

OK Cancel Apply

Appendix B figure 69a. Alternative A spruce-fir forest PNV State D transitions continued

Class Properties for Class D: SFM-T D.mcs

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	D	SFM-T	D.mcs

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
L RX FIRE ONLY High	0.0001	0.57	0.0001	A	Early A	GFB
L RX FIRE ONLY High	0.0001	0.05	0.0000	B	Aspen	B.sc
L RX FIRE ONLY High	0.0001	0.05	0.0000	G	SFM-I	G.so
L RX FIRE ONLY High	0.0001	0.29	0.0000	H	SFM-I	H.mos
M Thin under 9-inch diameter	0.0100	1.00	0.0100	D	SFM-T	D.mcs
Mixed Severity Fire	0.0100	0.05	0.0005	F	SFM-T	F.vcm
Mixed Severity Fire	0.0100	0.29	0.0029	H	SFM-I	H.mos
Nonlethal Fire	0.0100	0.05	0.0005	F	SFM-T	F.vcm
Stand-Replacing Fire	0.0100	0.57	0.0057	A	Early A	GFB
Stand-Replacing Fire	0.0100	0.05	0.0005	B	Aspen	B.sc
Stand-Replacing Fire	0.0100	0.05	0.0005	G	SFM-I	G.so
Stand-Replacing Fire	0.0100	0.29	0.0029	H	SFM-I	H.mos

SFM-T - Spruce-Fir Mix Shade Tolerant D.mcs - D.Medium_Closed_Single

Display Pathways
☒ From Class
☐ To Class

☐ TSD
☐ Ages

OK Cancel Apply

Appendix B figure 69b. Alternative A spruce-fir forest PNV State D transitions continued

Class Properties for Class E: SFM-T E.vcs

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	E	SFM-T	E.vcs

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
2_C	0.0017	1.00	0.0017	C	SFM-T	C.sc
2_F	0.0135	1.00	0.0135	F	SFM-T	F.vcm
2_I	0.0026	1.00	0.0026	I	SFM-M	I.vos
C Thin from below to target	0.0001	1.00	0.0001	I	SFM-M	I.vos
D Thin under	0.0100	0.10	0.0010	I	SFM-M	I.vos
E GroupSelect with matrix thin	0.0001	1.00	0.0001	J	SFM-M	J.vom
H Clearcut-Coppice	0.0001	1.00	0.0001	A	Early A	GFB
Insect/Disease	0.0300	1.00	0.0300	I	SFM-M	I.vos
J RX FIRE ONLY Low	0.0001	1.00	0.0001	E	SFM-T	E.vcs
K RX FIRE ONLY Moderate	0.0001	0.02	0.0000	I	SFM-M	I.vos
L RX FIRE ONLY High	0.0001	0.38	0.0000	A	Early A	GFB
L RX FIRE ONLY High	0.0001	0.02	0.0000	H	SFM-I	H.mos
L RX FIRE ONLY High	0.0001	0.50	0.0001	I	SFM-M	I.vos

SFM-T - Spruce-Fir Mix Shade Tolerant E.vcs - E.VLarge_Closed_Single

Display Pathways
☒ From Class
☐ To Class

☐ TSD
☐ Ages

OK Cancel Apply

Appendix B figure 70. Alternative A spruce-fir forest PNVs' potentially management driven (10) and naturally driven (9) transitions for State E. Alternative A spruce-fir forest PNV State E transitions continued in Appendix B figure 70a

Class Properties for Class E: SFM-T E.vcs

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	E	SFM-T	E.vcs

SFM-T - Spruce-Fir Mix Shade Tolerant
E.vcs - E.VLarge_Closed_Single

Display Pathways

☒ From Class
☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
Insect/Disease	0.0300	1.00	0.0300	I	SFM-M	I.vos
J RX FIRE ONLY Low	0.0001	1.00	0.0001	E	SFM-T	E.vcs
K RX FIRE ONLY Moderate	0.0001	0.02	0.0000	I	SFM-M	I.vos
L RX FIRE ONLY High	0.0001	0.38	0.0000	A	Early A	GFB
L RX FIRE ONLY High	0.0001	0.02	0.0000	H	SFM-I	H.mos
L RX FIRE ONLY High	0.0001	0.50	0.0001	I	SFM-M	I.vos
M Thin under 9-inch diameter	0.0100	1.00	0.0100	E	SFM-T	E.vcs
Mixed Severity Fire	0.0100	0.02	0.0002	I	SFM-M	I.vos
Nonlethal Fire	0.0100	1.00	0.0100	E	SFM-T	E.vcs
Stand-Replacing Fire	0.0100	0.38	0.0038	A	Early A	GFB
Stand-Replacing Fire	0.0100	0.02	0.0002	H	SFM-I	H.mos
Stand-Replacing Fire	0.0100	0.50	0.0050	I	SFM-M	I.vos

OK Cancel Apply

Appendix B figure 70a. Alternative A spruce-fir forest PNV State E transitions continued

Class Properties for Class F: SFM-T F.vcm

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	F	SFM-T	F.vcm

SFM-T - Spruce-Fir Mix Shade Tolerant
F.vcm - F.VLarge_Closed_Multi

Display Pathways

☒ From Class
☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
2_C	0.0036	1.00	0.0036	C	SFM-T	C.sc
2_D	0.0040	1.00	0.0040	D	SFM-T	D.mcs
2_E	0.0028	1.00	0.0028	E	SFM-T	E.vcs
2_I	0.0004	1.00	0.0004	I	SFM-M	I.vos
2_J	0.0004	1.00	0.0004	J	SFM-M	J.vom
C Thin from below to target	0.0001	0.67	0.0001	B	Aspen	B.sc
C Thin from below to target	0.0001	0.33	0.0000	I	SFM-M	I.vos
D Thin under	0.0100	0.33	0.0033	E	SFM-T	E.vcs
E GroupSelect with matrix thin	0.0001	1.00	0.0001	J	SFM-M	J.vom
H Clearcut-Coppice	0.0001	1.00	0.0001	A	Early A	GFB
Insect/Disease	0.0300	1.00	0.0300	J	SFM-M	J.vom
J RX FIRE ONLY Low	0.0001	0.33	0.0000	I	SFM-M	I.vos
K RX FIRE ONLY Moderate	0.0001	0.33	0.0000	I	SFM-M	I.vos

OK Cancel Apply

Appendix B figure 71. Alternative A spruce-fir forest PNVs' potentially management driven (10) and naturally driven (10) transitions for State F. Alternative A spruce-fir forest PNV State F transitions continued in Appendix B figure 71a

Class Properties for Class F: SFM-T F.vcm

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	F	SFM-T	F.vcm

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
E GroupSelect with matrix thin	0.0001	1.00	0.0001	J	SFM-M	J.vom
H Clearcut-Coppice	0.0001	1.00	0.0001	A	Early A	GFB
Insect/Disease	0.0300	1.00	0.0300	J	SFM-M	J.vom
J RX FIRE ONLY Low	0.0001	0.33	0.0000	I	SFM-M	I.vos
K RX FIRE ONLY Moderate	0.0001	0.33	0.0000	I	SFM-M	I.vos
L RX FIRE ONLY High	0.0001	0.33	0.0000	A	Early A	GFB
L RX FIRE ONLY High	0.0001	0.67	0.0001	J	SFM-M	J.vom
M Thin under 9-inch diameter	0.0100	0.33	0.0033	E	SFM-T	E.vcs
Mixed Severity Fire	0.0100	0.33	0.0033	I	SFM-M	I.vos
Nonlethal Fire	0.0100	0.33	0.0033	I	SFM-M	I.vos
Stand-Replacing Fire	0.0100	0.33	0.0033	A	Early A	GFB
Stand-Replacing Fire	0.0100	0.67	0.0067	J	SFM-M	J.vom

Display Pathways

☒ From Class
☐ To Class

☐ TSD
☐ Ages

OK Cancel Apply

Appendix B figure 71a. Alternative A spruce-fir forest PNVT State F transitions continued

Class Properties for Class G: SFM-I G.so

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	G	SFM-I	G.so

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
2_B	0.0263	1.00	0.0263	B	Aspen	B.sc
2_C	0.0569	1.00	0.0569	C	SFM-T	C.sc
2_H	0.0936	1.00	0.0936	H	SFM-I	H.mos
J RX FIRE ONLY Low	0.0001	0.17	0.0000	A	Early A	GFB
J RX FIRE ONLY Low	0.0001	0.17	0.0000	H	SFM-I	H.mos
K RX FIRE ONLY Moderate	0.0001	0.33	0.0000	A	Early A	GFB
K RX FIRE ONLY Moderate	0.0001	0.17	0.0000	H	SFM-I	H.mos
L RX FIRE ONLY High	0.0001	0.83	0.0001	A	Early A	GFB
Mixed Severity Fire	0.0100	0.33	0.0033	A	Early A	GFB
Mixed Severity Fire	0.0100	0.17	0.0017	H	SFM-I	H.mos
Nonlethal Fire	0.0100	0.17	0.0017	A	Early A	GFB
Nonlethal Fire	0.0100	0.17	0.0017	H	SFM-I	H.mos
Stand-Replacing Fire	0.0001	0.83	0.0001	A	Early A	GFB

Display Pathways

☒ From Class
☐ To Class

☐ TSD
☐ Ages

OK Cancel Apply

Appendix B figure 72. Alternative A spruce-fir forest PNVTs' potentially management driven (5) and naturally driven (8) transitions for State G

Class Properties for Class H: SFM-I H.mos

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	H	SFM-I	H.mos

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
2_B	0.0581	1.00	0.0581	B	Aspen	B.sc
2_G	0.0366	1.00	0.0366	G	SFM-I	G.so
2_I	0.0366	1.00	0.0366	I	SFM-M	I.vos
2_J	0.0174	1.00	0.0174	J	SFM-M	J.vom
D Thin under	0.0100	0.13	0.0013	J	SFM-M	J.vom
E GroupSelect with matrix thin	0.0100	1.00	0.0100	J	SFM-M	J.vom
H Clearcut-Coppice	0.0100	1.00	0.0100	A	Early A	GFB
J RX FIRE ONLY Low	0.0001	0.13	0.0000	J	SFM-M	J.vom
K RX FIRE ONLY Moderate	0.0001	0.25	0.0000	J	SFM-M	J.vom
L RX FIRE ONLY High	0.0001	0.38	0.0000	A	Early A	GFB
L RX FIRE ONLY High	0.0001	0.13	0.0000	G	SFM-I	G.so
L RX FIRE ONLY High	0.0001	0.13	0.0000	J	SFM-M	J.vom
Mixed Severity Fire	0.0100	0.25	0.0025	J	SFM-M	J.vom

Display Pathways

☒ From Class
☐ To Class

Buttons: New, Copy, Delete, TSD, Ages, Sort..., OK, Cancel, Apply

Appendix B figure 73. Alternative A spruce-fir forest PNVTs' potentially management driven (8) and naturally driven (8) transitions for State H. Alternative A spruce-fir forest PNVT State H transitions continued in Appendix B figure 73a

Class Properties for Class H: SFM-I H.mos

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	H	SFM-I	H.mos

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
E GroupSelect with matrix thin	0.0100	1.00	0.0100	J	SFM-M	J.vom
H Clearcut-Coppice	0.0001	1.00	0.0001	A	Early A	GFB
J RX FIRE ONLY Low	0.0001	0.13	0.0000	J	SFM-M	J.vom
K RX FIRE ONLY Moderate	0.0001	0.25	0.0000	J	SFM-M	J.vom
L RX FIRE ONLY High	0.0001	0.38	0.0000	A	Early A	GFB
L RX FIRE ONLY High	0.0001	0.13	0.0000	G	SFM-I	G.so
L RX FIRE ONLY High	0.0001	0.13	0.0000	J	SFM-M	J.vom
Mixed Severity Fire	0.0100	0.25	0.0025	J	SFM-M	J.vom
Nonlethal Fire	0.0100	0.13	0.0013	J	SFM-M	J.vom
Stand-Replacing Fire	0.0100	0.38	0.0038	A	Early A	GFB
Stand-Replacing Fire	0.0100	0.13	0.0013	G	SFM-I	G.so
Stand-Replacing Fire	0.0100	0.13	0.0013	J	SFM-M	J.vom

Display Pathways

☒ From Class
☐ To Class

Buttons: New, Copy, Delete, TSD, Ages, Sort..., OK, Cancel, Apply

Appendix B figure 73a. Alternative A spruce-fir forest PNVT State H transitions continued

Class Properties for Class I: SFM-M I.vos

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	I	SFM-M	I.vos

I-M - Spruce-Fir Mix Mixed Shade Tolerant
I.vos - I.VLarge_Open_Single

Display Pathways

☒ From Class
☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
2_B	0.0043	1.00	0.0043	B	Aspen	B.sc
2_C	0.0043	1.00	0.0043	C	SFM-T	C.sc
2_E	0.0087	1.00	0.0087	E	SFM-T	E.vcs
2_F	0.0043	1.00	0.0043	F	SFM-T	F.vcm
2_G	0.0043	1.00	0.0043	G	SFM-I	G.so
2_J	0.0087	1.00	0.0087	J	SFM-M	J.vom
C Thin from below to target	0.0100	0.75	0.0075	A	Early A	GFB
D Thin under	0.0100	1.00	0.0100	I	SFM-M	I.vos
E GroupSelect with matrix thin	0.0100	1.00	0.0100	J	SFM-M	J.vom
H Clearcut-Coppice	0.0100	1.00	0.0100	B	Aspen	B.sc
J RX FIRE ONLY Low	0.0001	1.00	0.0001	I	SFM-M	I.vos
K RX FIRE ONLY Moderate	0.0001	1.00	0.0001	I	SFM-M	I.vos
L RX FIRE ONLY High	0.0001	1.00	0.0001	I	SFM-M	I.vos

OK Cancel Apply

Appendix B figure 74. Alternative A spruce-fir forest PNVTs' potentially management driven (7) and naturally driven (9) transitions for State I. Alternative A spruce-fir forest PNVT State I transitions continued in Appendix B figure 74a

Class Properties for Class I: SFM-M I.vos

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	I	SFM-M	I.vos

I-M - Spruce-Fir Mix Mixed Shade Tolerant
I.vos - I.VLarge_Open_Single

Display Pathways

☒ From Class
☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
2_G	0.0043	1.00	0.0043	G	SFM-I	G.so
2_J	0.0087	1.00	0.0087	J	SFM-M	J.vom
C Thin from below to target	0.0100	0.75	0.0075	A	Early A	GFB
D Thin under	0.0100	1.00	0.0100	I	SFM-M	I.vos
E GroupSelect with matrix thin	0.0100	1.00	0.0100	J	SFM-M	J.vom
H Clearcut-Coppice	0.0100	1.00	0.0100	B	Aspen	B.sc
J RX FIRE ONLY Low	0.0001	1.00	0.0001	I	SFM-M	I.vos
K RX FIRE ONLY Moderate	0.0001	1.00	0.0001	I	SFM-M	I.vos
L RX FIRE ONLY High	0.0001	1.00	0.0001	I	SFM-M	I.vos
Mixed Severity Fire	0.0100	1.00	0.0100	I	SFM-M	I.vos
Nonlethal Fire	0.0100	1.00	0.0100	I	SFM-M	I.vos
Stand-Replacing Fire	0.0001	1.00	0.0001	I	SFM-M	I.vos

OK Cancel Apply

Appendix B figure 74a. Alternative A spruce-fir forest PNVT State I transitions continued

Class Properties for Class J: SFM-M J.vom

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	J	SFM-M	J.vom

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	Stage	To Class
2_C	0.0089	1.00	0.0089	C	SFM-T	C.sc	
2_G	0.0089	1.00	0.0089	G	SFM-I	G.so	
2_I	0.0184	1.00	0.0184	I	SFM-M	I.vos	
D Thin under	0.0100	0.17	0.0017	F	SFM-T	F.vcm	
D Thin under	0.0100	0.08	0.0008	I	SFM-M	I.vos	
E GroupSelect with matrix thin	0.0001	1.00	0.0001	J	SFM-M	J.vom	
H Clearcut-Coppice	0.0100	1.00	0.0100	B	Aspen	B.sc	
J RX FIRE ONLY Low	0.0001	0.08	0.0000	I	SFM-M	I.vos	
K RX FIRE ONLY Moderate	0.0001	0.17	0.0000	I	SFM-M	I.vos	
L RX FIRE ONLY High	0.0001	0.33	0.0000	A	Early A	GFB	
L RX FIRE ONLY High	0.0001	0.17	0.0000	I	SFM-M	I.vos	
M Thin under 9-inch diameter	0.0100	1.00	0.0100	J	SFM-M	J.vom	
Mixed Severity Fire	0.0100	0.17	0.0017	I	SFM-M	I.vos	

Display Pathways

☒ From Class
☐ To Class

☐ TSD
☐ Ages

OK Cancel Apply

Appendix B figure 75. Alternative A spruce-fir forest PNVTs' potentially management driven (9) and naturally driven (7) transitions for State J. Alternative A spruce-fir forest PNVT State J transitions continued in Appendix B figure 75a

Class Properties for Class J: SFM-M J.vom

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	J	SFM-M	J.vom

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	Stage	To Class
D Thin under	0.0100	0.08	0.0008	I	SFM-M	I.vos	
E GroupSelect with matrix thin	0.0001	1.00	0.0001	J	SFM-M	J.vom	
H Clearcut-Coppice	0.0100	1.00	0.0100	B	Aspen	B.sc	
J RX FIRE ONLY Low	0.0001	0.08	0.0000	I	SFM-M	I.vos	
K RX FIRE ONLY Moderate	0.0001	0.17	0.0000	I	SFM-M	I.vos	
L RX FIRE ONLY High	0.0001	0.33	0.0000	A	Early A	GFB	
L RX FIRE ONLY High	0.0001	0.17	0.0000	I	SFM-M	I.vos	
M Thin under 9-inch diameter	0.0100	1.00	0.0100	J	SFM-M	J.vom	
Mixed Severity Fire	0.0100	0.17	0.0017	I	SFM-M	I.vos	
Nonlethal Fire	0.0100	0.08	0.0008	I	SFM-M	I.vos	
Stand-Replacing Fire	0.0001	0.33	0.0000	A	Early A	GFB	
Stand-Replacing Fire	0.0001	0.17	0.0000	I	SFM-M	I.vos	

Display Pathways

☒ From Class
☐ To Class

☐ TSD
☐ Ages

OK Cancel Apply

Appendix B figure 75a. Alternative A spruce-fir forest PNVT State J transitions continued

Class Properties for Class K: Early K GFB

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	K	Early K	GFB

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
2_P	0.3333	1.00	0.3333	P	SFM-In	P.sc
I Plant Seedlings	0.0100	0.20	0.0020	C	SFM-T	C.sc
I Plant Seedlings	0.0100	0.65	0.0065	G	SFM-I	G.sc
Mixed Severity Fire	0.0001	1.00	0.0001	K	Early K	GFB
Nonlethal Fire	0.0100	1.00	0.0100	K	Early K	GFB
Stand-Replacing Fire	0.0001	1.00	0.0001	K	Early K	GFB

Display Pathways

☒ From Class
☐ To Class

☐ TSD
☐ Ages

OK Cancel Apply

Appendix B figure 76. Alternative A spruce-fir forest PNVTs' potentially management driven (2) and naturally driven (4) transitions for State K

Class Properties for Class L: SFM-In L.sc

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	L	SFM-In	L.sc

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
2_M	0.0158	1.00	0.0158	M	SFM-To	M.mcs
2_O	0.0007	1.00	0.0007	O	SFM-To	O.vcm
B Free thin all sizes to target	0.0001	0.12	0.0000	C	SFM-T	C.sc
B Free thin all sizes to target	0.0001	0.04	0.0000	D	SFM-T	D.mcs
B Free thin all sizes to target	0.0001	0.08	0.0000	H	SFM-I	H.mcs
B Free thin all sizes to target	0.0001	0.01	0.0000	I	SFM-M	I.vos
B Free thin all sizes to target	0.0001	0.12	0.0000	M	SFM-To	M.mcs
B Free thin all sizes to target	0.0001	0.28	0.0000	Q	SFM-In	Q.mcs
B Free thin all sizes to target	0.0001	0.04	0.0000	R	SFM-Mi	R.vos
C Thin from below to target	0.0001	0.13	0.0000	C	SFM-T	C.sc
C Thin from below to target	0.0001	0.08	0.0000	D	SFM-T	D.mcs
C Thin from below to target	0.0001	0.04	0.0000	H	SFM-I	H.mcs
C Thin from below to target	0.0001	0.24	0.0000	M	SFM-To	M.mcs

Display Pathways

☒ From Class
☐ To Class

☐ TSD
☐ Ages

OK Cancel Apply

Appendix B figure 77. Alternative A spruce-fir forest PNVTs' potentially management driven (2) and naturally driven (4) transitions for State L. Alternative A spruce-fir forest PNVT State L transitions continued in Appendix B figures 77a through 77d

Class Properties for Class L: SFM-In L.sc

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	L	SFM-In	L.sc

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
C Thin from below to target	0.0001	0.12	0.0000	Q	SFM-In	Q.mos
Insect/Disease	0.0300	1.00	0.0300	P	SFM-In	P.so
J RX FIRE ONLY Low	0.0001	0.13	0.0000	C	SFM-T	C.sc
J RX FIRE ONLY Low	0.0001	0.09	0.0000	D	SFM-T	D.mcs
J RX FIRE ONLY Low	0.0001	0.01	0.0000	F	SFM-T	F.vcm
J RX FIRE ONLY Low	0.0001	0.01	0.0000	H	SFM-I	H.mos
J RX FIRE ONLY Low	0.0001	0.28	0.0000	M	SFM-To	M.mcs
J RX FIRE ONLY Low	0.0001	0.04	0.0000	O	SFM-To	O.vcm
J RX FIRE ONLY Low	0.0001	0.04	0.0000	Q	SFM-In	Q.mos
K RX FIRE ONLY Moderate	0.0001	0.08	0.0000	C	SFM-T	C.sc
K RX FIRE ONLY Moderate	0.0001	0.04	0.0000	D	SFM-T	D.mcs
K RX FIRE ONLY Moderate	0.0001	0.09	0.0000	G	SFM-I	G.so
K RX FIRE ONLY Moderate	0.0001	0.04	0.0000	H	SFM-I	H.mos

Display Pathways

☒ From Class

☐ To Class

☐ TSD

☐ Ages

OK Cancel Apply

Appendix B figure 77a. Alternative A spruce-fir forest PNVT State L transitions continued

Class Properties for Class L: SFM-In L.sc

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	L	SFM-In	L.sc

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
K RX FIRE ONLY Moderate	0.0001	0.12	0.0000	M	SFM-To	M.mcs
K RX FIRE ONLY Moderate	0.0001	0.28	0.0000	P	SFM-In	P.so
K RX FIRE ONLY Moderate	0.0001	0.12	0.0000	Q	SFM-In	Q.mos
L RX FIRE ONLY High	0.0001	0.03	0.0000	A	Early A	GFB
L RX FIRE ONLY High	0.0001	0.01	0.0000	C	SFM-T	C.sc
L RX FIRE ONLY High	0.0001	0.13	0.0000	G	SFM-I	G.so
L RX FIRE ONLY High	0.0001	0.08	0.0000	H	SFM-I	H.mos
L RX FIRE ONLY High	0.0001	0.08	0.0000	K	Early K	GFB
L RX FIRE ONLY High	0.0001	0.39	0.0000	P	SFM-In	P.so
L RX FIRE ONLY High	0.0001	0.24	0.0000	Q	SFM-In	Q.mos
M Thin under 9-inch diameter	0.0100	0.25	0.0025	C	SFM-T	C.sc
M Thin under 9-inch diameter	0.0100	0.75	0.0075	L	SFM-In	L.sc
Mixed Severity Fire	0.0100	0.08	0.0008	C	SFM-T	C.sc

Display Pathways

☒ From Class

☐ To Class

☐ TSD

☐ Ages

OK Cancel Apply

Appendix B figure 77b. Alternative A spruce-fir forest PNVT State L transitions continued

Class Properties for Class L: SFM-In L.sc

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	L	SFM-In	L.sc

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
Mixed Severity Fire	0.0100	0.04	0.0004	D	SFM-T	D.mcs
Mixed Severity Fire	0.0100	0.09	0.0009	G	SFM-I	G.so
Mixed Severity Fire	0.0100	0.04	0.0004	H	SFM-I	H.mos
Mixed Severity Fire	0.0100	0.12	0.0012	M	SFM-To	M.mcs
Mixed Severity Fire	0.0100	0.28	0.0028	P	SFM-In	P.so
Mixed Severity Fire	0.0100	0.12	0.0012	Q	SFM-In	Q.mos
Nonlethal Fire	0.0100	0.13	0.0013	C	SFM-T	C.sc
Nonlethal Fire	0.0100	0.09	0.0009	D	SFM-T	D.mcs
Nonlethal Fire	0.0100	0.01	0.0001	F	SFM-T	F.vcm
Nonlethal Fire	0.0100	0.01	0.0001	H	SFM-I	H.mos
Nonlethal Fire	0.0100	0.28	0.0028	M	SFM-To	M.mcs
Nonlethal Fire	0.0100	0.04	0.0004	O	SFM-To	O.vcm
Nonlethal Fire	0.0100	0.04	0.0004	O	SFM-In	O.mos

Display Pathways

☒ From Class
☐ To Class

Buttons: New, Copy, Delete, TSD, Ages, Sort...

OK Cancel Apply

Appendix B figure 77c. Alternative A spruce-fir forest PNV State L transitions continued

Class Properties for Class L: SFM-In L.sc

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	L	SFM-In	L.sc

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
Nonlethal Fire	0.0100	0.01	0.0001	F	SFM-T	F.vcm
Nonlethal Fire	0.0100	0.01	0.0001	H	SFM-I	H.mos
Nonlethal Fire	0.0100	0.28	0.0028	M	SFM-To	M.mcs
Nonlethal Fire	0.0100	0.04	0.0004	O	SFM-To	O.vcm
Nonlethal Fire	0.0100	0.04	0.0004	Q	SFM-In	Q.mos
Stand-Replacing Fire	0.0100	0.03	0.0003	A	Early A	GFB
Stand-Replacing Fire	0.0100	0.01	0.0001	C	SFM-T	C.sc
Stand-Replacing Fire	0.0100	0.13	0.0013	G	SFM-I	G.so
Stand-Replacing Fire	0.0100	0.08	0.0008	H	SFM-I	H.mos
Stand-Replacing Fire	0.0100	0.08	0.0008	K	Early K	GFB
Stand-Replacing Fire	0.0100	0.39	0.0039	P	SFM-In	P.so
Stand-Replacing Fire	0.0100	0.24	0.0024	Q	SFM-In	Q.mos

Display Pathways

☒ From Class
☐ To Class

Buttons: New, Copy, Delete, TSD, Ages, Sort...

OK Cancel Apply

Appendix B figure 77d. Alternative A spruce-fir forest PNV State L transitions continued

Class Properties for Class M: SFM-To M.mcs

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	M	SFM-To	M.mcs

SFM-To - Spruce-Fir Mix-Shade Tolerant
M.mcs - M.Medium_Closed_Single

Display Pathways

☒ From Class
☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
2_L	0.0039	1.00	0.0039	L	SFM-In	L.sc
2_N	0.0029	1.00	0.0029	N	SFM-To	N.vcs
2_D	0.0074	1.00	0.0074	O	SFM-To	O.vcm
2_Q	0.0004	1.00	0.0004	Q	SFM-In	Q.mos
2_R	0.0001	1.00	0.0001	R	SFM-Mi	R.vos
C Thin from below to target	0.0001	0.01	0.0000	C	SFM-T	C.sc
C Thin from below to target	0.0001	0.10	0.0000	D	SFM-T	D.mcs
C Thin from below to target	0.0001	0.09	0.0000	H	SFM-I	H.mos
C Thin from below to target	0.0001	0.04	0.0000	I	SFM-M	I.vos
C Thin from below to target	0.0001	0.01	0.0000	J	SFM-M	J.vom
C Thin from below to target	0.0001	0.02	0.0000	L	SFM-In	L.sc
C Thin from below to target	0.0001	0.28	0.0000	Q	SFM-In	Q.mos
C Thin from below to target	0.0001	0.12	0.0000	R	SFM-Mi	R.vos

OK Cancel Apply

Appendix B figure 78. Alternative A spruce-fir forest PNVTs' potentially management driven (59) and naturally driven (31) transitions for State M. Alternative A spruce-fir forest PNVT State M transitions continued in Appendix B figures 78a through 78f

Class Properties for Class M: SFM-To M.mcs

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	M	SFM-To	M.mcs

SFM-To - Spruce-Fir Mix-Shade Tolerant
M.mcs - M.Medium_Closed_Single

Display Pathways

☒ From Class
☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
C Thin from below to target	0.0001	0.04	0.0000	S	SFM-Mi	S.vom
D Thin under	0.0100	0.01	0.0001	C	SFM-T	C.sc
D Thin under	0.0100	0.11	0.0011	D	SFM-T	D.mcs
D Thin under	0.0100	0.01	0.0001	F	SFM-T	F.vcm
D Thin under	0.0100	0.09	0.0009	H	SFM-I	H.mos
D Thin under	0.0100	0.02	0.0002	I	SFM-M	I.vos
D Thin under	0.0100	0.02	0.0002	J	SFM-M	J.vom
D Thin under	0.0100	0.02	0.0002	L	SFM-In	L.sc
D Thin under	0.0100	0.02	0.0002	O	SFM-To	O.vcm
D Thin under	0.0100	0.26	0.0026	Q	SFM-In	Q.mos
D Thin under	0.0100	0.06	0.0006	R	SFM-Mi	R.vos
D Thin under	0.0100	0.06	0.0006	S	SFM-Mi	S.vom
F GroupSelect with matrix thin	0.0001	0.09	0.0000	D	SFM-T	D.mcs

OK Cancel Apply

Appendix B figure 78a. Alternative A spruce-fir forest PNVT State M transitions continued

Class Properties for Class M: SFM-To M.mcs

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	M	SFM-To	M.mcs

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
E GroupSelect with matrix thin	0.0001	0.09	0.0000	H	SFM-I	H.mcs
E GroupSelect with matrix thin	0.0001	0.01	0.0000	I	SFM-M	I.vcs
E GroupSelect with matrix thin	0.0001	0.06	0.0000	J	SFM-M	J.vom
E GroupSelect with matrix thin	0.0001	0.28	0.0000	Q	SFM-In	Q.mcs
E GroupSelect with matrix thin	0.0001	0.04	0.0000	R	SFM-Mi	R.vcs
E GroupSelect with matrix thin	0.0001	0.18	0.0000	S	SFM-Mi	S.vom
G Clearcut with legacy trees	0.0100	0.24	0.0024	A	Early A	GFB
G Clearcut with legacy trees	0.0100	0.01	0.0001	H	SFM-I	H.mcs
G Clearcut with legacy trees	0.0100	0.73	0.0073	K	Early K	GFB
G Clearcut with legacy trees	0.0100	0.02	0.0002	Q	SFM-In	Q.mcs
Insect/Disease	0.0300	1.00	0.0300	Q	SFM-In	Q.mcs
J RX FIRE ONLY Low	0.0001	0.01	0.0000	C	SFM-T	C.sc
J RX FIRE ONLY Low	0.0001	0.23	0.0000	D	SFM-T	D.mcs

Display Pathways

☒ From Class
☐ To Class

Buttons: New, Copy, Delete, TSD, Ages, Sort...

OK Cancel Apply

Appendix B figure 78b. Alternative A spruce-fir forest PNV State M transitions continued

Class Properties for Class M: SFM-To M.mcs

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	M	SFM-To	M.mcs

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
J RX FIRE ONLY Low	0.0001	0.01	0.0000	E	SFM-T	E.vcs
J RX FIRE ONLY Low	0.0001	0.01	0.0000	F	SFM-T	F.vom
J RX FIRE ONLY Low	0.0001	0.02	0.0000	L	SFM-In	L.sc
J RX FIRE ONLY Low	0.0001	0.02	0.0000	N	SFM-To	N.vcs
J RX FIRE ONLY Low	0.0001	0.02	0.0000	O	SFM-To	O.vom
K RX FIRE ONLY Moderate	0.0001	0.16	0.0000	D	SFM-T	D.mcs
K RX FIRE ONLY Moderate	0.0001	0.01	0.0000	E	SFM-T	E.vcs
K RX FIRE ONLY Moderate	0.0001	0.01	0.0000	F	SFM-T	F.vom
K RX FIRE ONLY Moderate	0.0001	0.07	0.0000	H	SFM-I	H.mcs
K RX FIRE ONLY Moderate	0.0001	0.01	0.0000	J	SFM-M	J.vom
K RX FIRE ONLY Moderate	0.0001	0.02	0.0000	N	SFM-To	N.vcs
K RX FIRE ONLY Moderate	0.0001	0.02	0.0000	O	SFM-To	O.vom
K RX FIRE ONLY Moderate	0.0001	0.22	0.0000	Q	SFM-In	Q.mcs

Display Pathways

☒ From Class
☐ To Class

Buttons: New, Copy, Delete, TSD, Ages, Sort...

OK Cancel Apply

Appendix B figure 78c. Alternative A spruce-fir forest PNV State M transitions continued

Class Properties for Class M: SFM-To M.mcs

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	M	SFM-To	M.mcs

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
K RX FIRE ONLY Moderate	0.0001	0.02	0.0000	S	SFM-Mi	S.vom
L RX FIRE ONLY High	0.0001	0.09	0.0000	A	Early A	GFB
L RX FIRE ONLY High	0.0001	0.02	0.0000	D	SFM-T	D.mcs
L RX FIRE ONLY High	0.0001	0.12	0.0000	H	SFM-I	H.mcs
L RX FIRE ONLY High	0.0001	0.01	0.0000	I	SFM-M	I.vcs
L RX FIRE ONLY High	0.0001	0.01	0.0000	J	SFM-M	J.vom
L RX FIRE ONLY High	0.0001	0.28	0.0000	K	Early K	GFB
L RX FIRE ONLY High	0.0001	0.36	0.0000	Q	SFM-In	Q.mcs
L RX FIRE ONLY High	0.0001	0.02	0.0000	R	SFM-Mi	R.vcs
L RX FIRE ONLY High	0.0001	0.04	0.0000	S	SFM-Mi	S.vom
M Thin under 9-inch diameter	0.0100	0.01	0.0001	C	SFM-T	C.sc
M Thin under 9-inch diameter	0.0100	0.24	0.0024	D	SFM-T	D.mcs
M Thin under 9-inch diameter	0.0100	0.02	0.0002	I	SFM-M	I.vcs

Display Pathways

☒ From Class
☐ To Class

Buttons: New, Copy, Delete, TSD, Ages, Sort...

OK Cancel Apply

Appendix B figure 78d. Alternative A spruce-fir forest PNVT State M transitions continued

Class Properties for Class M: SFM-To M.mcs

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	M	SFM-To	M.mcs

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
Mixed Severity Fire	0.0100	0.16	0.0016	D	SFM-T	D.mcs
Mixed Severity Fire	0.0100	0.01	0.0001	E	SFM-T	E.vcs
Mixed Severity Fire	0.0100	0.01	0.0001	F	SFM-T	F.vcm
Mixed Severity Fire	0.0100	0.07	0.0007	H	SFM-I	H.mcs
Mixed Severity Fire	0.0100	0.01	0.0001	J	SFM-M	J.vom
Mixed Severity Fire	0.0100	0.02	0.0002	N	SFM-To	N.vcs
Mixed Severity Fire	0.0100	0.02	0.0002	O	SFM-To	O.vcm
Mixed Severity Fire	0.0100	0.22	0.0022	Q	SFM-In	Q.mcs
Mixed Severity Fire	0.0100	0.02	0.0002	S	SFM-Mi	S.vom
Nonlethal Fire	0.0100	0.01	0.0001	C	SFM-T	C.sc
Nonlethal Fire	0.0100	0.23	0.0023	D	SFM-T	D.mcs
Nonlethal Fire	0.0100	0.01	0.0001	E	SFM-T	E.vcs
Nonlethal Fire	0.0100	0.01	0.0001	F	SFM-T	F.vcm

Display Pathways

☒ From Class
☐ To Class

Buttons: New, Copy, Delete, TSD, Ages, Sort...

OK Cancel Apply

Appendix B figure 78e. Alternative A spruce-fir forest PNVT State M transitions continued

Class Properties for Class M: SFM-To M.mcs

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	M	SFM-To	M.mcs

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
Nonlethal Fire	0.0100	0.02	0.0002	L	SFM-In	L.sc
Nonlethal Fire	0.0100	0.02	0.0002	N	SFM-To	N.vcs
Nonlethal Fire	0.0100	0.02	0.0002	O	SFM-To	O.vcm
Stand-Replacing Fire	0.0100	0.09	0.0009	A	Early A	GFB
Stand-Replacing Fire	0.0100	0.02	0.0002	D	SFM-T	D.mcs
Stand-Replacing Fire	0.0100	0.12	0.0012	H	SFM-I	H.mos
Stand-Replacing Fire	0.0100	0.01	0.0001	I	SFM-M	I.vos
Stand-Replacing Fire	0.0100	0.01	0.0001	J	SFM-M	J.vom
Stand-Replacing Fire	0.0100	0.28	0.0028	K	Early K	GFB
Stand-Replacing Fire	0.0100	0.36	0.0036	Q	SFM-In	Q.mos
Stand-Replacing Fire	0.0100	0.02	0.0002	R	SFM-Mi	R.vos
Stand-Replacing Fire	0.0100	0.04	0.0004	S	SFM-Mi	S.vom

Display Pathways

☒ From Class
☐ To Class

Buttons: New, Copy, Delete, TSD, Ages, Sort..., OK, Cancel, Apply

Appendix B figure 78f. Alternative A spruce-fir forest PNV State M transitions continued

Class Properties for Class N: SFM-To N.vcs

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	N	SFM-To	N.vcs

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
2_L	0.0029	1.00	0.0029	L	SFM-In	L.sc
2_O	0.0163	1.00	0.0163	O	SFM-To	O.vcm
2_R	0.0039	1.00	0.0039	R	SFM-Mi	R.vos
2_S	0.0010	1.00	0.0010	S	SFM-Mi	S.vom
C Thin from below to target	0.0001	0.25	0.0000	I	SFM-M	I.vos
C Thin from below to target	0.0001	0.75	0.0001	R	SFM-Mi	R.vos
D Thin under	0.0100	0.06	0.0006	E	SFM-T	E.vcs
D Thin under	0.0100	0.19	0.0019	I	SFM-M	I.vos
D Thin under	0.0100	0.56	0.0056	R	SFM-Mi	R.vos
E GroupSelect with matrix thin	0.0001	0.13	0.0000	E	SFM-T	E.vcs
E GroupSelect with matrix thin	0.0001	0.06	0.0000	H	SFM-I	H.mos
E GroupSelect with matrix thin	0.0001	0.06	0.0000	I	SFM-M	I.vos
E GroupSelect with matrix thin	0.0001	0.19	0.0000	O	SFM-In	O.vcm

Display Pathways

☒ From Class
☐ To Class

Buttons: New, Copy, Delete, TSD, Ages, Sort..., OK, Cancel, Apply

Appendix B figure 79. Alternative A spruce-fir forest PNVs' potentially management driven (24) and naturally driven (15) transitions for State N. Alternative A spruce-fir forest PNV State N transitions continued in Appendix B figures 79a and 79b

Class Properties for Class N: SFM-To N.vcs

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	N	SFM-To	N.vcs

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
E GroupSelect with matrix thin	0.0001	0.19	0.0000	R	SFM-Mi	R.vcs
G Clearcut with legacy trees	0.0001	0.25	0.0000	A	Early A	GFB
G Clearcut with legacy trees	0.0001	0.75	0.0001	K	Early K	GFB
Insect/Disease	0.0300	1.00	0.0300	R	SFM-Mi	R.vcs
J RX FIRE ONLY Low	0.0001	0.13	0.0000	E	SFM-T	E.vcs
J RX FIRE ONLY Low	0.0001	0.13	0.0000	I	SFM-M	I.vcs
J RX FIRE ONLY Low	0.0001	0.38	0.0000	R	SFM-Mi	R.vcs
K RX FIRE ONLY Moderate	0.0001	0.13	0.0000	E	SFM-T	E.vcs
K RX FIRE ONLY Moderate	0.0001	0.13	0.0000	I	SFM-M	I.vcs
K RX FIRE ONLY Moderate	0.0001	0.38	0.0000	R	SFM-Mi	R.vcs
L RX FIRE ONLY High	0.0001	0.19	0.0000	A	Early A	GFB
L RX FIRE ONLY High	0.0001	0.06	0.0000	I	SFM-M	I.vcs
L RX FIRE ONLY High	0.0001	0.56	0.0001	K	Early K	GFB

Display Pathways

☒ From Class
☐ To Class

☐ TSD
☐ Ages

OK Cancel Apply

Appendix B figure 79a. Alternative A spruce-fir forest PNVT State N transitions continued

Class Properties for Class N: SFM-To N.vcs

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	N	SFM-To	N.vcs

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
L RX FIRE ONLY High	0.0001	0.19	0.0000	R	SFM-Mi	R.vcs
M Thin under 9-inch diameter	0.0100	0.25	0.0025	E	SFM-T	E.vcs
M Thin under 9-inch diameter	0.0100	0.75	0.0075	N	SFM-To	N.vcs
Mixed Severity Fire	0.0100	0.13	0.0013	E	SFM-T	E.vcs
Mixed Severity Fire	0.0100	0.13	0.0013	I	SFM-M	I.vcs
Mixed Severity Fire	0.0100	0.38	0.0038	R	SFM-Mi	R.vcs
Nonlethal Fire	0.0100	0.13	0.0013	E	SFM-T	E.vcs
Nonlethal Fire	0.0100	0.13	0.0013	I	SFM-M	I.vcs
Nonlethal Fire	0.0100	0.38	0.0038	R	SFM-Mi	R.vcs
Stand-Replacing Fire	0.0100	0.19	0.0019	A	Early A	GFB
Stand-Replacing Fire	0.0100	0.06	0.0006	I	SFM-M	I.vcs
Stand-Replacing Fire	0.0100	0.56	0.0056	K	Early K	GFB
Stand-Replacing Fire	0.0100	0.19	0.0019	R	SFM-Mi	R.vcs

Display Pathways

☒ From Class
☐ To Class

☐ TSD
☐ Ages

OK Cancel Apply

Appendix B figure 79b. Alternative A spruce-fir forest PNVT State N transitions continued

Class Properties for Class O: SFM-To O.vcm

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	O	SFM-To	O.vcm

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
2_L	0.0016	1.00	0.0016	L	SFM-In	L.sc
2_M	0.0051	1.00	0.0051	M	SFM-To	M.mcs
2_N	0.0022	1.00	0.0022	N	SFM-To	N.vcs
C Thin from below to target	0.0100	0.08	0.0008	D	SFM-T	D.mcs
C Thin from below to target	0.0100	0.08	0.0008	E	SFM-T	E.vcs
C Thin from below to target	0.0100	0.08	0.0008	F	SFM-T	F.vcm
C Thin from below to target	0.0100	0.25	0.0025	M	SFM-To	M.mcs
C Thin from below to target	0.0100	0.25	0.0025	N	SFM-To	N.vcs
D Thin under	0.0100	0.25	0.0025	F	SFM-T	F.vcm
E GroupSelect with matrix thin	0.0001	0.08	0.0000	H	SFM-I	H.mcs
E GroupSelect with matrix thin	0.0001	0.17	0.0000	J	SFM-M	J.vcm
E GroupSelect with matrix thin	0.0001	0.25	0.0000	Q	SFM-In	Q.mcs
E GroupSelect with matrix thin	0.0001	0.50	0.0001	S	SFM-Mi	S.vcm

Display Pathways

☒ From Class

☐ To Class

☐ TSD

☐ Ages

OK Cancel Apply

Appendix B figure 80. Alternative A spruce-fir forest PNVTs' potentially management driven (23) and naturally driven (13) transitions for State O. Alternative A spruce-fir forest PNVT State O transitions continued in Appendix B figures 80a and 80b

Class Properties for Class O: SFM-To O.vcm

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	O	SFM-To	O.vcm

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
G Clearcut with legacy trees	0.0100	0.25	0.0025	A	Early A	GFB
G Clearcut with legacy trees	0.0100	0.75	0.0075	K	Early K	GFB
Insect/Disease	0.0300	1.00	0.0300	S	SFM-Mi	S.vcm
J RX FIRE ONLY Low	0.0001	0.25	0.0000	F	SFM-T	F.vcm
J RX FIRE ONLY Low	0.0001	0.75	0.0001	O	SFM-To	O.vcm
K RX FIRE ONLY Moderate	0.0001	0.25	0.0000	F	SFM-T	F.vcm
K RX FIRE ONLY Moderate	0.0001	0.75	0.0001	O	SFM-To	O.vcm
L RX FIRE ONLY High	0.0001	0.08	0.0000	E	SFM-T	E.vcs
L RX FIRE ONLY High	0.0001	0.08	0.0000	F	SFM-T	F.vcm
L RX FIRE ONLY High	0.0001	0.08	0.0000	J	SFM-M	J.vcm
L RX FIRE ONLY High	0.0001	0.25	0.0000	N	SFM-To	N.vcs
L RX FIRE ONLY High	0.0001	0.25	0.0000	S	SFM-Mi	S.vcm
M Thin under 9-inch diameter	0.0100	0.25	0.0025	F	SFM-T	F.vcm

Display Pathways

☒ From Class

☐ To Class

☐ TSD

☐ Ages

OK Cancel Apply

Appendix B figure 80a. Alternative A spruce-fir forest PNVT State O transitions continued

Class Properties for Class O: SFM-To O.vcm

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	O	SFM-To	O.vcm

SFM-To - Spruce-Fir Mix-Shade Tolerant
O.vcm - O.VLarge_Closed_Multi

Display Pathways

☒ From Class
☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
L RX FIRE ONLY High	0.0001	0.25	0.0000	S	SFM-Mi	S.vcm
M Thin under 9-inch diameter	0.0100	0.25	0.0025	F	SFM-T	F.vcm
M Thin under 9-inch diameter	0.0100	0.75	0.0075	O	SFM-To	O.vcm
Mixed Severity Fire	0.0100	0.25	0.0025	F	SFM-T	F.vcm
Mixed Severity Fire	0.0100	0.75	0.0075	O	SFM-To	O.vcm
Nonlethal Fire	0.0100	0.25	0.0025	F	SFM-T	F.vcm
Nonlethal Fire	0.0100	0.75	0.0075	O	SFM-To	O.vcm
Stand-Replacing Fire	0.0100	0.08	0.0008	E	SFM-T	E.vcs
Stand-Replacing Fire	0.0100	0.08	0.0008	F	SFM-T	F.vcm
Stand-Replacing Fire	0.0100	0.08	0.0008	J	SFM-M	J.vcm
Stand-Replacing Fire	0.0100	0.25	0.0025	N	SFM-To	N.vcs
Stand-Replacing Fire	0.0100	0.25	0.0025	S	SFM-Mi	S.vcm

New
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☐ TSD
☐ Ages
Sort...

OK Cancel Apply

Appendix B figure 80b. Alternative A spruce-fir forest PNVT State O transitions continued

Class Properties for Class P: SFM-In P.so

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	P	SFM-In	P.so

SFM-In - Spruce-Fir Mix Shade-Intolerant
P.so - P.Seed/Sap/Small_Open

Display Pathways

☒ From Class
☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
2_L	0.3333	1.00	0.3333	L	SFM-In	L.sc
B Free thin all sizes to target	0.0100	1.00	0.0100	P	SFM-In	P.so
C Thin from below to target	0.0100	1.00	0.0100	P	SFM-In	P.so
J RX FIRE ONLY Low	0.0001	0.08	0.0000	A	Early A	GFB
J RX FIRE ONLY Low	0.0001	0.17	0.0000	G	SFM-I	G.so
J RX FIRE ONLY Low	0.0001	0.25	0.0000	K	Early K	GFB
K RX FIRE ONLY Moderate	0.0001	0.08	0.0000	A	Early A	GFB
K RX FIRE ONLY Moderate	0.0001	0.08	0.0000	G	SFM-I	G.so
K RX FIRE ONLY Moderate	0.0001	0.08	0.0000	H	SFM-I	H.mos
K RX FIRE ONLY Moderate	0.0001	0.25	0.0000	K	Early K	GFB
K RX FIRE ONLY Moderate	0.0001	0.25	0.0000	Q	SFM-In	Q.mos
L RX FIRE ONLY High	0.0001	0.25	0.0000	A	Early A	GFB
L RX FIRE ONLY High	0.0001	0.75	0.0001	K	Early K	GFB

New
Copy
Delete

☐ TSD
☐ Ages
Sort...

OK Cancel Apply

Appendix B figure 81. Alternative A spruce-fir forest PNVTs' potentially management driven (13) and naturally driven (11) transitions for State P. Alternative A spruce-fir forest PNVT State P transitions continued in Appendix B figure 81a

Class Properties for Class P: SFM-In P.so

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	P	SFM-In	P.so

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
L RX FIRE ONLY High	0.0001	0.75	0.0001	K	Early K	GFB
M Thin under 9-inch diameter	0.0001	1.00	0.0001	P	SFM-In	P.so
Mixed Severity Fire	0.0100	0.08	0.0008	A	Early A	GFB
Mixed Severity Fire	0.0100	0.08	0.0008	G	SFM-I	G.so
Mixed Severity Fire	0.0100	0.08	0.0008	H	SFM-I	H.mos
Mixed Severity Fire	0.0100	0.25	0.0025	K	Early K	GFB
Mixed Severity Fire	0.0100	0.25	0.0025	Q	SFM-In	Q.mos
Nonlethal Fire	0.0100	0.08	0.0008	A	Early A	GFB
Nonlethal Fire	0.0100	0.17	0.0017	G	SFM-I	G.so
Nonlethal Fire	0.0100	0.25	0.0025	K	Early K	GFB
Stand-Replacing Fire	0.0001	0.25	0.0000	A	Early A	GFB
Stand-Replacing Fire	0.0001	0.75	0.0001	K	Early K	GFB

Display Pathways

☒ From Class
☐ To Class

☐ TSD
☐ Ages

OK Cancel Apply

Appendix B figure 81a. Alternative A spruce-fir forest PNV State P transitions continued

Class Properties for Class Q: SFM-In Q.mos

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	Q	SFM-In	Q.mos

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
2_R	0.0270	1.00	0.0270	R	SFM-Mi	R.vos
2_S	0.0127	1.00	0.0127	S	SFM-Mi	S.vom
B Free thin all sizes to target	0.0100	0.02	0.0002	A	Early A	GFB
B Free thin all sizes to target	0.0100	0.02	0.0002	G	SFM-I	G.so
B Free thin all sizes to target	0.0100	0.17	0.0017	H	SFM-I	H.mos
B Free thin all sizes to target	0.0100	0.02	0.0002	I	SFM-M	I.vos
B Free thin all sizes to target	0.0100	0.02	0.0002	J	SFM-M	J.vom
B Free thin all sizes to target	0.0100	0.06	0.0006	K	Early K	GFB
B Free thin all sizes to target	0.0100	0.06	0.0006	P	SFM-In	P.so
B Free thin all sizes to target	0.0100	0.06	0.0006	R	SFM-Mi	R.vos
B Free thin all sizes to target	0.0100	0.06	0.0006	S	SFM-Mi	S.vom
C Thin from below to target	0.0100	0.02	0.0002	A	Early A	GFB
C Thin from below to target	0.0100	0.02	0.0002	G	SFM-I	G.so

Display Pathways

☒ From Class
☐ To Class

☐ TSD
☐ Ages

OK Cancel Apply

Appendix B figure 82. Alternative A spruce-fir forest PNVs' potentially management driven (43) and naturally driven (9) transitions for State Q. Alternative A spruce-fir forest PNV State Q transitions continued in Appendix B figures 82a through 82c

Class Properties for Class Q: SFM-In Q.mos

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	Q	SFM-In	Q.mos

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
C Thin from below to target	0.0100	0.02	0.0002	I	SFM-M	I.vos
C Thin from below to target	0.0100	0.02	0.0002	J	SFM-M	J.vom
C Thin from below to target	0.0100	0.06	0.0006	K	Early K	GFB
C Thin from below to target	0.0100	0.06	0.0006	M	SFM-To	M.mcs
C Thin from below to target	0.0100	0.06	0.0006	P	SFM-In	P.so
C Thin from below to target	0.0100	0.06	0.0006	R	SFM-Mi	R.vos
D Thin under	0.0100	0.02	0.0002	G	SFM-I	G.so
D Thin under	0.0100	0.17	0.0017	H	SFM-I	H.mos
D Thin under	0.0100	0.02	0.0002	I	SFM-M	I.vos
D Thin under	0.0100	0.04	0.0004	J	SFM-M	J.vom
D Thin under	0.0100	0.06	0.0006	P	SFM-In	P.so
D Thin under	0.0100	0.06	0.0006	R	SFM-Mi	R.vos
D Thin under	0.0100	0.13	0.0013	S	SFM-Mi	S.vom

Display Pathways

☒ From Class

☐ To Class

Buttons: New, Copy, Delete, TSD, Ages, Sort...

OK Cancel Apply

Appendix B figure 82a. Alternative A spruce-fir forest PNV State Q transitions continued

Class Properties for Class Q: SFM-In Q.mos

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	Q	SFM-In	Q.mos

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
E GroupSelect with matrix thin	0.0100	0.06	0.0006	G	SFM-I	G.so
E GroupSelect with matrix thin	0.0100	0.13	0.0013	H	SFM-I	H.mos
E GroupSelect with matrix thin	0.0100	0.06	0.0006	J	SFM-M	J.vom
E GroupSelect with matrix thin	0.0100	0.19	0.0019	P	SFM-In	P.so
E GroupSelect with matrix thin	0.0100	0.19	0.0019	S	SFM-Mi	S.vom
G Clearcut with legacy trees	0.0100	0.25	0.0025	A	Early A	GFB
G Clearcut with legacy trees	0.0100	0.75	0.0075	K	Early K	GFB
J RX FIRE ONLY Low	0.0001	0.25	0.0000	H	SFM-I	H.mos
J RX FIRE ONLY Low	0.0001	0.75	0.0001	Q	SFM-In	Q.mos
K RX FIRE ONLY Moderate	0.0001	0.25	0.0000	H	SFM-I	H.mos
K RX FIRE ONLY Moderate	0.0001	0.75	0.0001	Q	SFM-In	Q.mos
L RX FIRE ONLY High	0.0001	0.13	0.0000	A	Early A	GFB
L RX FIRE ONLY High	0.0001	0.13	0.0000	H	SFM-I	H.mos

Display Pathways

☒ From Class

☐ To Class

Buttons: New, Copy, Delete, TSD, Ages, Sort...

OK Cancel Apply

Appendix B figure 82b. Alternative A spruce-fir forest PNV State Q transitions continued

Class Properties for Class Q: SFM-In Q.mos

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	Q	SFM-In	Q.mos

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
L RX FIRE ONLY High	0.0001	0.38	0.0000	K	Early K	GFB
M Thin under 9-inch diameter	0.0100	0.02	0.0002	D	SFM-T	D.mcs
M Thin under 9-inch diameter	0.0100	0.02	0.0002	G	SFM-I	G.so
M Thin under 9-inch diameter	0.0100	0.21	0.0021	H	SFM-I	H.mos
M Thin under 9-inch diameter	0.0100	0.06	0.0006	M	SFM-To	M.mcs
M Thin under 9-inch diameter	0.0100	0.06	0.0006	P	SFM-In	P.so
Mixed Severity Fire	0.0100	0.25	0.0025	H	SFM-I	H.mos
Mixed Severity Fire	0.0100	0.75	0.0075	Q	SFM-In	Q.mos
Nonlethal Fire	0.0100	0.25	0.0025	H	SFM-I	H.mos
Nonlethal Fire	0.0100	0.75	0.0075	Q	SFM-In	Q.mos
Stand-Replacing Fire	0.0100	0.13	0.0013	A	Early A	GFB
Stand-Replacing Fire	0.0100	0.13	0.0013	H	SFM-I	H.mos
Stand-Replacing Fire	0.0100	0.38	0.0038	K	Early K	GFB

Display Pathways

☒ From Class

☐ To Class

☐ TSD

☐ Ages

OK Cancel Apply

Appendix B figure 82c. Alternative A spruce-fir forest PNV State Q transitions continued

Class Properties for Class R: SFM-Mi R.vos

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	R	SFM-Mi	R.vos

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
2_L	0.0034	1.00	0.0034	L	SFM-In	L.sc
2_N	0.0104	1.00	0.0104	N	SFM-To	N.vcs
2_O	0.0034	1.00	0.0034	O	SFM-To	O.vcm
2_P	0.0034	1.00	0.0034	P	SFM-In	P.so
2_S	0.0068	1.00	0.0068	S	SFM-Mi	S.vom
C Thin from below to target	0.0100	0.25	0.0025	I	SFM-M	I.vos
C Thin from below to target	0.0100	0.75	0.0075	R	SFM-Mi	R.vos
D Thin under	0.0100	0.25	0.0025	I	SFM-M	I.vos
D Thin under	0.0100	0.75	0.0075	R	SFM-Mi	R.vos
E GroupSelect with matrix thin	0.0100	0.08	0.0008	D	SFM-T	D.mcs
E GroupSelect with matrix thin	0.0100	0.08	0.0008	I	SFM-M	I.vos
E GroupSelect with matrix thin	0.0100	0.08	0.0008	J	SFM-M	J.vom
E GroupSelect with matrix thin	0.0100	0.25	0.0025	M	SFM-To	M.mcs

Display Pathways

☒ From Class

☐ To Class

☐ TSD

☐ Ages

OK Cancel Apply

Appendix B figure 83. Appendix B figure 83. Alternative A spruce-fir forest PNVTs' potentially management driven (19) and naturally driven (12) transitions for State R. Alternative A spruce-fir forest PNV State R transitions continued in Appendix B figures 83a and 83b

Class Properties for Class R: SFM-Mi R.vos

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	R	SFM-Mi	R.vos

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
E GroupSelect with matrix thin	0.0100	0.25	0.0025	S	SFM-Mi	S.vom
G Clearcut with legacy trees	0.0100	0.17	0.0017	A	Early A	GFB
G Clearcut with legacy trees	0.0100	0.08	0.0008	I	SFM-M	I.vos
G Clearcut with legacy trees	0.0100	0.50	0.0050	K	Early K	GFB
J RX FIRE ONLY Low	0.0001	0.25	0.0000	I	SFM-M	I.vos
J RX FIRE ONLY Low	0.0001	0.75	0.0001	R	SFM-Mi	R.vos
K RX FIRE ONLY Moderate	0.0001	0.25	0.0000	I	SFM-M	I.vos
K RX FIRE ONLY Moderate	0.0001	0.75	0.0001	R	SFM-Mi	R.vos
L RX FIRE ONLY High	0.0001	0.08	0.0000	A	Early A	GFB
L RX FIRE ONLY High	0.0001	0.17	0.0000	I	SFM-M	I.vos
L RX FIRE ONLY High	0.0001	0.25	0.0000	K	Early K	GFB
Mixed Severity Fire	0.0100	0.25	0.0025	I	SFM-M	I.vos
Mixed Severity Fire	0.0100	0.75	0.0075	R	SFM-Mi	R.vos

Display Pathways

☒ From Class
☐ To Class

☐ TSD
☐ Ages

OK Cancel Apply

Appendix B figure 83a. Alternative A spruce-fir forest PNV State R transitions continued

Class Properties for Class R: SFM-Mi R.vos

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	R	SFM-Mi	R.vos

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
K RX FIRE ONLY Moderate	0.0001	0.25	0.0000	I	SFM-M	I.vos
K RX FIRE ONLY Moderate	0.0001	0.75	0.0001	R	SFM-Mi	R.vos
L RX FIRE ONLY High	0.0001	0.08	0.0000	A	Early A	GFB
L RX FIRE ONLY High	0.0001	0.17	0.0000	I	SFM-M	I.vos
L RX FIRE ONLY High	0.0001	0.25	0.0000	K	Early K	GFB
Mixed Severity Fire	0.0100	0.25	0.0025	I	SFM-M	I.vos
Mixed Severity Fire	0.0100	0.75	0.0075	R	SFM-Mi	R.vos
Nonlethal Fire	0.0100	0.25	0.0025	I	SFM-M	I.vos
Nonlethal Fire	0.0100	0.75	0.0075	R	SFM-Mi	R.vos
Stand-Replacing Fire	0.0001	0.08	0.0000	A	Early A	GFB
Stand-Replacing Fire	0.0001	0.17	0.0000	I	SFM-M	I.vos
Stand-Replacing Fire	0.0001	0.25	0.0000	K	Early K	GFB

Display Pathways

☒ From Class
☐ To Class

☐ TSD
☐ Ages

OK Cancel Apply

Appendix B figure 83b. Alternative A spruce-fir forest PNV State R transitions continued

Class Properties for Class S: SFM-Mi S.vom

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	S	SFM-Mi	S.vom

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	Stage	To Class
2_L	0.0117	1.00	0.0117	L	SFM-In	L.sc	
2_Q	0.0117	1.00	0.0117	Q	SFM-In	Q.mos	
2_R	0.0117	1.00	0.0117	R	SFM-Mi	R.vos	
C Thin from below to target	0.0100	0.06	0.0006	A	Early A	GFB	
C Thin from below to target	0.0100	0.17	0.0017	I	SFM-M	I.vos	
C Thin from below to target	0.0100	0.03	0.0003	J	SFM-M	J.vom	
C Thin from below to target	0.0100	0.17	0.0017	K	Early K	GFB	
C Thin from below to target	0.0100	0.50	0.0050	R	SFM-Mi	R.vos	
D Thin under	0.0100	0.04	0.0004	I	SFM-M	I.vos	
D Thin under	0.0100	0.21	0.0021	J	SFM-M	J.vom	
D Thin under	0.0100	0.13	0.0013	R	SFM-Mi	R.vos	
E GroupSelect with matrix thin	0.0100	0.17	0.0017	I	SFM-M	I.vos	
E GroupSelect with matrix thin	0.0100	0.08	0.0008	I	SFM-M	I.vom	

Display Pathways
☒ From Class
☐ To Class

Buttons: New, Copy, Delete, TSD, Ages, Sort..., OK, Cancel, Apply

Appendix B figure 84. Alternative A spruce-fir forest PNVTs' potentially management driven (23) and naturally driven (10) transitions for State S. Alternative A spruce-fir forest PNV State S transitions continued in Appendix B figures 84a and 84b

Class Properties for Class S: SFM-Mi S.vom

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	S	SFM-Mi	S.vom

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	Stage	To Class
E GroupSelect with matrix thin	0.0100	0.50	0.0050	R	SFM-Mi	R.vos	
G Clearcut with legacy trees	0.0001	0.25	0.0000	A	Early A	GFB	
G Clearcut with legacy trees	0.0001	0.75	0.0001	K	Early K	GFB	
J RX FIRE ONLY Low	0.0001	0.25	0.0000	J	SFM-M	J.vom	
J RX FIRE ONLY Low	0.0001	0.75	0.0001	S	SFM-Mi	S.vom	
K RX FIRE ONLY Moderate	0.0001	0.25	0.0000	J	SFM-M	J.vom	
K RX FIRE ONLY Moderate	0.0001	0.75	0.0001	S	SFM-Mi	S.vom	
L RX FIRE ONLY High	0.0001	0.06	0.0000	A	Early A	GFB	
L RX FIRE ONLY High	0.0001	0.19	0.0000	J	SFM-M	J.vom	
L RX FIRE ONLY High	0.0001	0.17	0.0000	K	Early K	GFB	
M Thin under 9-inch diameter	0.0100	0.01	0.0001	H	SFM-I	H.mos	
M Thin under 9-inch diameter	0.0100	0.24	0.0024	J	SFM-M	J.vom	
M Thin under 9-inch diameter	0.0100	0.04	0.0004	I	SFM-M	I.vom	

Display Pathways
☒ From Class
☐ To Class

Buttons: New, Copy, Delete, TSD, Ages, Sort..., OK, Cancel, Apply

Appendix B figure 84a. Alternative A spruce-fir forest PNV State S transitions continued

Class Properties for Class S: SFM-Mi S.vom

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	S	SFM-Mi	S.vom

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	To Class		
				Box	Cover	Stage
L RX FIRE ONLY High	0.0001	0.19	0.0000	J	SFM-M	J.vom
L RX FIRE ONLY High	0.0001	0.17	0.0000	K	Early K	GFB
M Thin under 9-inch diameter	0.0100	0.01	0.0001	H	SFM-I	H.mos
M Thin under 9-inch diameter	0.0100	0.24	0.0024	J	SFM-M	J.vom
M Thin under 9-inch diameter	0.0100	0.04	0.0004	Q	SFM-In	Q.mos
Mixed Severity Fire	0.0100	0.25	0.0025	J	SFM-M	J.vom
Mixed Severity Fire	0.0100	0.75	0.0075	S	SFM-Mi	S.vom
Nonlethal Fire	0.0100	0.25	0.0025	J	SFM-M	J.vom
Nonlethal Fire	0.0100	0.75	0.0075	S	SFM-Mi	S.vom
Stand-Replacing Fire	0.0001	0.06	0.0000	A	Early A	GFB
Stand-Replacing Fire	0.0001	0.19	0.0000	J	SFM-M	J.vom
Stand-Replacing Fire	0.0001	0.17	0.0000	K	Early K	GFB

Display Pathways

☒ From Class

☐ To Class

S
-Mi - Spruce-Fir-Mix Mixed Shade Tolerant
S.vom - S.VLarge_Open_Multi

☐ TSD ☐ Ages

Appendix B figure 84b. Alternative A spruce-fir forest PNV State S transitions continued

Woodland PNVTs (other than piñon-juniper woodland PNVT)

Madrean Pine-Oak Woodland PNVT

Appendix B table 12. Madrean pine-oak woodland PNVT crosswalks developed by Region 3 (19 March 2010) used in the determination of departure from HRV and DCs. DCs were provided by the Regional Office, and HRV was derived from the Nature Conservancy (Schussman and Gori, 2006)

Current Trends Model			R3 Mid-scale Existing Vegetation Mapping	Reference Condition				Baseline Desired Conditions	
source	state	description	dominance unit - size/cover	source	TNC state	historic mean (%)	description	structural stage (%)	description
USFS R3 model MPO	A	GFB/SHR	= NON-TREED: Recently burned, grass, forb, and shrub types - N/A	TNC Madrean Pine Oak Woodland	A	4	Grass, seedling/sapling	4	Reference condition
	B	SSO	= All tree types - Seedling/sapling - open canopy		F	5	Resprouter dominated	5	Reference condition
	E	SSC	= All tree types - Seedling/sapling - closed canopy		C	24	Young with grass understory, moderate canopy cover	13	Reference condition, and conditions indicative of even-aged stand dynamics and the development of Mexican spotted owl (MSO) habitat ¹
	C	SMO	= All tree types - Small - open canopy		B	3	Young with grass understory, closed canopy	3	Reference condition
	F	SMC	= All tree types - Small - closed canopy		D	60	Old with grass understory, moderate canopy cover	60	Reference condition
	D	MVO	= All tree types - Medium - open canopy, very large - open canopy		E	4	Old with grass understory, closed canopy	15	Conditions indicative of MSO habitat and mature closed-forest conditions ²
	G	MVC	= All tree types - Medium - closed canopy, very large - closed canopy						

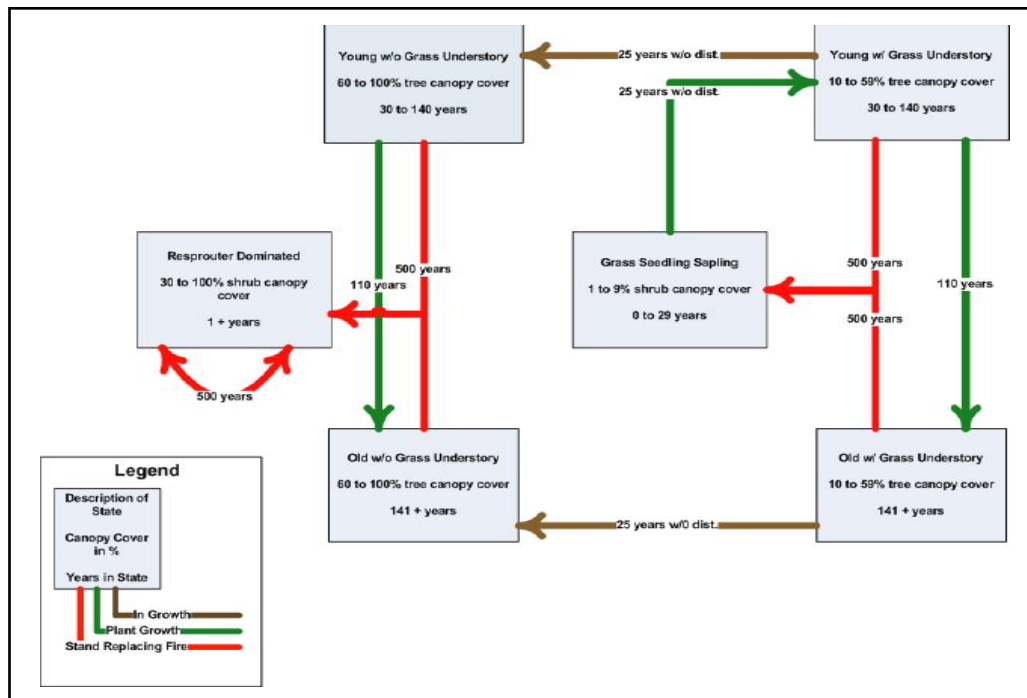
¹ Reflects the reference condition of 24% minus the additional 9% allocated to state E for MSO habitat (mature-closed)

² Reference condition for this state is 4%

Madrean Pine-Oak Woodland State and Transition Models

The following is Schussman and Gori's (2006) discussion concerning the current modeling results for Madrean pine-oak woodlands.

Appendix B figure 85 displays a conceptual current state and transition model for the Madrean pine-oak woodland vegetation type (Schussman and Gori, 2006) used in VDDT modeling. In table 13³², Schussman and Gori (2006) describe the parameters included or not included within the current VDDT model (Schussman and Gori, 2006), as well as the sources of information and any assumptions used to create the model parameters.



Appendix B figure 85. Conceptual current state and transition model for the Madrean pine-oak woodland vegetation type, frequency of transitions are noted (Schussman and Gori, 2006)

³² See Schussman and Gori, 2006

Appendix B table 13. Identification of historic transitions, frequency of transitions, sources of information and assumptions used to develop the frequency of transitions and their effects on vegetation states included in the VDDT model for Madrean pine-oak woodland (adapted from Schussman and Gori, 2006)

Transition Type	Transition Frequency or Length	Source	Assumptions
In-growth	After 25 years without fire	Barton et al., 2001	Based on Barton et al. (2001) study that showed that pines need 20 to 30 years of fire free periods in order to establish, we determined that in growth would occur in areas that had been free of fire for 25 years.
Plant growth (25 years)	After 25 years without fire	Barton et al., 2001	Based on Barton et al. (2001) study that showed that pines need 20 to 30 years of fire free periods in order to establish, we determined that plant growth would occur in areas that had been free of fire for 25 years, resulting in a transition from a grass/seedling/sapling state to a young pine oak woodland.
Plant growth (110 years)	110 years	Andrew Barton, personal communication ¹	Based on unpublished data on the age of various size classes of pine in the Chiricahua Mountains of southeastern Arizona, we determined that it takes 110 years for a pine to grow from a young pine (5 cm DBH) to an old pine (8 inches DBH).
Stand replacing fire	Every 500 years	Don Falk and Jose Iñiguez, personal communication ¹ and unpublished data	In a study of large homogenous stands of ponderosa pine, Don Falk could find no tree-ring evidence of a stand-replacing fire that was 1,000 acres or larger in size over a period of 500 years. His sampling design, however, could not discern a stand-replacing fire of 100 acres in size over the same time period. In general, Don Falk's theoretical and empirical work indicates that estimates of fire frequency are area sensitive. Based on a recently-completed study of Madrean pine-oak in the Catalina and Rincon Mountains, Arizona, Jose Iñiguez estimates the probability of a SRF 1,000 acres in size in large homogenous pine-oak stands as once every 600 years (0.0017) and in small heterogeneous stands as once every 300 years (0.0033). Considering pine-oak woodland regionally (1,416,765 acres in Region 3) and using 1,000 pixels in the simulation, pixel size would be 1,416 acres which is close to the event size (1,000 acres) of the above SRF estimates. For this reason and because there was no a priori way to distinguish large homogeneous vs. small heterogeneous areas of Madrean pine-oak based on existing data, we used a SRF probability of every 500 years (0.002). It is important to note that there is little difference in final output using a SRF probability of 0.001 and 0.002 which bracket the values for a 1000-acre stand-replacing event discussed above. However, there is a significant change in the output if a SRF probability of 0.0033 is used.
Surface fire	Every 6 to 11.5 years	Fulé and Covington, 1996, 1997, 1998 and 1999; Fulé et al., 2005; Kaib et al., 1996; Swetnam and Baisan, 1996; Swetnam et al., 1992 and 2001	Mean fire return intervals (MFRI) for fires that scarred 25% or more trees at 17 sites located in Arizona and northern Mexico ranged between 6 and 14.5 years. This is more than a two-fold difference between sites at the low vs. high end of the MFRI range. All but 1 site (Bear Canyon Catalina Mountains, Arizona) fell between 6 and 11.5 years with Bear Canyon appearing to be an outlier so we eliminated this site from the analysis. Running the model at an MFRI of 14.5 years (0.069) significantly changes the output. Surface fire potentially affects all vegetation states including the resprouter dominated state which can move back into pine-oak woodland following a period of 100 years that allows for pine recruitment and frequent surface fires to reduce resprouting species (Drew Barton, personal communication ²).
Mixed severity fire	At the same frequency as surface fires but only affects states or stands that have not experienced a surface fire for > 50 years	Barton 1999 and 2002; Fulé et al., 2000	An increase in the density of pines, oaks and other resprouters as well as a compositional shift in favor of oaks following a fire-free period of more than 50 years leads to a mixed severity fire with some patches experiencing high-intensity, crown replacing fire that moves vegetation from a closed canopy stand (i.e., without a grass understory) to the resprouter dominated state with few to no pines. Other patches, however, experience lower intensity fire that thins vegetation and moves it from a closed canopy stand to an open canopy stand with a grass understory (after a post-burn recovery period). The probability of high vs. low intensity effects on patches for the mixed severity fire was assumed to be equal (= 0.5). The model was also run assuming the probability of high vs. low intensity effects was 0.67 vs. 0.33, respectively. The results were very similar to those in Table 6-3, except that more of the historic landscape ended up in the resprouter dominated state (1.3 to 5.2% more, on average, depending on the FRI); output for this second set of runs is available from D. Gori on request.

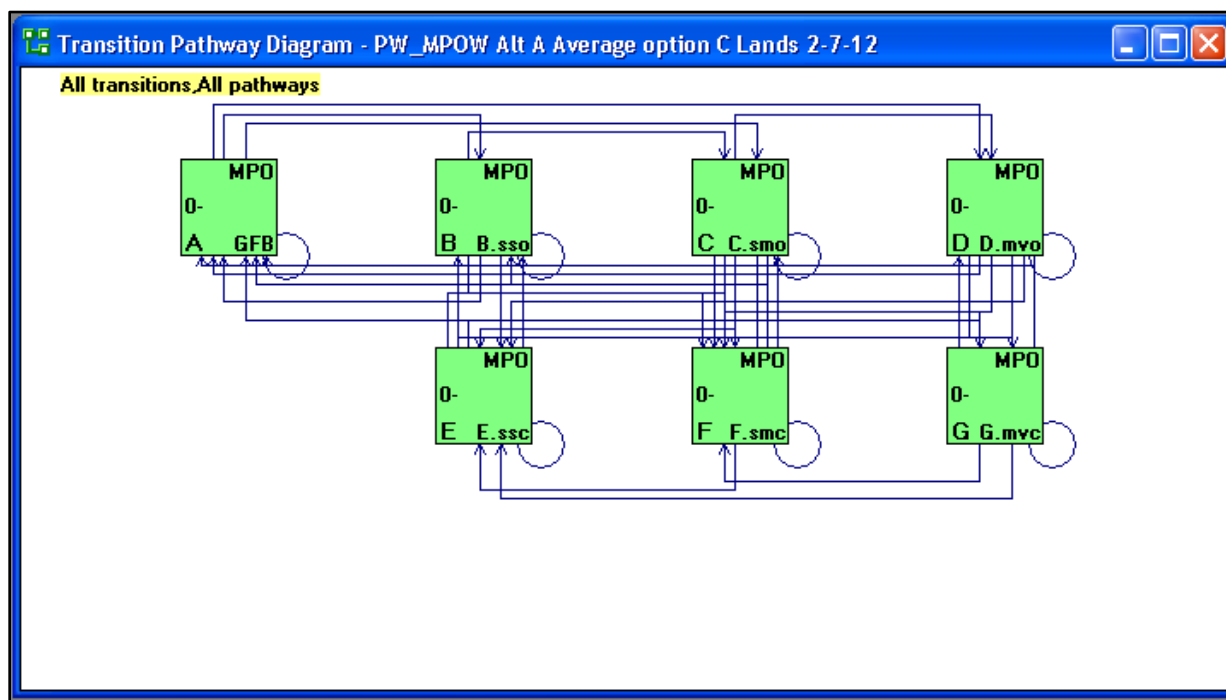
¹ Don Falk and Jose Iñiguez's personal communications with Schussman and Gori (2006)

² Drew Barton's personal communications with Schussman and Gori (2006)

Results of the Madrean pine oak woodland historic VDDT model show some variability in the 900-year average percent of the modeled landscape in each state based on the fire return interval range. Even with this variability, all models showed a consistent pattern of the majority of the historic vegetation occurring in the old pine-oak with understory state (48.6%, 60.2% and 71.2% for fire return intervals of 11.5, 9, and 6 years respectively). A significant proportion of the vegetation also occurs in the young pine-oak with understory state. A comparison of simulated historic conditions and current conditions shows an increase in the amount of old pine-oak without understory (76.5%) from all historic model runs. Additionally, the current model has 14.8% of the landscape in the resprouter dominated state compared to less than 10% in the historic model.

These results highlight the importance of maintaining a frequent surface fire regime within the Madrean pine oak woodland vegetation type. Without frequent fires the modeled landscape shifted from open canopied young and old pine oak woodland to denser canopied old pine oak woodland. The increase in canopy cover and oak abundance resulted in a larger proportion of the stand replacing fires transitioning to a resprouter dominated community. These modeled results are similar to the changes that have been documented within the vegetation type (Barton 1999 and 2002; Barton et al., 2001; Fulé and Covington, 1997 and 1998; Fulé et al., 2000).

Appendix B figures 86 through 93 display the actual VDDT model for Madrean pine-oak woodland, developed by the USDA FS Southwestern Region 3, and utilized during the planning effort on the A-SNFs to determine future departure conditions and assessment of trends.



Appendix B figure 86. Actual Alternative A VDDT state and transition model used for assessing trends in the Madrean pine-oak woodland PNVt on the A-SNFs

Class Properties for Class A: MPO GFB

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	A	MPO	GFB

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
2_B	0.0138	1.00	0.0138	B	MPO	B.sso
2_C	0.0031	1.00	0.0031	C	MPO	C.smo
2_D	0.0159	1.00	0.0159	D	MPO	D.mvo
J RX FIRE ONLY Low	0.0001	1.00	0.0001	A	MPO	GFB
K RX FIRE ONLY Moderate	0.0001	1.00	0.0001	A	MPO	GFB
Mixed Severity Fire	0.0100	1.00	0.0100	A	MPO	GFB
Nonlethal Fire	0.0100	1.00	0.0100	A	MPO	GFB
Stand-Replacing Fire	0.0001	1.00	0.0001	A	MPO	GFB

Display Pathways

☒ From Class
☐ To Class

☐ TSD
☐ Ages

OK Cancel Apply

Appendix B figure 87. Alternative A Madrean pine-oak woodland PNVTs' potentially management driven (2) and naturally driven (6) transitions for State A

Class Properties for Class B: MPO B.sso

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	B	MPO	B.sso

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
2_C	0.0249	1.00	0.0249	C	MPO	C.smo
2_E	0.0359	1.00	0.0359	E	MPO	E.ssc
2_F	0.0280	1.00	0.0280	F	MPO	F.smc
J RX FIRE ONLY Low	0.0100	0.09	0.0009	A	MPO	GFB
J RX FIRE ONLY Low	0.0100	0.91	0.0091	B	MPO	B.sso
K RX FIRE ONLY Moderate	0.0001	0.55	0.0001	A	MPO	GFB
K RX FIRE ONLY Moderate	0.0001	0.45	0.0000	B	MPO	B.sso
L RX FIRE ONLY High	0.0001	1.00	0.0001	A	MPO	GFB
Mixed Severity Fire	0.0100	0.55	0.0055	A	MPO	GFB
Mixed Severity Fire	0.0100	0.45	0.0045	B	MPO	B.sso
Nonlethal Fire	0.0100	0.09	0.0009	A	MPO	GFB
Nonlethal Fire	0.0100	0.91	0.0091	B	MPO	B.sso
Stand-Replacing Fire	0.0100	1.00	0.0100	A	MPO	GFB

Display Pathways

☒ From Class
☐ To Class

☐ TSD
☐ Ages

OK Cancel Apply

Appendix B figure 88. Alternative A Madrean pine-oak woodland PNVTs' potentially management driven (5) and naturally driven (8) transitions for State B

Class Properties for Class C: MPO C.smo

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	C	MPO	C.smo

MPO - Madrean Pine-Oak Woodlands
C.smo - C.Small_Open

Display Pathways

☒ From Class
☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
2_B	0.0036	1.00	0.0036	B	MPO	B.sso
2_D	0.0457	1.00	0.0457	D	MPO	D.mvo
2_E	0.0012	1.00	0.0012	E	MPO	E.ssc
2_F	0.0409	1.00	0.0409	F	MPO	F.smc
2_G	0.0073	1.00	0.0073	G	MPO	G.mvc
J RX FIRE ONLY Low	0.0100	0.09	0.0009	A	MPO	GFB
J RX FIRE ONLY Low	0.0100	0.91	0.0091	C	MPO	C.smo
K RX FIRE ONLY Moderate	0.0001	0.55	0.0001	A	MPO	GFB
K RX FIRE ONLY Moderate	0.0001	0.45	0.0000	C	MPO	C.smo
L RX FIRE ONLY High	0.0001	0.91	0.0001	A	MPO	GFB
Mixed Severity Fire	0.0100	0.55	0.0055	A	MPO	GFB
Mixed Severity Fire	0.0100	0.45	0.0045	C	MPO	C.smo
Nonlethal Fire	0.0100	0.09	0.0009	A	MPO	GFB

OK Cancel Apply

Appendix B figure 89. Alternative A Madrean pine-oak woodland PNVTs' potentially management driven (5) and naturally driven (10) transitions for State C. Alternative A Madrean pine-oak woodland PNV State C transitions continued in Appendix B figure 89a

Class Properties for Class C: MPO C.smo

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	C	MPO	C.smo

MPO - Madrean Pine-Oak Woodlands
C.smo - C.Small_Open

Display Pathways

☒ From Class
☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
2_F	0.0409	1.00	0.0409	F	MPO	F.smc
2_G	0.0073	1.00	0.0073	G	MPO	G.mvc
J RX FIRE ONLY Low	0.0100	0.09	0.0009	A	MPO	GFB
J RX FIRE ONLY Low	0.0100	0.91	0.0091	C	MPO	C.smo
K RX FIRE ONLY Moderate	0.0001	0.55	0.0001	A	MPO	GFB
K RX FIRE ONLY Moderate	0.0001	0.45	0.0000	C	MPO	C.smo
L RX FIRE ONLY High	0.0001	0.91	0.0001	A	MPO	GFB
Mixed Severity Fire	0.0100	0.55	0.0055	A	MPO	GFB
Mixed Severity Fire	0.0100	0.45	0.0045	C	MPO	C.smo
Nonlethal Fire	0.0100	0.09	0.0009	A	MPO	GFB
Nonlethal Fire	0.0100	0.91	0.0091	C	MPO	C.smo
Stand-Replacing Fire	0.0100	1.00	0.0100	A	MPO	GFB

OK Cancel Apply

Appendix B figure 89a. Alternative A Madrean pine-oak woodland PNV State C transitions continued

Class Properties for Class D: MPO D.mvo

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	D	MPO	D.mvo

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
2_A	0.0002	1.00	0.0002	A	MPO	GFB
2_B	0.0040	1.00	0.0040	B	MPO	B.sso
2_C	0.0014	1.00	0.0014	C	MPO	C.smo
2_E	0.0015	1.00	0.0015	E	MPO	E.ssc
2_F	0.0007	1.00	0.0007	F	MPO	F.smc
2_G	0.0199	1.00	0.0199	G	MPO	G.mvc
J RX FIRE ONLY Low	0.0100	0.09	0.0009	A	MPO	GFB
J RX FIRE ONLY Low	0.0100	0.91	0.0091	D	MPO	D.mvo
K RX FIRE ONLY Moderate	0.0001	0.55	0.0001	A	MPO	GFB
K RX FIRE ONLY Moderate	0.0001	0.45	0.0000	D	MPO	D.mvo
L RX FIRE ONLY High	0.0001	1.00	0.0001	A	MPO	GFB
Mixed Severity Fire	0.0100	0.55	0.0055	A	MPO	GFB
Mixed Severity Fire	0.0100	0.45	0.0045	D	MPO	D.mvo

Display Pathways

☒ From Class

☐ To Class

Buttons: New, Copy, Delete, TSD, Ages, Sort...

OK Cancel Apply

Appendix B figure 90. Alternative A Madrean pine-oak woodland PNVts' potentially management driven (5) and naturally driven (11) transitions for State D. Alternative A Madrean pine-oak woodland PNVt State D transitions continued in Appendix B figure 90a

Class Properties for Class D: MPO D.mvo

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	D	MPO	D.mvo

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
2_F	0.0007	1.00	0.0007	F	MPO	F.smc
2_G	0.0199	1.00	0.0199	G	MPO	G.mvc
J RX FIRE ONLY Low	0.0100	0.09	0.0009	A	MPO	GFB
J RX FIRE ONLY Low	0.0100	0.91	0.0091	D	MPO	D.mvo
K RX FIRE ONLY Moderate	0.0001	0.55	0.0001	A	MPO	GFB
K RX FIRE ONLY Moderate	0.0001	0.45	0.0000	D	MPO	D.mvo
L RX FIRE ONLY High	0.0001	1.00	0.0001	A	MPO	GFB
Mixed Severity Fire	0.0100	0.55	0.0055	A	MPO	GFB
Mixed Severity Fire	0.0100	0.45	0.0045	D	MPO	D.mvo
Nonlethal Fire	0.0100	0.09	0.0009	A	MPO	GFB
Nonlethal Fire	0.0100	0.91	0.0091	D	MPO	D.mvo
Stand-Replacing Fire	0.0100	1.00	0.0100	A	MPO	GFB

Display Pathways

☒ From Class

☐ To Class

Buttons: New, Copy, Delete, TSD, Ages, Sort...

OK Cancel Apply

Appendix B figure 90a. Alternative A Madrean pine-oak woodland PNVt State D transitions continued

Class Properties for Class E: MPO E.ssc

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	E	MPO	E.ssc

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
2_F	0.0668	1.00	0.0668	F	MPO	F.smc
2_G	0.0015	1.00	0.0015	G	MPO	G.mvc
J RX FIRE ONLY Low	0.0100	0.16	0.0016	B	MPO	B.sso
J RX FIRE ONLY Low	0.0100	0.84	0.0084	E	MPO	E.ssc
K RX FIRE ONLY Moderate	0.0100	0.02	0.0002	A	MPO	GFB
K RX FIRE ONLY Moderate	0.0100	0.79	0.0079	B	MPO	B.sso
K RX FIRE ONLY Moderate	0.0100	0.19	0.0019	E	MPO	E.ssc
L RX FIRE ONLY High	0.0001	0.87	0.0001	A	MPO	GFB
L RX FIRE ONLY High	0.0001	0.13	0.0000	B	MPO	B.sso
Mixed Severity Fire	0.0100	0.02	0.0002	A	MPO	GFB
Mixed Severity Fire	0.0100	0.79	0.0079	B	MPO	B.sso
Mixed Severity Fire	0.0100	0.19	0.0019	E	MPO	E.ssc
Nonlethal Fire	0.0100	0.16	0.0016	B	MPO	B.sso

Display Pathways

☒ From Class
☐ To Class

☐ TSD
☐ Ages

OK Cancel Apply

Appendix B figure 91. Alternative A Madrean pine-oak woodland PNVTs' potentially management driven (7) and naturally driven (9) transitions for State E. Alternative A Madrean pine-oak woodland PNV State E transitions continued in Appendix B figure 91a

Class Properties for Class E: MPO E.ssc

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	E	MPO	E.ssc

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
K RX FIRE ONLY Moderate	0.0100	0.02	0.0002	A	MPO	GFB
K RX FIRE ONLY Moderate	0.0100	0.79	0.0079	B	MPO	B.sso
K RX FIRE ONLY Moderate	0.0100	0.19	0.0019	E	MPO	E.ssc
L RX FIRE ONLY High	0.0001	0.87	0.0001	A	MPO	GFB
L RX FIRE ONLY High	0.0001	0.13	0.0000	B	MPO	B.sso
Mixed Severity Fire	0.0100	0.02	0.0002	A	MPO	GFB
Mixed Severity Fire	0.0100	0.79	0.0079	B	MPO	B.sso
Mixed Severity Fire	0.0100	0.19	0.0019	E	MPO	E.ssc
Nonlethal Fire	0.0100	0.16	0.0016	B	MPO	B.sso
Nonlethal Fire	0.0100	0.84	0.0084	E	MPO	E.ssc
Stand-Replacing Fire	0.0100	0.87	0.0087	A	MPO	GFB
Stand-Replacing Fire	0.0100	0.13	0.0013	B	MPO	B.sso

Display Pathways

☒ From Class
☐ To Class

☐ TSD
☐ Ages

OK Cancel Apply

Appendix B figure 91a. Alternative A Madrean pine-oak woodland PNV State E transitions continued

Class Properties for Class F: MPO F.smc

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	F	MPO	F.smc

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
2_D	0.0001	1.00	0.0001	D	MPO	D.mvo
2_E	0.0004	1.00	0.0004	E	MPO	E.ssc
2_G	0.0237	1.00	0.0237	G	MPO	G.mvc
J RX FIRE ONLY Low	0.0100	0.16	0.0016	C	MPO	C.smo
J RX FIRE ONLY Low	0.0100	0.84	0.0084	F	MPO	F.smc
K RX FIRE ONLY Moderate	0.0100	0.02	0.0002	A	MPO	GFB
K RX FIRE ONLY Moderate	0.0100	0.79	0.0079	C	MPO	C.smo
K RX FIRE ONLY Moderate	0.0100	0.19	0.0019	F	MPO	F.smc
L RX FIRE ONLY High	0.0001	0.87	0.0001	A	MPO	GFB
L RX FIRE ONLY High	0.0001	0.13	0.0000	C	MPO	C.smo
M Thin under 9-inch diameter	0.0001	0.14	0.0000	G	MPO	G.mvc
Mixed Severity Fire	0.0100	0.02	0.0002	A	MPO	GFB
Mixed Severity Fire	0.0100	0.79	0.0079	C	MPO	C.smo

Display Pathways

☒ From Class

☐ To Class

OK Cancel Apply

Appendix B figure 92. Alternative A Madrean pine-oak woodland PNVTs' potentially management driven (8) and naturally driven (10) transitions for State F. Alternative A Madrean pine-oak woodland PNV State F transitions continued in Appendix B figure 92a

Class Properties for Class F: MPO F.smc

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	F	MPO	F.smc

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
K RX FIRE ONLY Moderate	0.0100	0.79	0.0079	C	MPO	C.smo
K RX FIRE ONLY Moderate	0.0100	0.19	0.0019	F	MPO	F.smc
L RX FIRE ONLY High	0.0001	0.87	0.0001	A	MPO	GFB
L RX FIRE ONLY High	0.0001	0.13	0.0000	C	MPO	C.smo
M Thin under 9-inch diameter	0.0001	0.14	0.0000	G	MPO	G.mvc
Mixed Severity Fire	0.0100	0.02	0.0002	A	MPO	GFB
Mixed Severity Fire	0.0100	0.79	0.0079	C	MPO	C.smo
Mixed Severity Fire	0.0100	0.19	0.0019	F	MPO	F.smc
Nonlethal Fire	0.0100	0.16	0.0016	C	MPO	C.smo
Nonlethal Fire	0.0100	0.84	0.0084	F	MPO	F.smc
Stand-Replacing Fire	0.0100	0.87	0.0087	A	MPO	GFB
Stand-Replacing Fire	0.0100	0.13	0.0013	C	MPO	C.smo

Display Pathways

☒ From Class

☐ To Class

OK Cancel Apply

Appendix B figure 92a. Alternative A Madrean pine-oak woodland PNV State F transitions continued

Class Properties for Class G: MPO G.mvc

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	G	MPO	G.mvc

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
2_D	0.0003	1.00	0.0003	D	MPO	D.mvo
2_E	0.0002	1.00	0.0002	E	MPO	E.ssc
2_F	0.0017	1.00	0.0017	F	MPO	F.smc
J RX FIRE ONLY Low	0.0100	0.16	0.0016	D	MPO	D.mvo
J RX FIRE ONLY Low	0.0100	0.84	0.0084	G	MPO	G.mvc
K RX FIRE ONLY Moderate	0.0100	0.02	0.0002	A	MPO	GFB
K RX FIRE ONLY Moderate	0.0100	0.79	0.0079	D	MPO	D.mvo
K RX FIRE ONLY Moderate	0.0100	0.19	0.0019	G	MPO	G.mvc
L RX FIRE ONLY High	0.0001	0.87	0.0001	A	MPO	GFB
L RX FIRE ONLY High	0.0001	0.13	0.0000	D	MPO	D.mvo
Mixed Severity Fire	0.0100	0.02	0.0002	A	MPO	GFB
Mixed Severity Fire	0.0100	0.79	0.0079	D	MPO	D.mvo
Mixed Severity Fire	0.0100	0.19	0.0019	G	MPO	G.mvc

Display Pathways

☒ From Class

☐ To Class

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OK Cancel Apply

Appendix B figure 93. Alternative A Madrean pine-oak woodland PNVTs' potentially management driven (7) and naturally driven (10) transitions for State G. Alternative A Madrean pine-oak woodland PNV State G transitions continued in Appendix B figure 93a

Class Properties for Class G: MPO G.mvc

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	1000	G	MPO	G.mvc

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
K RX FIRE ONLY Moderate	0.0100	0.02	0.0002	A	MPO	GFB
K RX FIRE ONLY Moderate	0.0100	0.79	0.0079	D	MPO	D.mvo
K RX FIRE ONLY Moderate	0.0100	0.19	0.0019	G	MPO	G.mvc
L RX FIRE ONLY High	0.0001	0.87	0.0001	A	MPO	GFB
L RX FIRE ONLY High	0.0001	0.13	0.0000	D	MPO	D.mvo
Mixed Severity Fire	0.0100	0.02	0.0002	A	MPO	GFB
Mixed Severity Fire	0.0100	0.79	0.0079	D	MPO	D.mvo
Mixed Severity Fire	0.0100	0.19	0.0019	G	MPO	G.mvc
Nonlethal Fire	0.0100	0.16	0.0016	D	MPO	D.mvo
Nonlethal Fire	0.0100	0.84	0.0084	G	MPO	G.mvc
Stand-Replacing Fire	0.0100	0.87	0.0087	A	MPO	GFB
Stand-Replacing Fire	0.0100	0.13	0.0013	D	MPO	D.mvo

Display Pathways

☒ From Class

☐ To Class

☐ TSD

☐ Ages

OK Cancel Apply

Appendix B figure 93a. Alternative A Madrean pine-oak woodland PNV State G transitions continued

Grassland PNVTs

Great Basin Grassland PNVT

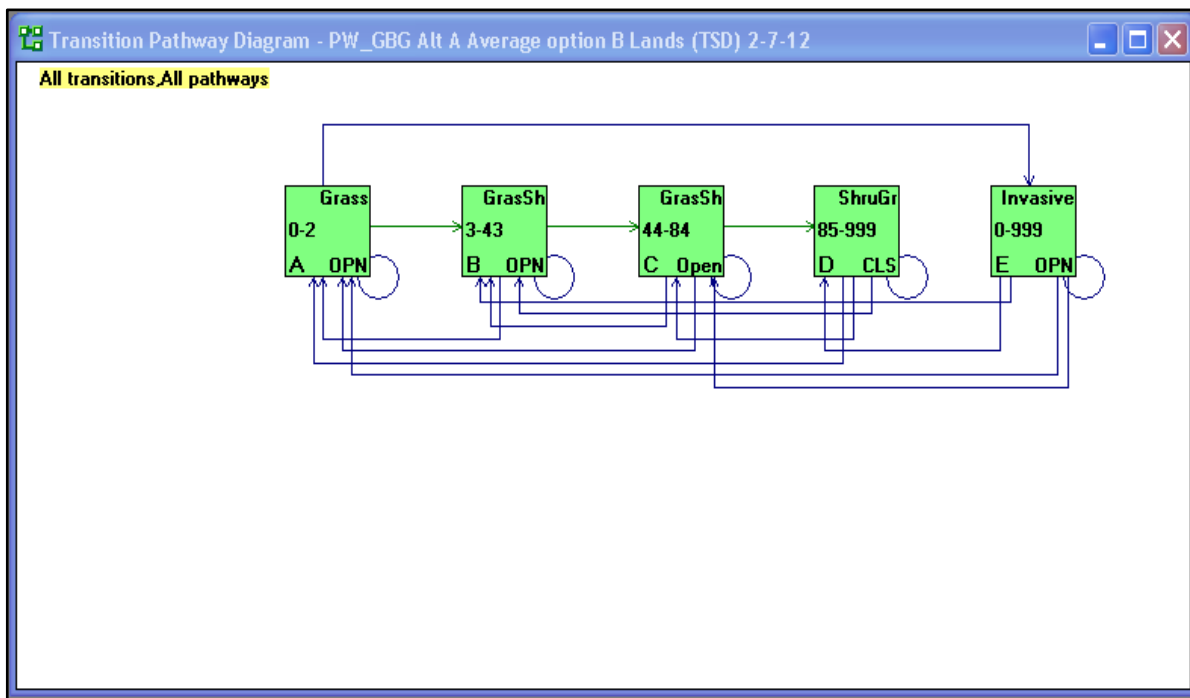
Appendix B table 14. Great Basin grassland (*Colorado Plateau/Great Basin Grassland*) PNVT crosswalks developed by Region 3 (30 August 2010) used in the determination of departure from HRV and DCs. DCs were provided by the Regional Office, and HRV was derived from LANDFIRE (2007b)

Model	State	Desired Condition/Reference Condition (%)	VDDT Model Vegetation States		R3 Existing Vegetation Classes
					dominance type group - structure class
LANDFIRE National "Inter-Mountain Basins Semi-Desert Grassland" (1511350)	A	5	Early development 1 - open canopy	=	Recently burned, sparsely vegetated - N/A
	B	70	Mid development 1 - open canopy	=	All corresponding herbaceous types - N/A
	C	20	Late development 1 - open canopy	=	Shrub types: All corresponding shrub types - Shrub - open canopy Tree types: All corresponding tree types - Seedling/sapling, small/medium - open canopy
	D	5	Mid development 2 - closed canopy	=	Shrub types: All corresponding shrub types - Shrub - closed canopy Tree types: All corresponding tree types - Very large - open canopy
	Contemporary Landscapes Only ...				
	E ¹	0	Noxious and/or invasive plants - open or closed canopy	=	Noxious and/or invasive plants

¹ This state was added to the model to reflect the presence of various noxious weeds and invasive plants that makeup a significant portion of the herbaceous vegetation composition; not part of the historic conditions or within historic range of variability and are occurring on contemporary landscapes only

State and Transition Models for Great Basin Grassland

See the state and transition model discussion for semi-desert grassland. Appendix B figures 94 through 99 display the actual VDDT model for Great Basin grassland, developed, and utilized during the planning effort on the A-SNFs to determine future departure conditions and assessment of trends. This model was pattern after the semi-desert grassland model.



Appendix B figure 94. Actual Alternative A VDDT state and transition model used for assessing trends in the Great Basin grassland PNVt on the A-SNFs

Class Properties for Class A: Grass OPN

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	2	B	GrasSh	OPN

Grass - Early-Develop
OPN - Open

Display Pathways

☒ From Class

☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	To Class		
				Box	Cover	Stage
InvasiveSpecies	0.0050	1.00	0.0050	E	Invasive	OPN
J RX Fire low condition	0.0001	1.00	0.0001	A	Grass	OPN
K RX Fire moderate condition	0.0001	1.00	0.0001	A	Grass	OPN
L RX Fire high condition	0.0001	1.00	0.0001	A	Grass	OPN
Mixed Severity Fire	0.0001	1.00	0.0001	A	Grass	OPN
Nonlethal Fire	0.0100	1.00	0.0100	A	Grass	OPN
Stand Replacing Fire	0.0001	1.00	0.0001	A	Grass	OPN

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☐ Ages

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Appendix B figure 95. Alternative A Great Basin grassland PNVt's potentially management driven (3) and naturally driven (4) transitions for State A

Class Properties for Class B: GrasSh OPN

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
3	43	C	GrasSh	Open

GrasSh - Mid-Develop
OPN - Open

Display Pathways
☒ From Class
☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
G Clearcut with legacy trees	0.0001	1.00	0.0001	A	Grass	OPN
J RX Fire low condition	0.0001	1.00	0.0001	B	GrasSh	OPN
K RX Fire moderate condition	0.0001	0.55	0.0001	A	Grass	OPN
K RX Fire moderate condition	0.0001	0.45	0.0000	B	GrasSh	OPN
L RX Fire high condition	0.0001	1.00	0.0001	A	Grass	OPN
Mixed Severity Fire	0.0001	0.55	0.0001	A	Grass	OPN
Mixed Severity Fire	0.0001	0.45	0.0000	B	GrasSh	OPN
Nonlethal Fire	0.0100	1.00	0.0100	B	GrasSh	OPN
Stand Replacing Fire	0.0001	1.00	0.0001	A	Grass	OPN
Wind/Weather/Stress	0.0070	1.00	0.0070	A	Grass	OPN
Wind/Weather/Stress	0.0200	1.00	0.0200	B	GrasSh	OPN

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Appendix B figure 96. Alternative A Great Basin grassland PNVTs' potentially management driven (5) and naturally driven (6) transitions for State B

Class Properties for Class C: GrasSh Open

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
44	84	D	ShruGr	CLS

GrasSh - Mid-Develop
Open - OPN

Display Pathways
☒ From Class
☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
G Clearcut with legacy trees	0.0100	1.00	0.0100	B	GrasSh	OPN
K RX Fire moderate condition	0.0100	0.55	0.0055	B	GrasSh	OPN
K RX Fire moderate condition	0.0100	0.45	0.0045	C	GrasSh	Open
L RX Fire high condition	0.0001	0.33	0.0000	A	Grass	OPN
L RX Fire high condition	0.0001	0.67	0.0001	B	GrasSh	OPN
Mixed Severity Fire	0.0100	0.55	0.0055	B	GrasSh	OPN
Mixed Severity Fire	0.0100	0.45	0.0045	C	GrasSh	Open
Nonlethal Fire	0.0100	0.09	0.0009	B	GrasSh	OPN
Nonlethal Fire	0.0100	0.91	0.0091	C	GrasSh	Open
Stand Replacing Fire	0.0100	0.33	0.0033	A	Grass	OPN
Stand Replacing Fire	0.0100	0.67	0.0067	B	GrasSh	OPN
Wind/Weather/Stress	0.0070	1.00	0.0070	B	GrasSh	OPN
Wind/Weather/Stress	0.0200	1.00	0.0200	C	GrasSh	Open

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☐ Ages
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Appendix B figure 97. Alternative A Great Basin grassland PNVTs' potentially management driven (5) and naturally driven (8) transitions for State C. Alternative A Great Basin grassland PNT State C transitions continued in Appendix B figure 97a

Class Properties for Class C: GrasSh Open

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
44	84	D	ShruGr	CLS

**GrasSh - Mid-Develop
Open - OPN**

Display Pathways
☒ From Class
☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	To Class		
				Box	Cover	Stage
K RX Fire moderate condition	0.0100	0.55	0.0055	B	GrasSh	OPN
K RX Fire moderate condition	0.0100	0.45	0.0045	C	GrasSh	Open
L RX Fire high condition	0.0001	0.33	0.0000	A	Grass	OPN
L RX Fire high condition	0.0001	0.67	0.0001	B	GrasSh	OPN
Mixed Severity Fire	0.0100	0.55	0.0055	B	GrasSh	OPN
Mixed Severity Fire	0.0100	0.45	0.0045	C	GrasSh	Open
Nonlethal Fire	0.0100	0.09	0.0009	B	GrasSh	OPN
Nonlethal Fire	0.0100	0.91	0.0091	C	GrasSh	Open
Stand Replacing Fire	0.0100	0.33	0.0033	A	Grass	OPN
Stand Replacing Fire	0.0100	0.67	0.0067	B	GrasSh	OPN
Wind/Weather/Stress	0.0070	1.00	0.0070	B	GrasSh	OPN
Wind/Weather/Stress	0.0200	1.00	0.0200	C	GrasSh	Open

☐ TSD
 ☐ Ages

Appendix B figure 97a. Alternative A Great Basin grassland PNV State C transitions continued

Class Properties for Class D: ShruGr CLS

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
85	999	D	ShruGr	CLS

**ShruGr - Late-Develop
CLS - Closed**

Display Pathways
☒ From Class
☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	To Class		
				Box	Cover	Stage
G Clearcut with legacy trees	0.0100	1.00	0.0100	B	GrasSh	OPN
K RX Fire moderate condition	0.0100	0.02	0.0002	B	GrasSh	OPN
K RX Fire moderate condition	0.0100	0.79	0.0079	C	GrasSh	Open
K RX Fire moderate condition	0.0100	0.19	0.0019	D	ShruGr	CLS
L RX Fire high condition	0.0001	0.43	0.0000	A	Grass	OPN
L RX Fire high condition	0.0001	0.44	0.0000	B	GrasSh	OPN
L RX Fire high condition	0.0001	0.13	0.0000	C	GrasSh	Open
Mixed Severity Fire	0.0100	0.02	0.0002	B	GrasSh	OPN
Mixed Severity Fire	0.0100	0.79	0.0079	C	GrasSh	Open
Mixed Severity Fire	0.0100	0.19	0.0019	D	ShruGr	CLS
Stand Replacing Fire	0.0100	0.43	0.0043	A	Grass	OPN
Stand Replacing Fire	0.0100	0.44	0.0044	B	GrasSh	OPN
Stand Replacing Fire	0.0100	0.13	0.0013	C	GrasSh	Open

☐ TSD
 ☐ Ages

Appendix B figure 98. Alternative A Great Basin grassland PNVs' potentially management driven (7) and naturally driven (8) transitions for State D. Alternative A Great Basin grassland PNV State D transitions continued in Appendix B figure 98a

Class Properties for Class D: ShruGr CLS

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
85	999	D	ShruGr	CLS

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	To Class		
				Box	Cover	Stage
K RX Fire moderate condition	0.0100	0.19	0.0019	D	ShruGr	CLS
L RX Fire high condition	0.0001	0.43	0.0000	A	Grass	OPN
L RX Fire high condition	0.0001	0.44	0.0000	B	GrasSh	OPN
L RX Fire high condition	0.0001	0.13	0.0000	C	GrasSh	Open
Mixed Severity Fire	0.0100	0.02	0.0002	B	GrasSh	OPN
Mixed Severity Fire	0.0100	0.79	0.0079	C	GrasSh	Open
Mixed Severity Fire	0.0100	0.19	0.0019	D	ShruGr	CLS
Stand Replacing Fire	0.0100	0.43	0.0043	A	Grass	OPN
Stand Replacing Fire	0.0100	0.44	0.0044	B	GrasSh	OPN
Stand Replacing Fire	0.0100	0.13	0.0013	C	GrasSh	Open
Wind/Weather/Stress	0.0070	1.00	0.0070	C	GrasSh	Open
Wind/Weather/Stress	0.0200	1.00	0.0200	D	ShruGr	CLS

Display Pathways

☒ From Class
☐ To Class

☐ TSD
☐ Ages

OK Cancel Apply

Appendix B figure 98a. Alternative A Great Basin grassland PNV State D transitions continued

Class Properties for Class E: Invasive OPN

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	999	E	Invasive	OPN

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	To Class		
				Box	Cover	Stage
Eradication Treatments	0.0200	1.00	0.0200	A	Grass	OPN
Eradication Treatments	0.0200	1.00	0.0200	B	GrasSh	OPN
Eradication Treatments	0.0200	1.00	0.0200	C	GrasSh	Open
Eradication Treatments	0.0200	1.00	0.0200	D	ShruGr	CLS
Nonlethal Fire	0.0100	1.00	0.0100	E	Invasive	OPN

Display Pathways

☒ From Class
☐ To Class

☐ TSD
☐ Ages

OK Cancel Apply

Appendix B figure 99. Alternative A Great Basin grassland PNVs' potentially management driven (4) and naturally driven (1) transitions for State E

Semi-desert Grassland PNVT

Appendix B table 15. Semi-desert grassland PNVT crosswalks developed by Region 3 (14 October 2010) used in the determination of departure from HRV and DCs. DCs were provided by the Regional Office, and HRV was derived from the Nature Conservancy (Schussman, 2006a)

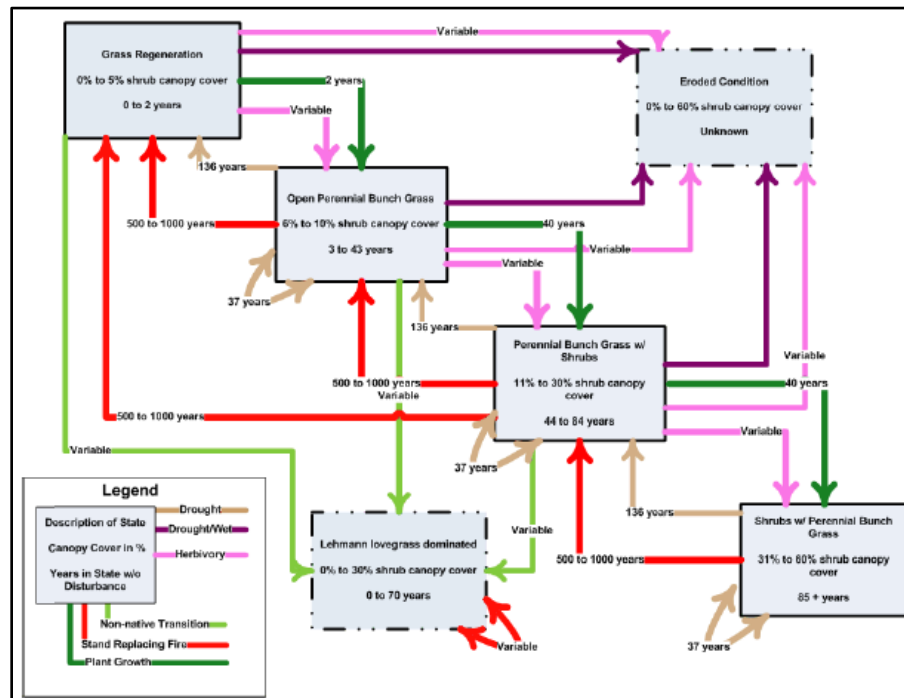
Model	State	Desired Condition/ Reference Condition		VDDT Model Vegetation States		R3 Existing Vegetation Classes	
		mean (%)	sd (%)			dominance type group - structure class	
TNC Semi-Desert Grassland	A	24	10.2	Grass regeneration	=	Recently burned, sparsely vegetated - N/A	
	B	76	10.2	Open perennial bunchgrasses	=	All corresponding herbaceous types - N/A	
	<i>Contemporary Landscapes Only ...</i>						
	C	0	0	Perennial bunchgrasses with shrubs and trees	=	Shrub types: All corresponding shrub types - Shrub - open canopy Tree types: All corresponding tree types - Seedling/sapling, small/medium - open canopy	
	D	0	0	Shrubs and trees with perennial bunchgrasses	=	Shrub types: All corresponding shrub types - Shrub - closed canopy Tree types: All corresponding tree types - Very large - open canopy	
	E ¹	0	0	Noxious and/or invasive plants - open or closed canopy	=	Noxious and/or invasive plants	

¹ This state was added to the model to reflect the presence of various noxious weeds and invasive plants that makeup a significant portion of the herbaceous vegetation composition; not part of the historic conditions or within historic range of variability and is occurring on contemporary landscapes only

State and Transition Models for Semi-desert Grassland

The following is Schussman's (2006) discussion concerning the current modeling results for semi-desert grasslands.

Appendix B figure 100 displays a conceptual current state and transition model for the semi-desert grassland- vegetation type (Schussman and Smith, 2006a and 2006b) used in VDDT modeling. In table 15³³, Schussman (2006a) describes the parameters included or not included within the current VDDT models (Schussman and Smith, 2006a and 2006b), as well as the sources of information and any assumptions used to create the model parameters.



Appendix B figure 100. Conceptual current state and transition model for the semi-desert grassland mixed native vegetation type. Frequency of transitions are noted when this information is supported by published sources; where no or conflicting information exists on the frequency of transitions, a blank arrow or variable, respectively, is the notation. Dashed outlines represent states which have crossed an ecological threshold (Schussman, 2006a; Schussman and Smith, 2006a and 2006b)

³³ See Schussman, 2006a

Appendix B table 16. Identification of current transition types, frequency of transitions, sources of information and assumptions used to develop the frequency of transitions and their effects on vegetation states included in the semi-desert grassland mixed native vegetation type VDDT model (adapted from Schussman, 2006a)¹

Transition Type	Transition Frequency or Length	Information Sources	Assumptions
Drought (moderate events)	Every 37 years	Schussman calculated frequency of moderate drought events from 1,000 years of reconstructed winter precipitation data (Ni et al., 2002). Schussman identified droughts effect on shrubs from the following publications: Bock and Bock, 1997; McClaran, 2003; Turner et al., 2003	Prolonged drought has been shown to cause declines in shrub density and cover within these grasslands. Based on this, we used moderate drought events (equivalent to 1950's drought) in the model to transition vegetation back to its starting conditions within that state (i.e. lowest shrub cover value) using the average historic moderate drought frequency.
Drought (extreme events)	Every 136 years	Schussman calculated frequency of extreme drought events from 1,000 years of reconstructed winter precipitation data (Ni et al., 2002). Schussman identified droughts effect on shrubs from the following publications: Bock and Bock, 1997; McClaran 2003; Turner et al., 2003	Prolonged drought has been shown to cause declines in shrub density and cover within these grasslands. Based on this, and the above use of moderate droughts, we used extreme drought events (more severe than 1950's drought) to transition higher shrub density states to lower shrub density states using the average historic extreme drought frequency.
Drought/wet	Blank, not included in model	Hennessey et al., 1983. In order to utilize information available on erosion impacts, Schussman included a study from New Mexico. This may result in erroneous information for the mixed native grasslands of the Arizona uplands	Schussman determined that some level (unknown but probably at least equivalent to the 1950's drought, (Hennessey et al., 1983)) of drought coupled with some level of wet event could create conditions that would lead to a loss of topsoil and an eroded condition. Additionally, transitions out of the eroded condition are not known. Given this lack of information we did not model this transition.
Herbivory (non-native)	Variable, not included in model	Schussman identified possible effects of grazing on shrubs from the following publications: Bock and Bock, 1997; Brown and Archer, 1987 and 1999 ² ; Brown et al., 1997; Drewa and Havstad 2001; McClaran, 2003; McPherson, 1997; Smith and Schmutz, 1975; Valone and Kelt, 1999. In order to utilize the breadth of studies on grazing effects we included studies from Arizona, New Mexico, and Texas. This may result in erroneous information for the mixed native grasslands of the Arizona uplands	Schussman determined that information regarding effects of livestock grazing on shrub cover is conflicting. For example, Valone and Kelt (1999), and Brown and Archer (1987 and 1999 ²) found <i>Gutierrezia sarothrae</i> (Pursh) Britton & Rusby, and <i>Prosopis</i> spp. L., to be more common on grazed plots. Drewa and Havstad (2001), Smith and Schmutz (1975), and McClaran (2003) found grazing to have no effect on shrub density; while Bock and Bock (1997) identified a negative effect of grazing on <i>Isocoma</i> spp. Nutt., species density. Given the conflicting results of studies we did not include this transition in our model.
Plants (non-native)	Variable, not included in model	Schussman identified information on <i>Eragrostis lehmanniana</i> Nees, spread from the following publications: Anable et al., 1992; Angel and McClaran, 2001; Cable, 1971; Cox and Ruyle, 1986; Gori and Enquist, 2003; Ruyle et al., 1988; Schussman et al., 2006	Studies indicate that the transition of a state from native to non-native grassland is dependent on the presence of a non-native seed source and soil type. Given that we were trying to model a large area that has multiple soil types and is likely to only have a seed source on a portion of the landscape, we decided not to model this parameter for the regional model.
Stand replacing fire, native plant	Every none to 500 years	Kaib et al., 1996; Swetnam and Betancourt, 1998	Schussman based her estimate of fire on fire-scar data. Specifically, regional fire-scar data shows drastic declines in the number of fires from 1880 to present. Additionally, a fire-scar study that is directly applicable to these grasslands (Kaib et al., 1996) shows decreases to no fires and fire every 25 years. Based on the knowledge that some areas had not seen a fire at all, and others had some fire, we used a range of relatively infrequent fire occurrence (no fire to fire across the whole landscape every 500 years).

Appendix B table 16. Continued

Transition Type	Transition Frequency or Length	Information Sources	Assumptions
Stand replacing fire, non-native plant	Variable, not included in model	Schussman identified information on the effects of burning on <i>E. lehmanniana</i> Nees spread from the following publications: Anable et al., 1992; Cable, 1971; McPherson, 1995; Ruyle et al., 1988. Erika Geiger, personal communication with Schussman	It is well documented that stand replacing fires increase the abundance of <i>E. lehmanniana</i> Nees, on sites where it already exists, the frequency of fires at sites dominated by <i>E. lehmanniana</i> Nees, is site specific. Given this constraint, and the regional, not site specific, nature of the model we decided not to model this transition.
Plant growth following stand replacing fire	2 years	Schussman identified grass recovery time from the following publications: Bock and Bock, 1992; Cable, 1972; Martin, 1983; Wright, 1960	Studies on grass recovery following fires suggests that perennial grasses recover fully from fire in 1 to 2 growing seasons with average precipitation, but can take 3 to 4 growing seasons to recover under drought conditions. Based on this information, we used a mean value of 2 years to model plant growth immediately following fire.
Plant growth without stand replacing fire	40 years	Schussman calculated frequency of wet events from 1,000 years of reconstructed winter precipitation data (Ni et al., 2002). TNC identified effect of wet events on shrubs from the following publications: Bock and Bock, 1992; Brown et al., 1997; McClaran, 2003	Based on the average frequency of low, moderate, and extreme wet winter precipitation events (every 20 years) and the time (about 20 years) it takes for shrubs to show large cover increases (3-fold) following these wet periods, we used a value of 40 years to model the plant growth transition in the absence of stand replacing fire.

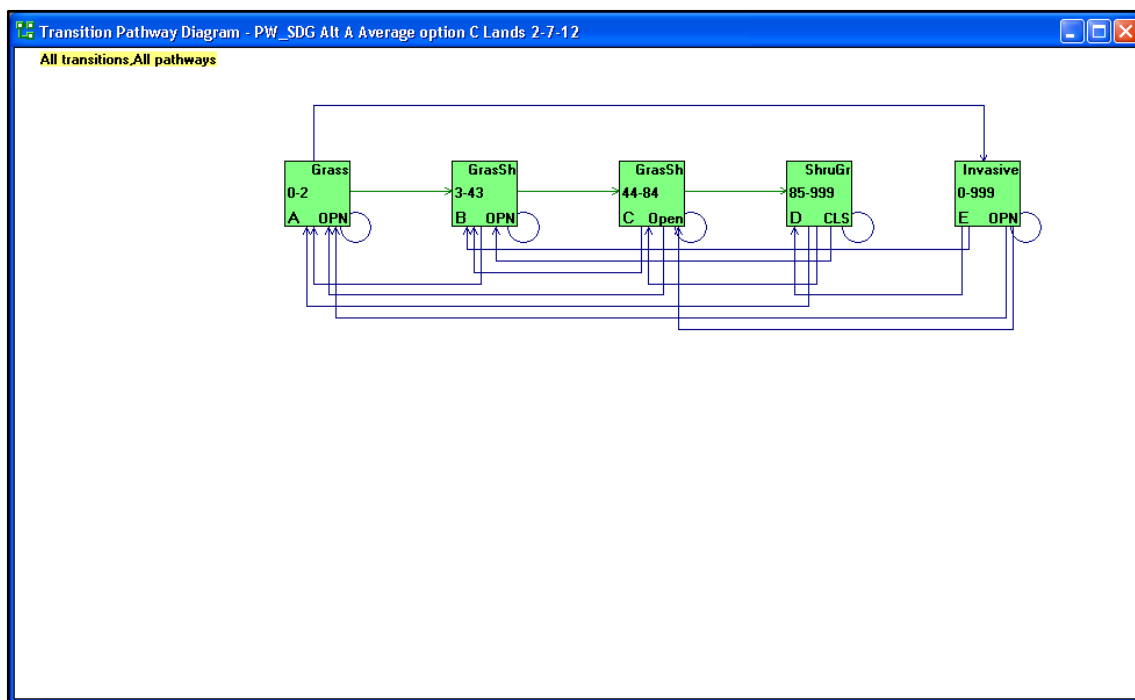
¹ See Schussman, 2006a

² This citation was added by White, 2014

Results of the semi-desert grassland – mixed native historic VDDT model show a good deal of variability in the 900-year average for each state based on the fire return interval. Even with this variability, the pattern was consistent between the three models with the bulk of historic vegetation occurring in the open grass state (82.4%, 75.5% and 56.2% for fire return intervals of 10, 6, and 2.5 years, respectively) and very little of the historic vegetation occurring in the shrub and grass state (0.0%, 0.0%, and 0.0% for fire return intervals 10, 6, and 2.5 years). A comparison of simulated historic conditions and current conditions shows a large decrease in the percent of the landscape in the open grass state (decrease of roughly 61%, 54%, and 35% for fire return intervals 10, 6, and 2.5, respectively) with a correspondingly large increase in the percent of the landscape in the shrub and grass state (roughly 30% to 41% for all fire return interval runs).

This analysis highlights the importance of frequent fire within the semi-desert grassland mixed native vegetation type. In the absence of frequent fire, the model simulates a landscape with increasingly less open grasslands dominated by perennial grasses. This result is in agreement with recent assessments of historic change within southeastern Arizona’s semi-desert grasslands that show an increase in shrubs and a loss of open grasslands (Turner et al., 2003; Gori and Enquist, 2003; Enquist and Gori, 2005). This suggests the need to maintain historic fire regimes if we are to maintain open grassland vegetation.

Appendix B figures 101 through 106 display the actual VDDT model for semi-desert grassland, developed by the USDA FS Southwestern Region 3, and utilized during the planning effort on the A-SNFs to determine future departure conditions and assessment of trends.



Appendix B figure 101. Actual Alternative A VDDT state and transition model used for assessing trends in the semi-desert grassland PNV on the A-SNFs

Class Properties for Class A: Grass OPN

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	2	B	GrasSh	OPN

Grass - Early-Develop
OPN - Open

Display Pathways
☒ From Class
☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	Stage
InvasiveSpecies	0.0050	1.00	0.0050	E	Invasive	OPN
J RX Fire low condition	0.0001	1.00	0.0001	A	Grass	OPN
K RX Fire moderate condition	0.0001	1.00	0.0001	A	Grass	OPN
L RX Fire high condition	0.0001	1.00	0.0001	A	Grass	OPN
Mixed Severity Fire	0.0001	1.00	0.0001	A	Grass	OPN
Nonlethal Fire	0.0100	1.00	0.0100	A	Grass	OPN
Stand Replacing Fire	0.0001	1.00	0.0001	A	Grass	OPN

☐ TSD
☐ Ages

Appendix B figure 102. Alternative A semi-desert grassland PNVTs' potentially management driven (3) and naturally driven (4) transitions for State A

Class Properties for Class B: GrasSh OPN

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
3	43	C	GrasSh	Open

GrasSh - Mid-Develop
OPN - Open

Display Pathways
☒ From Class
☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	Stage
J RX Fire low condition	0.0001	1.00	0.0001	B	GrasSh	OPN
K RX Fire moderate condition	0.0001	0.55	0.0001	A	Grass	OPN
K RX Fire moderate condition	0.0001	0.45	0.0000	B	GrasSh	OPN
L RX Fire high condition	0.0001	1.00	0.0001	A	Grass	OPN
Mixed Severity Fire	0.0001	0.55	0.0001	A	Grass	OPN
Mixed Severity Fire	0.0001	0.45	0.0000	B	GrasSh	OPN
Nonlethal Fire	0.0100	1.00	0.0100	B	GrasSh	OPN
Stand Replacing Fire	0.0001	1.00	0.0001	A	Grass	OPN
Wind/Weather/Stress	0.0070	1.00	0.0070	A	Grass	OPN
Wind/Weather/Stress	0.0200	1.00	0.0200	B	GrasSh	OPN

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Appendix B figure 103. Alternative A semi-desert grassland PNVTs' potentially management driven (4) and naturally driven (6) transitions for State B

Class Properties for Class C: GrasSh Open

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
44	84	D	ShruGr	CLS

**GrasSh - Mid-Develop
Open - OPN**

Display Pathways
☒ From Class
☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
K RX Fire moderate condition	0.0100	0.55	0.0055	B	GrasSh	OPN
K RX Fire moderate condition	0.0100	0.45	0.0045	C	GrasSh	Open
L RX Fire high condition	0.0001	0.33	0.0000	A	Grass	OPN
L RX Fire high condition	0.0001	0.67	0.0001	B	GrasSh	OPN
Mixed Severity Fire	0.0100	0.55	0.0055	B	GrasSh	OPN
Mixed Severity Fire	0.0100	0.45	0.0045	C	GrasSh	Open
Nonlethal Fire	0.0100	0.09	0.0009	B	GrasSh	OPN
Nonlethal Fire	0.0100	0.91	0.0091	C	GrasSh	Open
Stand Replacing Fire	0.0100	0.33	0.0033	A	Grass	OPN
Stand Replacing Fire	0.0100	0.67	0.0067	B	GrasSh	OPN
Wind/Weather/Stress	0.0070	1.00	0.0070	B	GrasSh	OPN
Wind/Weather/Stress	0.0200	1.00	0.0200	C	GrasSh	Open

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Appendix B figure 104. Alternative A semi-desert grassland PNVTs' potentially management driven (4) and naturally driven (8) transitions for State C

Class Properties for Class D: ShruGr CLS

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
85	999	D	ShruGr	CLS

**ShruGr - Late-Develop
CLS - Closed**

Display Pathways
☒ From Class
☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
K RX Fire moderate condition	0.0100	0.02	0.0002	B	GrasSh	OPN
K RX Fire moderate condition	0.0100	0.79	0.0079	C	GrasSh	Open
K RX Fire moderate condition	0.0100	0.19	0.0019	D	ShruGr	CLS
L RX Fire high condition	0.0001	0.43	0.0000	A	Grass	OPN
L RX Fire high condition	0.0001	0.44	0.0000	B	GrasSh	OPN
L RX Fire high condition	0.0001	0.13	0.0000	C	GrasSh	Open
Mixed Severity Fire	0.0100	0.02	0.0002	B	GrasSh	OPN
Mixed Severity Fire	0.0100	0.79	0.0079	C	GrasSh	Open
Mixed Severity Fire	0.0100	0.19	0.0019	D	ShruGr	CLS
Stand Replacing Fire	0.0100	0.43	0.0043	A	Grass	OPN
Stand Replacing Fire	0.0100	0.44	0.0044	B	GrasSh	OPN
Stand Replacing Fire	0.0100	0.13	0.0013	C	GrasSh	Open
Wind/Weather/Stress	0.0070	1.00	0.0070	C	GrasSh	Open

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Appendix B figure 105. Alternative A semi-desert grassland PNVTs' potentially management driven (6) and naturally driven (8) transitions for State D. Alternative A Semi-desert grassland PNV State D transitions continued in Appendix B figure 105a

Class Properties for Class D: ShruGr CLS

D
ShruGr - Late-Develop
CLS - Closed

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
85	999	D	ShruGr	CLS

Display Pathways

☒ From Class
☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	Stage
K RX Fire moderate condition	0.0100	0.19	0.0019	D	ShruGr	CLS
L RX Fire high condition	0.0001	0.43	0.0000	A	Grass	OPN
L RX Fire high condition	0.0001	0.44	0.0000	B	GrasSh	OPN
L RX Fire high condition	0.0001	0.13	0.0000	C	GrasSh	Open
Mixed Severity Fire	0.0100	0.02	0.0002	B	GrasSh	OPN
Mixed Severity Fire	0.0100	0.79	0.0079	C	GrasSh	Open
Mixed Severity Fire	0.0100	0.19	0.0019	D	ShruGr	CLS
Stand Replacing Fire	0.0100	0.43	0.0043	A	Grass	OPN
Stand Replacing Fire	0.0100	0.44	0.0044	B	GrasSh	OPN
Stand Replacing Fire	0.0100	0.13	0.0013	C	GrasSh	Open
Wind/Weather/Stress	0.0070	1.00	0.0070	C	GrasSh	Open
Wind/Weather/Stress	0.0200	1.00	0.0200	D	ShruGr	CLS

☐ TSD
☐ Ages

OK Cancel Apply

Appendix B figure 105a. Alternative A semi-desert grassland PNV State D transitions continued

Class Properties for Class E: Invasive OPN

E
Invasive - InvasiveSpecies
OPN - Open

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	999	E	Invasive	OPN

Display Pathways

☒ From Class
☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	Stage
Eradication Treatments	0.0200	1.00	0.0200	A	Grass	OPN
Eradication Treatments	0.0200	1.00	0.0200	B	GrasSh	OPN
Eradication Treatments	0.0200	1.00	0.0200	C	GrasSh	Open
Eradication Treatments	0.0200	1.00	0.0200	D	ShruGr	CLS
Nonlethal Fire	0.0100	1.00	0.0100	E	Invasive	OPN

☐ TSD
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Appendix B figure 106. Alternative A semi-desert grassland PNVs' potentially management driven (4) and naturally driven (1) transitions for State E

Montane/Subalpine Grasslands PNVT

Appendix B table 17. Montane/subalpine grasslands PNVT crosswalks developed by Region 3 (13 February 2008) used in the determination of departure from HRV and DCs. DCs were provided by the Regional Office, and HRV was derived from LANDFIRE (2007c)

Model	State	Desired Condition/ Reference Condition (mean %)	VDDT Model Vegetation States		R3 Existing Vegetation Classes
					dominance type group - structure class
LANDFIRE National "Southern Rocky Mountain Montane-Subalpine Grassland" (151146)	A	20	Early development 1 - All structures	=	Recently burned, sparsely vegetated - N/A
	B, C	80	Mid-late development	=	All corresponding grass and forb types - N/A
	<i>Contemporary Landscapes Only ...</i>				
	D	0	Tree or shrub cover (significant)	=	Shrub types: All corresponding shrub types - All
				=	Tree types: All corresponding tree types - Seedling/sapling and all open canopy tree structure classes
	E ¹	0	Noxious and/or invasive plants - open or closed canopy	=	Noxious and/or invasive plants

¹ This state was added to the model to reflect the presence of various noxious weeds and invasive plants that makeup a significant portion of the herbaceous vegetation composition; not part of the historic conditions or within historic range of variability and are occurring on contemporary landscapes only

State and Transition Models for Montane/Subalpine Grasslands

The following is Smith's (2007) discussion concerning the current modeling results for montane/subalpine grasslands.

The current high elevation grassland model, which was run for 120 years following the Historic conditions, had very different results from the historic model (appendix B table 17). Native grassland (state A) only occupied 23 to 28% of the landscape after 120 years of fire suppression, grazing, and exotic introductions. Grassland with low density of encroaching trees (state B) occupied 18 to 20% of the landscape, and conifer forest (state C) had invaded 53 to 58% of the landscape. From these model runs, 71 to 78% of the high elevation grassland landscape is anomalous to the historic conditions.

These modeled scenarios underscore the importance of frequent surface fire in maintaining open, high elevation montane grassland ecosystems. The increase in proportion of the landscape that is closed and susceptible to uncharacteristic, stand replacing fires is very high at more than 50%. This proportion is toward the high end of reported values of grassland encroachment for the Valles Caldera grasslands, New Mexico, studied by Coop and Givnish (2007), but close to the value of 55% grassland loss reported by Allen (1984). There are several variables that control grassland invasibility, including precipitation and temperature, and several site characteristics such as topographic position, aspect, slope inclination, soil type and depth, and disturbance history (Allen, 1984; Moore and Huffman, 2004; Coop and Givnish, 2007). Although it could not be quantified for this model, several areas have been invaded by non-native plant species, including species of bluegrass (*Poa* spp. L.), smooth brome (*Bromus inermis* L.), common dandelion (*Taraxacum officinale* F.H. Wigg.), and other plant species that change habitat suitability for wildlife species (Allen, 1984; Dick-Peddie, 1993; White, 2002). The simplistic model presented here incorporates the factors that have been quantified in the literature to date, and as more data become available, the model can incorporate that information to reflect the level of sophistication of our knowledge.

No USDA FS Southwestern Regional model was developed for the montane/subalpine grasslands.

Appendix B table 18. Identification of current transitions, frequency of transitions, sources of information used, and assumptions used to develop the frequency of transitions and its effect on vegetation included in the VDDT models (adopted from Smith, 2007)¹

Transition Type	Transition Frequency or Length	Sources	Assumptions
Microsite characteristics	Not used in model	Allen, 1984; Moore and Huffman, 2004; Coop and Givnish, 2007b	There are large differences in the ‘invasibility’ of grasslands, largely controlled by climate, but also controlled by several site gradients.
Plant growth	40 years	Ahlstrand et al., 1980; Allen 1984; Wyant et al., 1986	During the post-settlement period, tree encroachment began 30-40 years after cattle grazing and fire cessation, leading to the formation of a new ecological state that included more tree species. Several encroaching tree species become resistant to cambium scorching after attaining an age of 15 to 40 years.
Fuel build up	Once every year.	Covington and Moore, 1994; Swetnam and Baisan, 1996; Allen et al., 2002; Fulé et al., 2003	Several authors have documented the cessation of surface fires around 1880, which has led to the accumulation of fuels.
Stand replacing fire	Once every 100 years	Cessation of surface fires and accumulation of fuels and development of fuel ladders has led to an increase in the frequency of stand replacing fires (Covington and Moore, 1994; Swetnam and Baisan, 1996; Covington et al., 1997; Allen et al., 2002)	Smith based his estimate of fire on fire scar data. Specifically, regional fire scar data shows drastic declines in fires from 1900 to present. Given these data, we estimated a fire occurrence of 1 in the last 100 years during the current period. This frequency may have regional variation based on site characteristics, sources of ignition, and suppression success.
Non-native grazing	P=1 for all areas	Allen, 1984	Grazing by sheep and cattle, and concomitant reduction in fire frequency have led to increased invasion of high elevation grasslands by coniferous trees and aspen. Invasion followed an approximately 40-year lag period, during which time grazing practices changed in large part from sheep to cattle grazing.
Exotic plant introduction	Not used in model	Allen, 1984; Dick-Peddie, 1993; White, 2002	Canada bluegrass (<i>Poa compressa</i> L.) and Kentucky bluegrass (<i>P. pratensis</i> L.) and other plant species were introduced into many high elevation grasslands by early settlers and their grazing animals. This factor primarily affects understory composition and habitat quality. However, no transition probability could be discerned from the literature.
Prescribed fire and mechanical tree thinning	Not used in model		Mechanical removal of trees and prescribed burning may be effective in restoring grasslands, but this work has not been well documented.

¹ See Smith, 2007

Chaparral PNVT

Interior Chaparral PNVT

Appendix B table 19. Interior chaparral PNVT crosswalks developed by Region 3 (30 July 2010) used in the determination of departure from HRV and DCs. DCs were provided by the Regional Office, and HRV was derived from the Nature Conservancy (Schussman, 2006b)

Model	State	Desired Condition/Reference Condition ¹ (%)	VDDT Model Vegetation States	R3 Mid-scale Vegetation Mapping	
				dominance type group - structure class	
TNC Interior Chaparral	A	2	Grass and forb regeneration	=	Recently burned, sparsely vegetated, and all corresponding herbaceous types - N/A
	B	5	Grass and shrub	=	All corresponding shrub types - Shrub - open canopy
	C, D	93	Mid-late development dense shrub, no understory	=	All corresponding shrub types - Shrub - closed canopy and all tree size and canopy cover classes

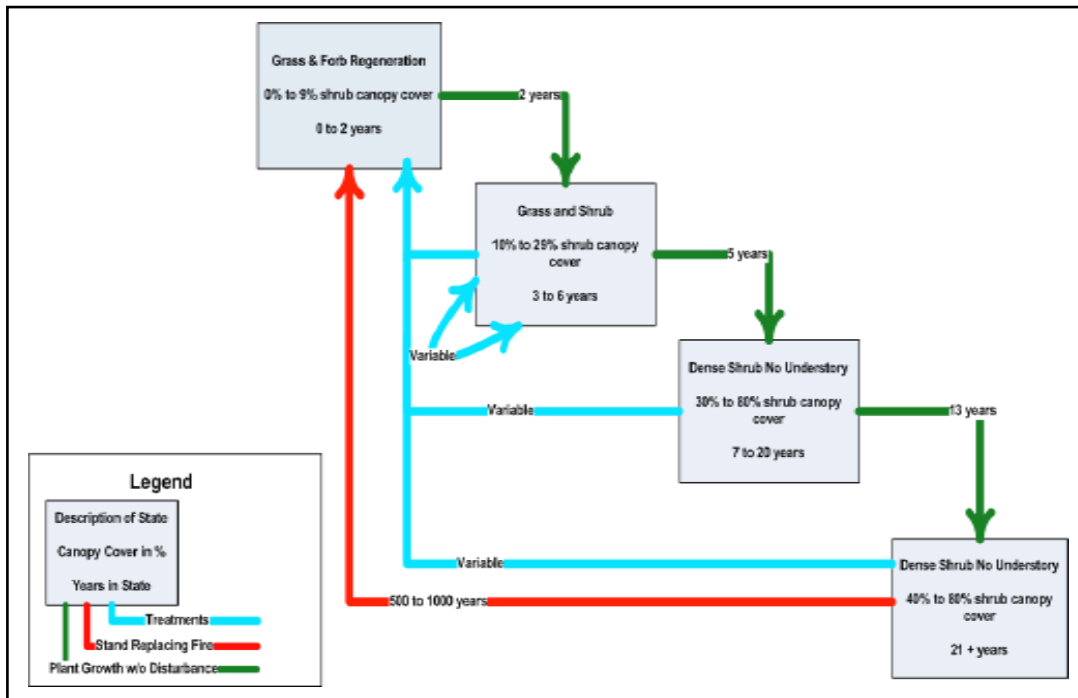
¹ Based on 60-year fire frequency

State and Transition Models for Interior Chaparral

The following is Schussman's (2006b) discussion concerning the current modeling results for interior chaparral. Interior chaparral appears to be a fairly stable vegetation type due to the majority of its species having the ability to quickly re-sprouting following disturbance events, such as fire and mechanical or chemical removal (Cable, 1975; Lillie et al., 1964; Pase and Ingebo, 1965; Pond and Cable, 1960). Additionally, the few species that regenerate from seed require fire to prepare the seedbed (Carmichael et al., 1978). Historically, this led to quick recovery of chaparral following the dominant natural disturbance, fire. In current times, these same mechanisms have allowed chaparral to maintain its dense canopy cover character regardless of human disturbance but have increased densities due to disturbance exclusion.

Appendix B figure 107 displays a conceptual current state and transition model for the interior chaparral-vegetation type (Schussman and Smith, 2006a and 2006b) used in VDDT modeling. In appendix B table 19, Schussman (2006b) describes the parameters included or not included within the current VDDT models (Schussman and Smith, 2006a and 2006b), as well as the sources of information and any assumptions used to create the model parameters.

Results of the interior chaparral historic VDDT model show some variability in the 900 year average percent of the modeled landscape in each state based on the fire return interval range (appendix B table 19). Even with this variability, all models showed a consistent pattern of the majority of the historic vegetation occurring in the Dense Shrub (greater than 21 years of age) state (83.6%, 76.2% and 50.5% ± 2.3%, 3.2%, and 5.2% for fire return intervals of 100, 60, and 20 years respectively). A comparison of simulated historic conditions and current conditions shows an increase in the amount of dense shrub (21+ years) present under current management. Specifically, increases of between 50% and 13% are seen for the 100, 60, and 20 year historic runs compared to the 0 to 500 year current runs.



Appendix B figure 107. Conceptual current state and transition model for the interior chaparral vegetation type. Frequency of transitions are noted when this information is supported by published sources; where no or conflicting information exists on the frequency of transitions, unknown or variable, respectively, is the notation (Schussman and Smith, 2006a and 2006b; Schussman, 2006b)

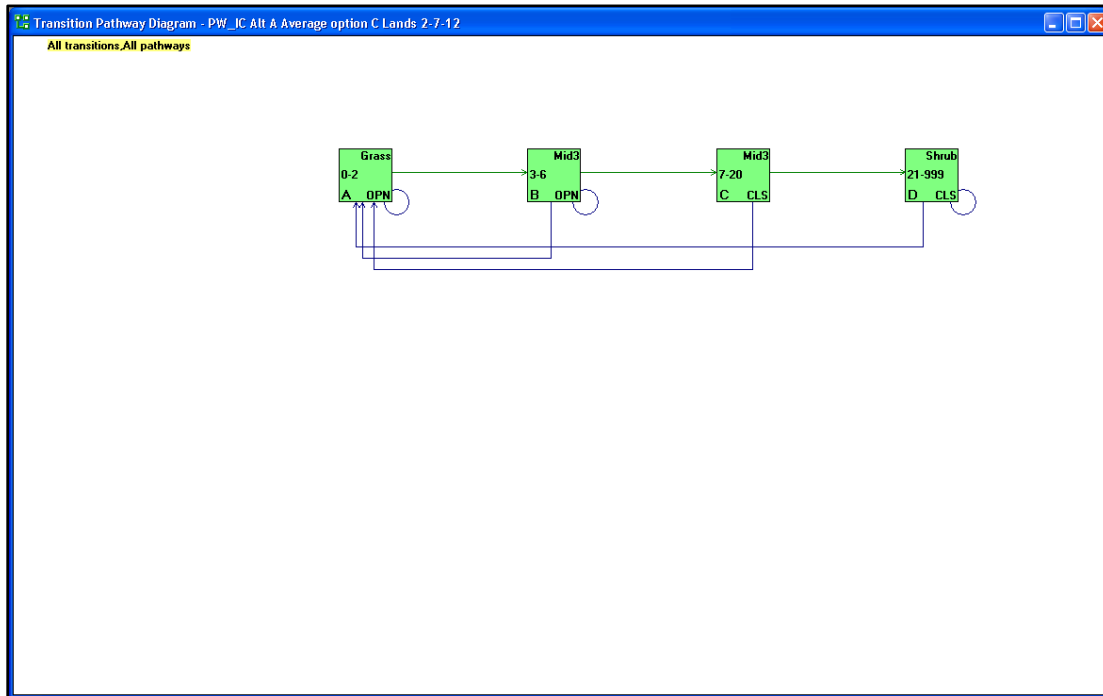
These results suggest that the last 120 years of land management, mainly fire suppression, have had some effect on historic chaparral landscape conditions. Changes primarily within stand age and density are reasonable as we wouldn't expect 120 years of fire suppression to have large effects on vegetation structure within a PNV with a historic fire return interval of 20 to 100 years. Additionally, this is in agreement with changes within chaparral vegetation documented by Huebner et al. (1999). These results suggest that current interior chaparral vegetation has lost the mosaic of less dense and younger aged states. Maintenance of the 20 to 100 year fire return interval will be important for restoring and maintaining the historic range of conditions for this landscape in the future.

Appendix B figures 108 through 112 display the actual VDDT model for interior chaparral, developed by the USDA FS Southwestern Region 3, and utilized during the planning effort (Phase I) on the A-SNFs.

Appendix B table 20. Identification of current transition types, probabilities, and source of information used to inform the interior chaparral VDDT model (adopted from Schussman, 2006b)¹

Transition Type	Transition Frequency or Length	Source	Assumptions
Treatments (mechanical, herbicide, and/or prescribed fire)	Variable, not included in model	Baldwin, 1968; Cable, 1975; Lillie et al., 1964; Pase and Ingebo, 1965; Pond and Cable, 1960	Schussman identified multiple studies, conducted primarily within the Tonto National Forest, which documented a wide range of mechanical, chemical, and fire treatments for interior chaparral vegetation. We concluded that the type of treatment was variable and occurred on a relatively small portion of interior chaparral within Arizona and New Mexico; hence we decided not to model this parameter in the regional current model.
Non-native seeding	Variable, not included in model	Cable, 1975; Hibbert et al., 1974	Schussman found documentation of the seeding of non-native perennial grasses (<i>Eragrostis lehmanniana</i> Nees, and <i>E. curvula</i> (Schrad.) Nees), following conversion treatments. However, as with the treatment parameter, Schussman determined that seeding was variable and occurred on a relatively small portion of interior chaparral in Arizona and New Mexico, hence Schussman decided not to model this parameter in the current model.
Stand replacing fire	Every 0 to 500 years	Savage and Swetnam, 1990; Swetnam and Betancourt, 1998; Sneed et al., 2002	Schussman based the estimate of fire on fire scar data; specifically, regional fire scar data, along with data more localized to southeastern Arizona and the Prescott Basin, Arizona, shows drastic declines in fires from 1900 to present (Savage and Swetnam, 1990; Sneed et al., 2002; Swetnam and Betancourt, 1998). Given this information, Schussman estimated a fire return interval of 0 to every 500 years.
Plant growth without disturbance	2, 5, and 13 years	Carmichael et al., 1978; Cable, 1975; Lillie et al., 1964; Pase and Brown, 1982; Pase and Ingebo, 1965; Pond and Cable, 1960	Schussman identified multiple sources (with similar results) that documented the time it took chaparral vegetation to reach the various canopy cover classes of each state. Specifically, multiple studies suggest that by 7 years chaparral has returned to pre-burn densities and/or densities high enough to eliminate the grass understory (Cable, 1975; Carmichael et al., 1978; Pond and Cable, 1962). Additionally, it is suggested that chaparral quickly recover to high cover levels (30 to 80%) but may not burn until roughly 20 years have passed (Cable, 1975). Based on these studies Schussman determined how long it would take to transition from one state to the next in the absence of a disturbance. Schussman also used this information to determine the canopy cover ranges for each state.

¹ See Schussman, 2006b



Appendix B figure 108. Actual Alternative A VDDT state and transition model used for assessing trends in the interior chaparral PNVt on the A-SNFs

Class Properties for Class A: Grass OPN

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
0	2	B	Mid3	OPN

Grass - Grass_Forb Regeneration
OPN - Open

Display Pathways

☒ From Class

☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	Box	Cover	To Class
Nonlethal Fire	0.0076	1.00	0.0076	A	Grass	OPN

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Appendix B figure 109. Alternative A interior chaparral PNVt's potentially management driven (0) and naturally driven (1) transitions for State A

Class Properties for Class B: Mid3 OPN

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
3	6	C	Mid3	CLS

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	To Class		
				Box	Cover	Stage
All Fuels	0.0002	1.00	0.0002	A	Grass	OPN
All RX Burning	0.0155	1.00	0.0155	A	Grass	OPN
Mixed Severity Fire	0.0065	0.55	0.0036	A	Grass	OPN
Mixed Severity Fire	0.0065	0.45	0.0029	B	Mid3	OPN
Nonlethal Fire	0.0076	1.00	0.0076	B	Mid3	OPN
Stand Replacing Fire	0.0029	0.87	0.0025	A	Grass	OPN
Stand Replacing Fire	0.0029	0.13	0.0004	B	Mid3	OPN

Display Pathways

☒ From Class
☐ To Class

☐ TSD
☐ Ages

Appendix B figure 110. Alternative A interior chaparral PNVTs' potentially management driven (2) and naturally driven (5) transitions for State B

Class Properties for Class C: Mid3 CLS

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
7	20	D	Shrub	CLS

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	To Class		
				Box	Cover	Stage
All Fuels	0.0002	1.00	0.0002	A	Grass	OPN

Display Pathways

☒ From Class
☐ To Class

☐ TSD
☐ Ages

Appendix B figure 111. Alternative A interior chaparral PNVTs' potentially management driven (1) and naturally driven (0) transitions for State C

Class Properties for Class D: Shrub CLS

D
Shrub - Dense Shrub-No Understory
CLS - Closed

Deterministic transitions

Timing		To Class		
Start Age	End Age	Box	Cover	Stage
21	999	D	Shrub	CLS

Display Pathways

☒ From Class
☐ To Class

Probabilistic transitions

Transition Type	Prob	Propn	Prob x Propn	To Class		
				Box	Cover	Stage
All Fuels	0.0002	1.00	0.0002	A	Grass	OPN
All RX Burning	0.0155	0.30	0.0047	D	Shrub	CLS
ReplacementFire	0.0029	1.00	0.0029	A	Grass	OPN

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Appendix B figure 112. Alternative A interior chaparral PNVTs' potentially management driven (2) and naturally driven (1) transitions for State D

Riparian Areas/Forest PNVTs

Wetland/Cienega Riparian Areas PNVT

Appendix B table 21. Wetland/cienega riparian areas PNVT crosswalks developed by USDA FS Southwestern Region 3 (10 March 2008) used in the determination of departure from HRV and DCs. DCs were provided by the Regional Office, and HRV was derived from LANDFIRE (2003)

Model	State	Historic Mean (%)	Vegetation States		Region 3 Existing Vegetation Classes
					dominance type group - structure class
LANDFIRE RA "Wet Grassland" PNVG (WGRA)	A	15	Post replacement	=	Herbaceous vegetation regeneration, recently burned, sparsely vegetated; with < 10% tree or shrub canopy cover; early successional development
	B	80	Mid development - open canopy	=	Perennial herbaceous vegetation, with < 10% tree or shrub canopy cover; mid successional development
	C	5	Mid development - closed canopy	=	Shrubs, and seedling and sapling size (< 5" diameter) trees with open (< 30%) or closed (≥ 30) canopy cover, with perennial herbaceous understory vegetation; mid successional development
	<i>Contemporary Landscapes Only ...</i>				
	D	0	Late development - open and closed canopy	=	Shrubs, small size (5"-9.9" diameter), medium size (10"-19.9" diameter), and large to very large size (> 20" diameter) trees with open (< 30%) or closed (≥ 30) canopy cover, with herbaceous understory vegetation; late successional development; not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

PNVT description: Large (generally greater than 120 square acres) montane and valley freshwater marsh and wet meadow communities dominated by bulrushes, cattails and/or other wetland herbaceous species with saturated soil or standing water for most of the year, but which all or a portion generally dry out annually.

Cottonwood-Willow Riparian Forest PNV

Appendix B table 22. Cottonwood-willow riparian forest¹ PNV crosswalks developed by USDA FS Southwestern Region 3 (10 March 2008) used in the determination of departure from HRV and DCs. DCs were provided by the Regional Office, and HRV was derived from LANDFIRE (2007d)

Model	State	Historic Mean (%)	Vegetation States	R3 Existing Vegetation Classes
LANDFIRE National "North American Warm Desert Riparian Systems" (1511551)	A	20	Early development 1- Post woody reproduction - All structures	Recently burned, all corresponding herbaceous types - N/A
				All corresponding shrub types other than mesquite or mesquite mixes ² - Shrub - open and closed canopies
	B	25	Mid development 1 - closed canopy	All corresponding tree types - Seedling/sapling
				All corresponding tree types - Small - open and closed canopies, Medium - open and closed canopies
	C	35	Late development 1 - closed canopy	All corresponding tree types - Very large - open and closed canopies
	D	20	Late development 2 - closed canopy	Mesquite or mesquite mixes ² - Shrub - open and closed canopies

¹ There are two "North America Warm Desert Riparian Systems" models (1511551 and 1511552) with very different reference conditions and fire regimes. 1511552 is described in stringers. 1511551 is the regional standard, for which reference conditions have not changed. Jack Triepke, USDA FS Southwestern Region 3 Ecologist, Jack Triepke, revisited the state descriptions, which makes for a difficult crosswalk without reliable cover type mapping to discern mesquite and cottonwood (USDA FS Southwestern Region 3 might need more than one crosswalk for this PNV). Jack Triepke has revamped the existing crosswalk to differentiate mesquite domination (state D), the updated crosswalk assuming that mesquite is mapped as a shrub form (this is true for most of Region 3 mid-scale mapping)

² Crosswalk assumes that mesquite and mesquite mixes are mapped as shrub life forms

PNVT description: Riparian systems occur primarily along perennial streams/rivers and arroyos and washes that have a high watertable or intermittent flows. The vegetation is a diverse mosaic of riparian forests, shrublands, streamside marshes and alluvial surfaces. Larger riparian systems are dominated by gallery forests. Dominant species are cottonwood, willow, saltgrass, bulrush, cattail, mesquite, seep willow, and muhlys. Vegetation is dependent upon periodic flooding. Native Americans also had a strong influence on vegetation composition and structure by favoring edible plants (e.g. mesquite), collecting fire wood and burning to flush animals and increase accessibility to open water and agricultural fields.

Mixed Broadleaf Deciduous Riparian Forest PNVT

Appendix B table 23. Mixed broadleaf deciduous riparian forest¹ PNVT crosswalks developed by Region 3 (19 September 2006) used in the determination of departure from HRV and DCs. DCs were provided by the Regional Office, and HRV was derived from LANDFIRE (2008)

Model	State	Desired Condition/ Historic Mean (%)	Historic Vegetation States		R3 Existing Vegetation Classes
					dominance type group - structure class
LANDFIRE RA "Mesquite Bosques" (R3MEBO)	A	10	Early 1 - Post woody reproduction - Dominated by resprouts and seedlings of shrubs and trees	=	Recently burned, sparsely vegetated, all corresponding herbaceous and shrub types - N/A
	B	30	Mid development 1 - closed canopy	=	All corresponding tree types - Small - closed canopy, Medium - closed canopy
	C	25	Mid development 1 - open canopy	=	All corresponding tree types - Seedling/sapling, Small - open canopy
	D	15	Late development 1 - open canopy	=	All corresponding tree types - Medium - open canopy, Very large - open canopy
	E	20	Late development 1 - closed canopy	=	All corresponding tree types - Very large - closed canopy

¹ The LANDFIRE model used to represent this PNVT provides a poor depiction of this system. USDA FS Southwestern Region 3 is in the process of developing a VDDT model and description for this PNVT

PNVT description: This riparian type typically occurs in the valleys, and found along intermittent streams and major drainages. Vegetation is woodland dominated by alder, sycamore, cottonwood, willow, catclaw, other associated shrubs and understory grasses and forbs.

Montane Willow Riparian Forest PNV

Appendix B table 24. Montane willow riparian forest¹ PNV crosswalks developed by Region 3 (10 March 2008) used in the determination of departure from HRV and DCs. DCs were provided by the Regional Office, and HRV was derived from LANDFIRE (2007e)

Model	State	Historic Mean (%)	Vegetation States	R3 Existing Vegetation Classes	
				Dominance Type Group - Structure Class	
LANDFIRE National "Montane Riparian Systems" (2411590)	A	65	Early development 1 - all	=	Recently burned, all corresponding herbaceous types - N/A
				=	All corresponding shrub types - Shrub - open canopy
	B	35	Mid development 1 - closed canopy	=	All corresponding shrub types - Shrub - closed canopy
				=	All corresponding tree types - All size classes

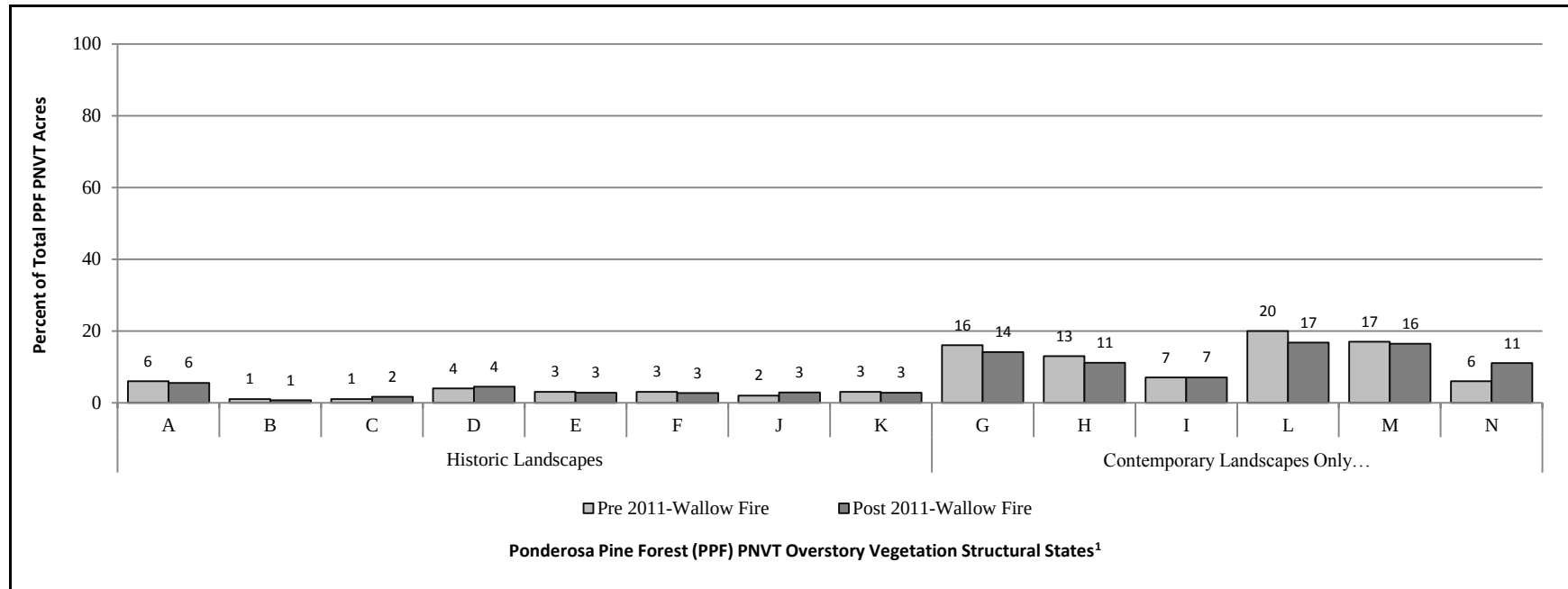
¹The LANDFIRE model used to represent this PNV provides a poor depiction of this system. USDA FS Southwestern Region 3 is in the process of developing a VDDT model and description for this PNV

PNV description: This riparian forest type exists as relatively small linear stringers occurring in the montane/subalpine zone. This PNV encompasses a broad array of riparian species. This riparian area is highly variable and generally consists of one or more of the following species: cottonwoods, willows, sedges and other herbaceous vegetation, aspen, and conifers (primarily spruce and fir).

Appendix C – Pre- and Post- 2011 Wallow Fire Overstory Vegetation Structural States

Forested PNVTs

Ponderosa Pine Forest PNVT



Appendix C figure 1. Ponderosa pine forest (PPF) PNVT pre-2011 Wallow Fire overstory vegetation structural states compared to post-2011 Wallow Fire overstory vegetation structural states

¹ Ponderosa Pine Forest (PPF) PNVT Overstory Vegetation Structural States. At 602,206 acres or approximately 30% of the forests this PNVT is the largest on the A-SNFs

STRUCTURAL STATES PART OF THE HISTORIC LANDSCAPE CONDITIONS OR WITHIN HISTORIC RANGE OF VARIABILITY

State A - Recently burned, grass, forb and shrub types with < 10% tree canopy cover; early successional development

State B - Seedling and sapling size (< 5" diameter) trees with open (≥ 10% & ≤ 30%) canopy cover; all tree types; early successional development

State C - Small size (5"-9.9" diameter) trees, with open canopy cover; all tree types; mid successional development

State D - Medium size (10"-19.9" diameter) trees, single storied, with open canopy cover; all tree types; late successional development

State E - Large to very large size (≥ 20" diameter) trees, single storied, with open canopy cover; all tree types; late successional development

State F - Seedling and sapling size trees with closed (> 30%) canopy cover; all tree types; early successional development

State J - Medium size trees, multi-storied, with open canopy cover; all tree types; late successional development

State K - Large to very large size trees, multi-storied, with open canopy cover; all tree types; late successional development

STRUCTURAL STATES NOT PART OF THE HISTORIC LANDSCAPE CONDITIONS OR WITHIN HISTORIC RANGE OF VARIABILITY, FOUND ON CONTEMPORARY LANDSCAPES ONLY

State G - Small size trees, with closed canopy cover; all tree types; mid successional development; not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

State H - Medium size trees, single storied, with closed canopy cover; all shade tree types; late successional development; not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

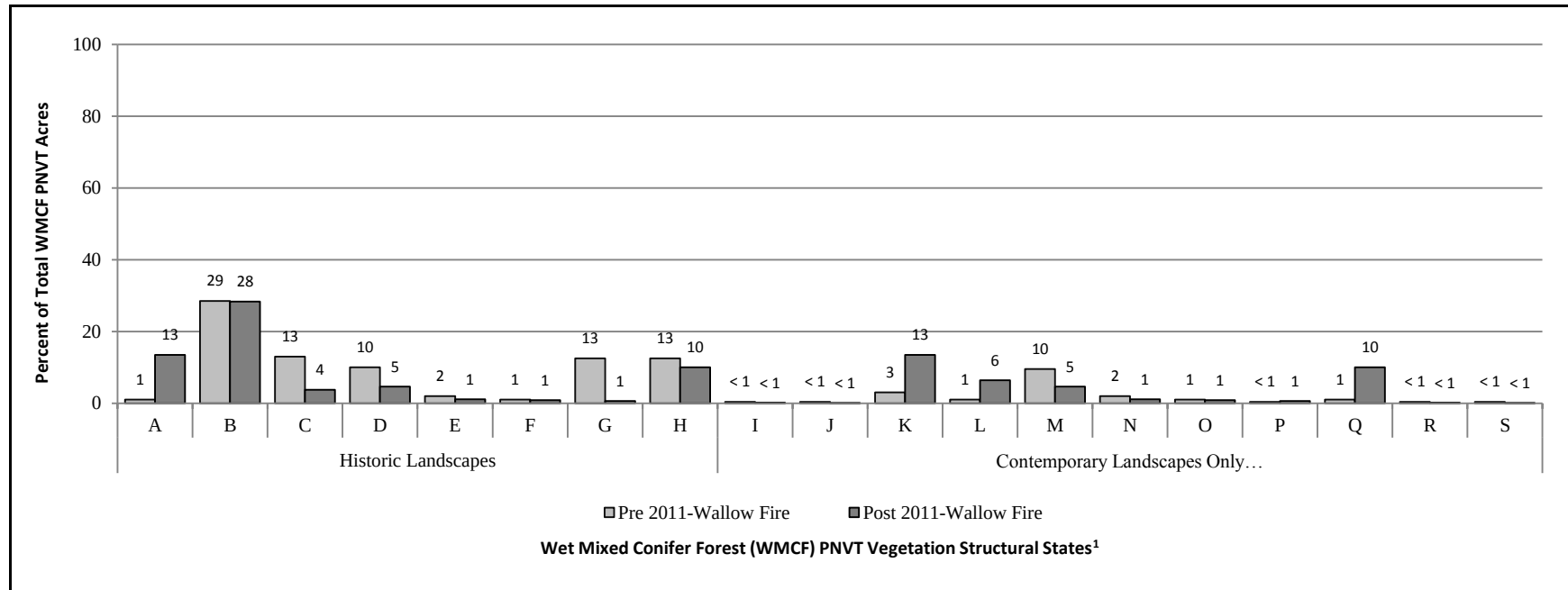
State I - Large to very large size trees, single storied, with closed canopy cover; all tree types; late successional development; not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

State L - Medium size trees, multi-storied, with closed canopy cover; all tree types; late successional development; not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

State M - Large to very large size trees, multi-storied, with closed canopy cover; tree types; late successional development; not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

State N - Recently burned, grass, forb and shrub types with < 10% tree canopy cover; uncharacteristic early successional development due to fire; not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

Wet Mixed Conifer Forest PNVT



Appendix C figure 2. Wet mixed conifer forest (WMCF) PNVT pre-2011 Wallow Fire overstory vegetation structural states compared to post-2011 Wallow Fire overstory vegetation structural states

¹ Wet Mixed Conifer Forest (WMCF) PNVT Overstory Vegetation Structural States. At 177,995 acres or approximately 9% of the forests this PNVT ranks 5th in order of size out of the 14 PNVTs on the A-SNFs

STRUCTURAL STATES PART OF THE HISTORIC LANDSCAPE CONDITIONS OR WITHIN HISTORIC RANGE OF VARIABILITY (PRE AND POST-2011 WALLOW FIRE THESE STATES EXISTED WITH ASPEN REGENERATION)

State A - Recently burned, grass, forb and shrub types, with < 10% tree canopy cover; early successional development; with aspen regeneration

State B - Seedling and sapling (< 5" diameter), small (5"-9.9" diameter), medium (10"-19.9" diameter), large to very large (≥ 20" diameter) size trees, with open (≥ 10% & ≤ 30%) or closed (> 30%) canopy cover, consisting of all aspen, deciduous tree mix, and evergreen-deciduous mix tree types; with aspen regeneration

State C - Seedling and sapling, and small size trees, with closed canopy cover; with a plurality of shade tolerant/mixed shade tolerant tree types; with aspen regeneration. Also includes seedling and sapling, and small size trees, with open canopy cover, with a plurality of shade tolerant tree types; with aspen regeneration

State D - Medium size trees, single or multi-storied, with closed canopy cover; with a plurality of shade tolerant/mixed shade tolerant tree types; with aspen regeneration. Also includes medium size trees, single or multi-storied, with open canopy cover; with a plurality of shade tolerant tree types; with aspen regeneration

State E - Large to very large size trees, single storied, with closed canopy cover; with a plurality of shade tolerant tree types; with aspen regeneration. Also includes large to very large size trees, single storied, with closed canopy cover; with a plurality of shade intolerant tree types; with aspen regeneration

State F - Large to very large size trees, multi-storied, with closed canopy cover; with a plurality of shade tolerant tree types; with aspen regeneration. Also includes large to very large size trees, multi-storied, with closed canopy cover; with a plurality of shade intolerant tree types; with aspen regeneration

State G - Seedling and sapling, and small size trees, with open canopy cover; with a plurality of shade intolerant tree types; with aspen regeneration

State H - Medium size trees, single or multi-storied, with open canopy cover; with a plurality of shade intolerant tree types; with aspen regeneration. Also includes medium size trees, single or multi-storied, with closed canopy cover; with a plurality of shade intolerant tree types; with aspen regeneration

STRUCTURAL STATES NOT PART OF THE HISTORIC LANDSCAPE CONDITIONS OR WITHIN HISTORIC RANGE OF VARIABILITY, FOUND ON CONTEMPORARY LANDSCAPES ONLY (PRE-2011 WALLOW FIRE THESE STATES EXISTED WITH LITTLE OR NO ASPEN REGENERATION; POST-2011 WALLOW FIRE THESE STATES EXIST WITH ASPEN REGENERATION)

State I - Large to very large size trees, single storied, with open canopy cover; with a plurality of shade tolerant tree types; with aspen regeneration. This state was not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

State J - Large to very large size trees, multi-storied, with open canopy cover; with a plurality of shade tolerant tree types; with aspen regeneration. Also includes large to very large size trees, multi-storied, with open canopy cover; with a plurality of shade intolerant tree types; with aspen regeneration. This state was not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

State K - Recently burned, grass, forb and shrub types, with < 10% tree canopy cover; early successional development; with aspen regeneration; not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

State L - Seedling and sapling, and small size trees, with closed canopy cover; with a plurality of shade intolerant tree types; with aspen regeneration; not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

State M - Medium size trees, single or multi-storied, with closed canopy cover; with a plurality of shade tolerant/mixed shade tolerant tree types. Also includes medium size trees, single or multi-storied, with open canopy cover; with a plurality of shade tolerant tree types; with aspen regeneration. This state was not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

State N - Large to very large size trees, single storied, with closed canopy cover; with a plurality of shade tolerant tree types. Also includes large to very large size trees, single storied, with closed canopy cover; with a plurality of shade intolerant tree types; with aspen regeneration; not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

State O - Large to very large size trees, multi-storied, with closed canopy cover; with a plurality of shade tolerant tree types. Also includes large to very large size trees, multi-storied, with closed canopy cover; with a plurality of shade intolerant tree types with aspen regeneration; not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

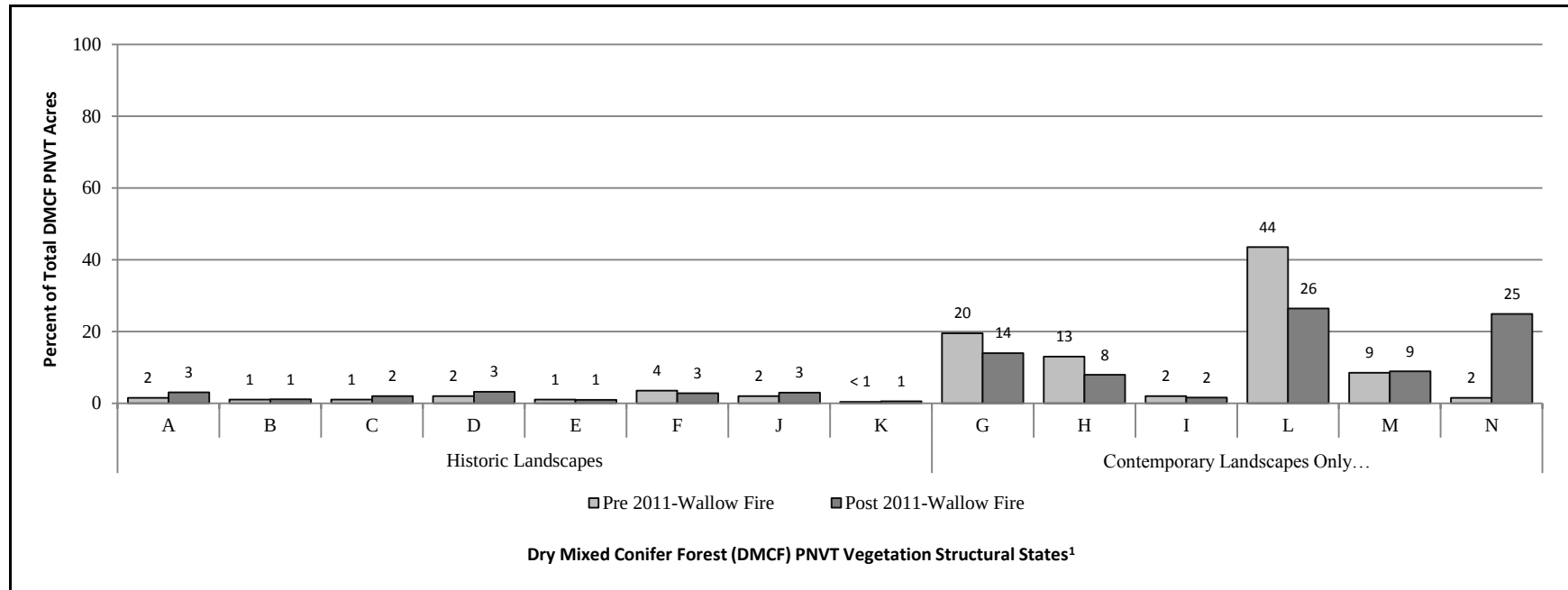
State P - Seedling and sapling, and small size trees, with open canopy cover; with a plurality of shade intolerant tree types; with aspen regeneration; not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

State Q - Medium size trees, single or multi-storied, with open canopy cover; with a plurality of shade intolerant tree types. Also includes medium size trees, single or multi-storied, with closed canopy cover; with a plurality of shade intolerant tree types; with aspen regeneration; not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

State R - Large to very large size trees, single storied, with open canopy cover; with a plurality of shade intolerant tree types; with aspen regeneration; not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

State S - Large to very large size trees, multi-storied, with open canopy cover; with a plurality of shade tolerant tree types. Also includes large to very large size trees, multi-storied, with open canopy cover; with a plurality of shade intolerant tree types; with aspen regeneration; not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

Dry Mixed Conifer Forest PNVT



Appendix C figure 3. Dry mixed conifer forest (DMCF) PNVT pre-2011 Wallow Fire overstory vegetation structural states compared to post-2011 Wallow Fire overstory vegetation structural states

¹ Dry Mixed Conifer Forest (DMCF) PNVT Overstory Vegetation Structural States. At 147,885 acres or approximately 7% of the forests this PNVT ranks 6th in order of size out of the 14 PNVTs on the A-SNFs

STRUCTURAL STATES PART OF THE HISTORIC LANDSCAPE CONDITIONS OR WITHIN HISTORIC RANGE OF VARIABILITY

State A - Recently burned, grass, forb and shrub types with < 10% tree canopy cover; early successional development

State B - Seedling and sapling size (< 5" diameter) trees with open (≥ 10% & ≤ 30%) canopy cover; all tree types; early successional development

State C - Small size (5"-9.9" diameter) trees, with open canopy cover; all tree types; mid successional development

State D - Medium size (10"-19.9" diameter) trees, single storied, with open canopy cover; all tree types; late successional development

State E - Large to very large size (≥ 20" diameter) trees, single storied, with open canopy cover; all tree types; late successional development

State F - Seedling and sapling size trees with closed (> 30%) canopy cover; all tree types; early successional development

State J - Medium size trees, multi-storied, with open canopy cover; all tree types; late successional development

State K - Large to very large size trees, multi-storied, with open canopy cover; all tree types; late successional development

STRUCTURAL STATES NOT PART OF THE HISTORIC LANDSCAPE CONDITIONS OR WITHIN HISTORIC RANGE OF VARIABILITY, FOUND ON CONTEMPORARY LANDSCAPES ONLY

State G - Small size trees, with closed canopy cover; all tree types; mid successional development; not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

State H - Medium size trees, single storied, with closed canopy cover; all shade tree types; late successional development; not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

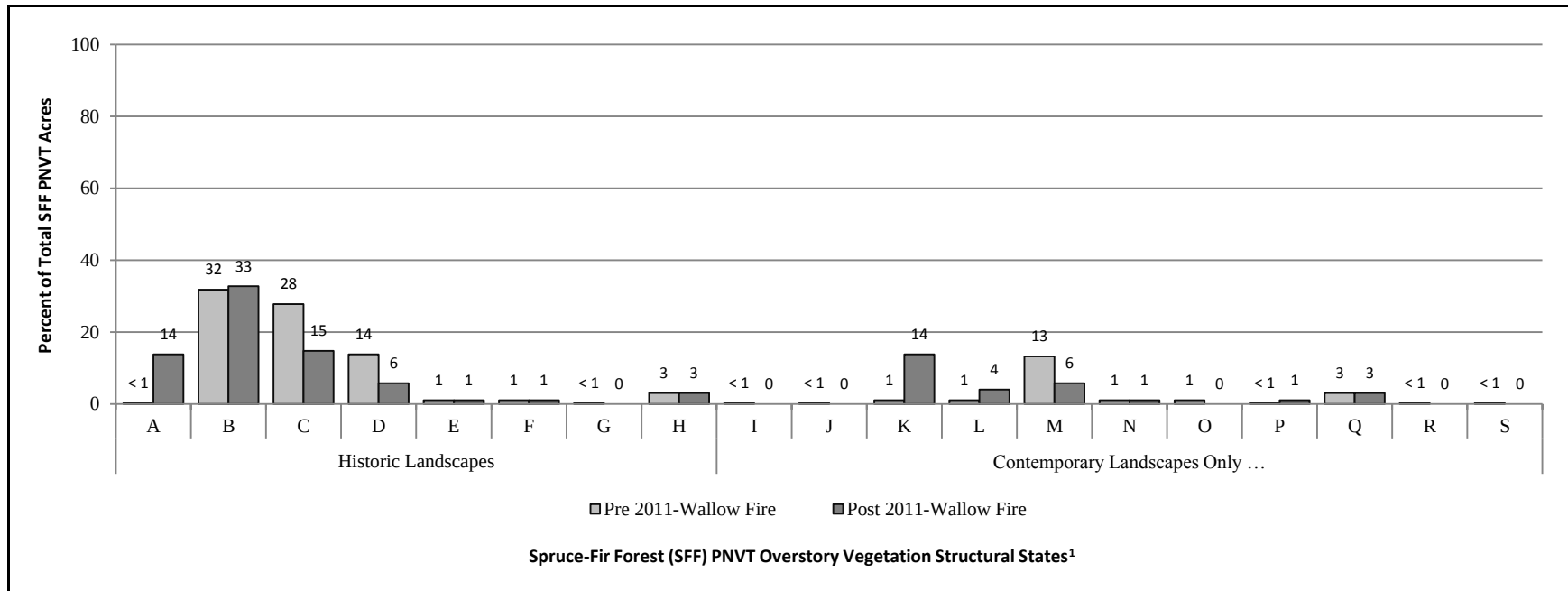
State I - Large to very large size trees, single storied, with closed canopy cover; all tree types; late successional development; not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

State L - Medium size trees, multi-storied, with closed canopy cover; all tree types; late successional development; not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

State M - Large to very large size trees, multi-storied, with closed canopy cover; tree types; late successional development; not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

State N - Recently burned, grass, forb and shrub types with < 10% tree canopy cover; uncharacteristic early successional development due to fire; not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

Spruce-Fir Forest PNVT



Appendix C figure 4. Spruce-fir forest (SFF) PNVT pre-2011 Wallow Fire overstory vegetation structural states compared to post-2011 Wallow Fire overstory vegetation structural states

¹ Spruce-Fir Forest (SFF) PNVT Overstory Vegetation Structural States. At 17,667 acres or approximately 0.9% of the forests this PNVT ranks 11th in order of size out of the 14 PNVTs on the A-SNFs

STRUCTURAL STATES PART OF THE HISTORIC LANDSCAPE CONDITIONS OR WITHIN HISTORIC RANGE OF VARIABILITY (PRE AND POST-2011 WALLOW FIRE THESE STATES EXISTED WITH ASPEN REGENERATION)

State A - Recently burned, grass, forb and shrub types, with < 10% tree canopy cover; early successional development; with aspen regeneration

State B - Seedling and sapling (< 5" diameter), small (5"-9.9" diameter), medium (10"-19.9" diameter), large to very large (≥ 20" diameter) size trees, with open (≥ 10% & ≤ 30%) or closed (> 30%) canopy cover, consisting of all aspen, deciduous tree mix, and evergreen-deciduous mix tree types; with aspen regeneration

State C - Seedling and sapling, and small size trees, with closed canopy cover; with a plurality of shade tolerant/mixed shade tolerant tree types; with aspen regeneration. Also includes seedling and sapling, and small size trees, with open canopy cover, with a plurality of shade tolerant tree types; with aspen regeneration

State D - Medium size trees, single or multi-storied, with closed canopy cover; with a plurality of shade tolerant/mixed shade tolerant tree types; with aspen regeneration. Also includes medium size trees, single or multi-storied, with open canopy cover; with a plurality of shade tolerant tree types; with aspen regeneration

State E - Large to very large size trees, single storied, with closed canopy cover; with a plurality of shade tolerant tree types; with aspen regeneration. Also includes large to very large size trees, single storied, with closed canopy cover; with a plurality of shade intolerant tree types; with aspen regeneration

State F - Large to very large size trees, multi-storied, with closed canopy cover; with a plurality of shade tolerant tree types; with aspen regeneration. Also includes large to very large size trees, multi-storied, with closed canopy cover; with a plurality of shade intolerant tree types; with aspen regeneration

State G - Seedling and sapling, and small size trees, with open canopy cover; with a plurality of shade intolerant tree types; with aspen regeneration

State H - Medium size trees, single or multi-storied, with open canopy cover; with a plurality of shade intolerant tree types; with aspen regeneration. Also includes medium size trees, single or multi-storied, with closed canopy cover; with a plurality of shade intolerant tree types; with aspen regeneration

STRUCTURAL STATES NOT PART OF THE HISTORIC LANDSCAPE CONDITIONS OR WITHIN HISTORIC RANGE OF VARIABILITY, FOUND ON CONTEMPORARY LANDSCAPES ONLY (PRE-2011 WALLOW FIRE THESE STATES EXISTED WITH LITTLE OR NO ASPEN REGENERATION; POST-2011 WALLOW FIRE THESE STATES EXIST WITH ASPEN REGENERATION)

State I - Large to very large size trees, single storied, with open canopy cover; with a plurality of shade tolerant tree types; with aspen regeneration. Also includes large to very large size trees, single storied, with open canopy cover; with a plurality of shade intolerant tree types; with aspen regeneration. This state was not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

State J - Large to very large size trees, multi-storied, with open canopy cover; with a plurality of shade tolerant tree types; with aspen regeneration. Also includes large to very large size trees, multi-storied, with open canopy cover; with a plurality of shade intolerant tree types; with aspen regeneration. This state was not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

State K - Recently burned, grass, forb and shrub types, with < 10% tree canopy cover; early successional development; with aspen regeneration; not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

State L - Seedling and sapling, and small size trees, with closed canopy cover; with a plurality of shade intolerant tree types; with aspen regeneration; not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

State M - Medium size trees, single or multi-storied, with closed canopy cover; with a plurality of shade tolerant/mixed shade tolerant tree types. Also includes medium size trees, single or multi-storied, with open canopy cover; with a plurality of shade tolerant tree types; with aspen regeneration; not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

State N - Large to very large size trees, single storied, with closed canopy cover; with a plurality of shade tolerant tree types. Also includes large to very large size trees, single storied, with closed canopy cover; with a plurality of shade intolerant tree types; with aspen regeneration; not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

State O - Large to very large size trees, multi-storied, with closed canopy cover; with a plurality of shade tolerant tree types. Also includes large to very large size trees, multi-storied, with closed canopy cover; with a plurality of shade intolerant tree types; with aspen regeneration; not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

State P - Seedling and sapling, and small size trees, with open canopy cover; with a plurality of shade intolerant tree types; with aspen regeneration; with aspen regeneration; not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

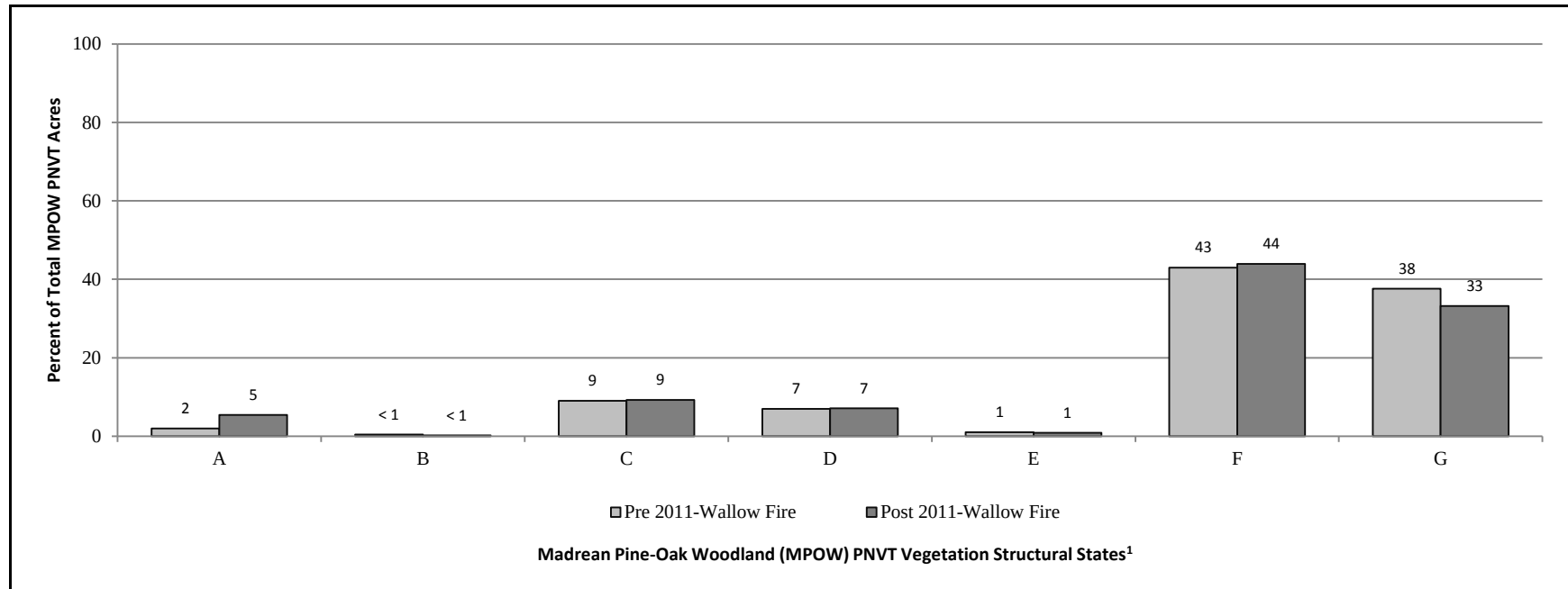
State Q - Medium size trees, single or multi-storied, with open canopy cover; with a plurality of shade intolerant tree types. Also includes medium size trees, single or multi-storied, with a plurality of closed canopy cover; with shade intolerant tree types; with aspen regeneration; not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

State R - Large to very large size trees, single storied, with open canopy cover; with a plurality of shade tolerant tree types. Also includes large to very large size trees, single storied, with open canopy cover; with a plurality of shade intolerant tree types; with aspen regeneration; not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

State S - Large to very large size trees, multi-storied, with open canopy cover; with a plurality of shade tolerant tree types. Also includes large to very large size trees, multi-storied, with open canopy cover; with a plurality of shade intolerant tree types. This state exists with elk and no or limited aspen regeneration; not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

WOODLAND PNVTS

Madrean Pine-Oak Woodland PNVNT



Appendix C figure 5. Madrean pine-oak woodland (MPOW) PNVNT pre-2011 Wallow Fire overstory vegetation structural states compared to post-2011 Wallow Fire overstory vegetation structural states

¹ Madrean Pine-Oak Woodland (MPOW) PNVNT Overstory Vegetation Structural States. At 394,928 acres or approximately 20% of the forests this PNVNT ranks 2nd in order of size out of the 14 PNVNTs on the A-SNFs

STRUCTURAL STATES PART OF THE HISTORIC LANDSCAPE CONDITIONS OR WITHIN HISTORIC RANGE OF VARIABILITY

State A - Recently burned, grass, forb and shrub types with < 10% tree canopy cover; early successional development

State B - Seedling and sapling size (< 5" diameter) trees with open ($\geq 10\%$ & $\leq 30\%$) canopy cover; all tree types; early successional development

State C - Small size (5"-9.9" diameter) trees, with open canopy cover; all tree types; mid successional development

State D - Medium (10"-19.9" diameter) and large to very large size (≥ 20 " diameter) trees; multi-storied, with open canopy cover; all tree types; late successional development

‡Current state makeup: 5% (20,461 ac) medium size trees; and 2% (7,579 ac) large to very large size trees

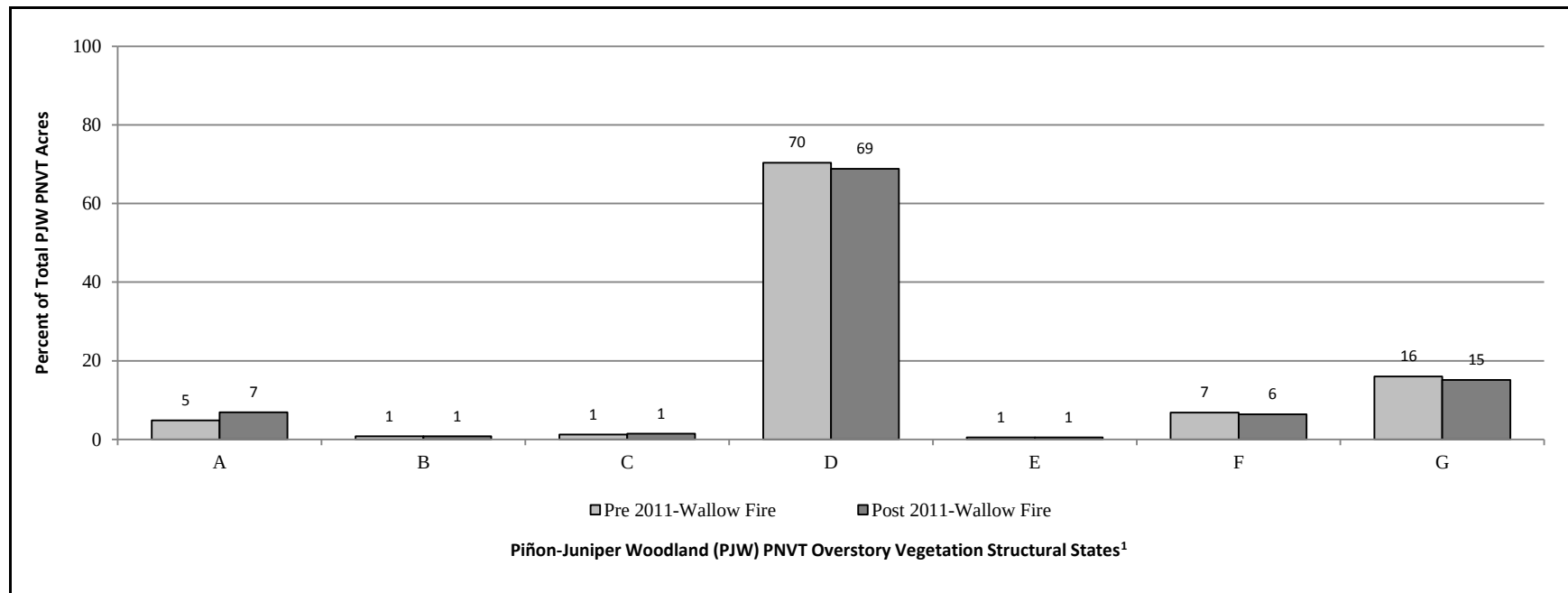
State E - Seedling and sapling size trees with closed ($> 30\%$) canopy cover; all tree types; early successional development

State F - Small size trees, with closed canopy cover; all tree types; mid successional development

State G - Medium and large to very large size trees; multi-storied, with closed canopy cover; all tree types; late successional development

†Current state makeup: 23% (89,110 ac) medium size trees; and 10% (41,863 ac) large to very large size trees

Piñon-Juniper Woodland PNVT



Appendix C figure 6. Piñon-juniper woodland (PJW) PNVT pre-2011 Wallow Fire overstory vegetation structural states compared to post-2011 Wallow Fire overstory vegetation structural states

¹ Piñon-Juniper Woodland (PJW) PNVT Overstory Vegetation Structural States. At 222,166 acres or approximately 11% of the forests this PNVT ranks 3rd in order of size out of the 14 PNVTs on the A-SNFs

STRUCTURAL STATES PART OF THE HISTORIC LANDSCAPE CONDITIONS OR WITHIN HISTORIC RANGE OF VARIABILITY

State A - Recently burned, grass, forb and shrub types with < 10% tree canopy cover; early successional development

State B - Seedling and sapling size (< 5" diameter) trees with open (≥ 10% & ≤ 30%) canopy cover; all tree types; early successional development

State C - Small size (5"-9.9" diameter) trees, with open canopy cover; all tree types; mid successional development

State D - Medium (10"-19.9" diameter) and large to very large size (≥ 20" diameter) trees; multi-storied, with open canopy cover; all tree types; late successional development

‡Current state makeup: 44% (97,416 ac) medium size trees; and 25% (54,547 ac) large to very large size trees

State E - Seedling and sapling size trees with closed (> 30%) canopy cover; all tree types; early successional development

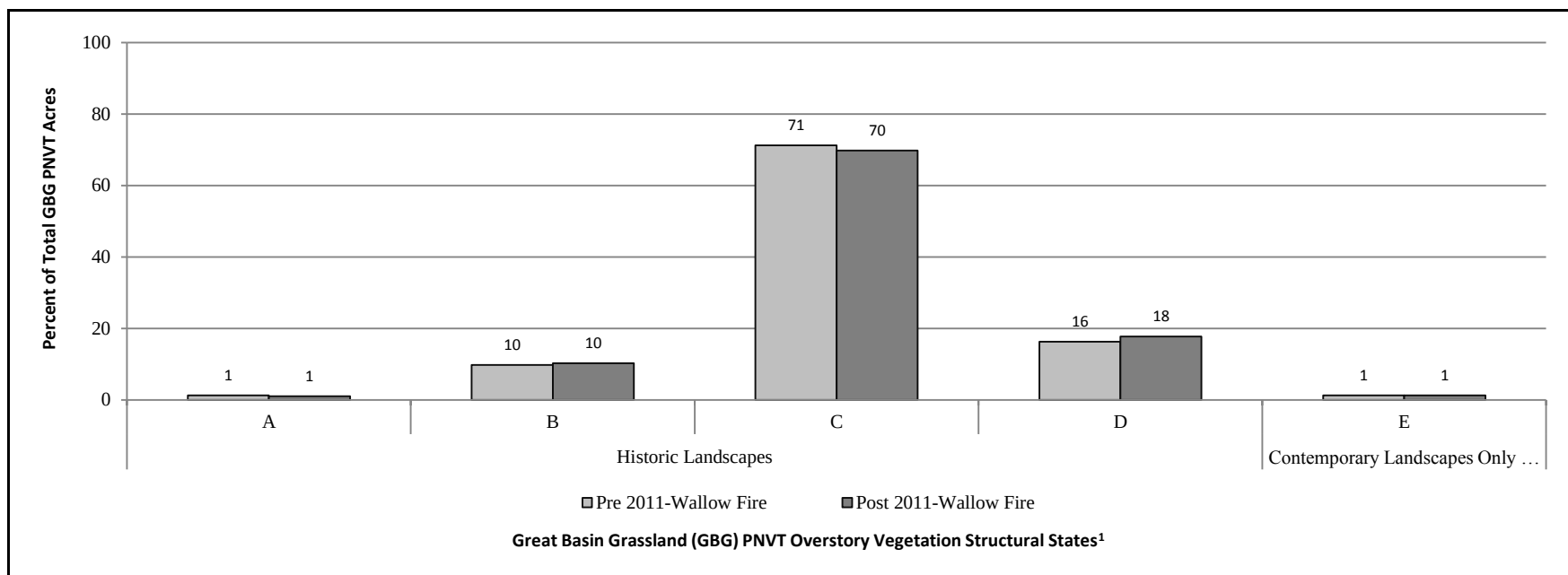
State F - Small size trees, with closed canopy cover; all tree types; mid successional development

State G - Medium and large to very large size trees; multi-storied, with closed canopy cover; all tree types; late successional development

†Current state makeup: 8% (17,580 ac) medium size trees; and 7% (16,013 ac) large to very large size trees

GRASSLAND PNVTs

Great Basin Grassland PNV



Appendix C figure 7. Great Basin grassland (GBG) PNV pre-2011 Wallow Fire overstory vegetation structural states compared to post-2011 Wallow Fire overstory vegetation structural states

¹ Great Basin Grassland (GBG) PNV Overstory Vegetation Structural States. At 185,523 acres or approximately 9% of the forests this PNV ranks 4th in order of size out of the 14 PNVTs on the A-SNFs

STRUCTURAL STATES PART OF THE HISTORIC LANDSCAPE CONDITIONS OR WITHIN HISTORIC RANGE OF VARIABILITY

State A - Herbaceous vegetation regeneration, recently burned, sparsely vegetated; with < 10% tree or shrub canopy cover; early successional development

State B - Open perennial herbaceous vegetation, with < 10% tree or shrub canopy cover; mid successional development

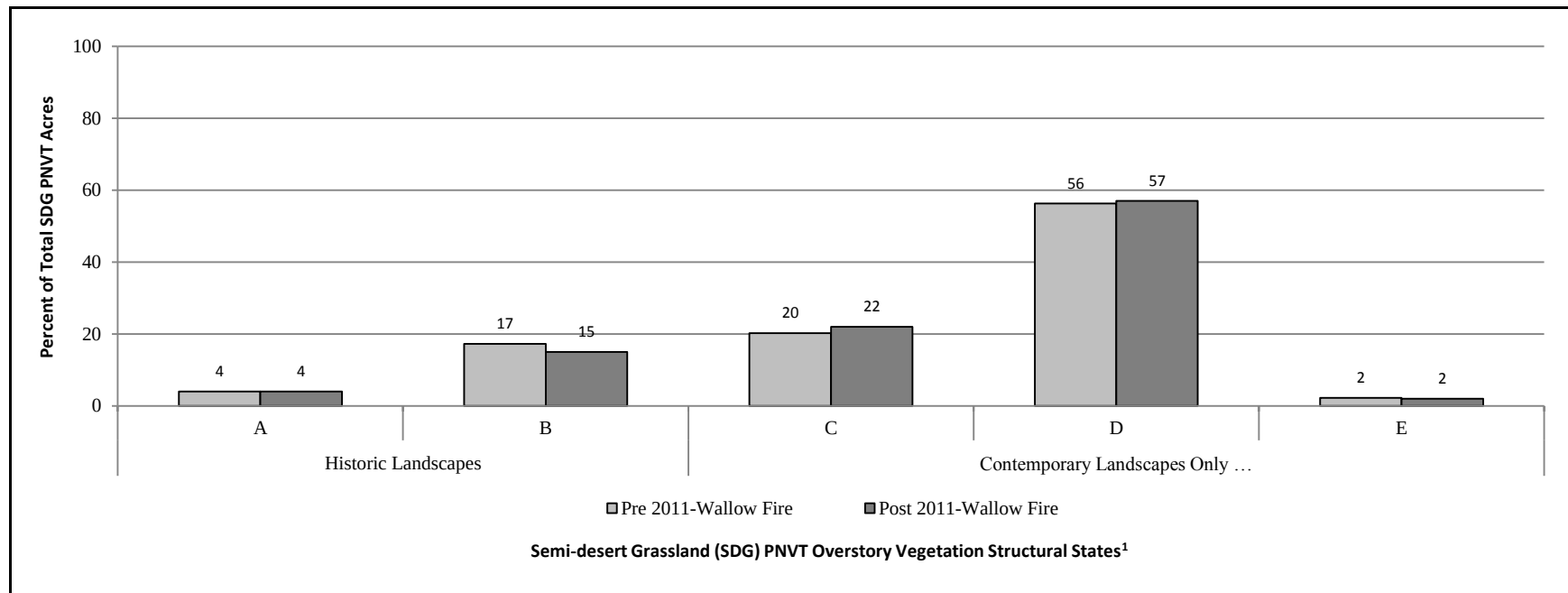
State C - Perennial herbaceous vegetation with shrubs, seedling and sapling size (< 5" diameter), small size (5"-9.9" diameter), and medium size (10"-19.9" diameter) trees with open (≥ 10% & ≤ 30%) canopy cover; late successional development

State D - Shrubs, seedling and sapling, small, medium, and large to very large size (≥ 20" diameter) trees with closed (> 30%) canopy cover, and large to very large size trees with open canopy cover with perennial herbaceous understory vegetation, mid successional development

STRUCTURAL STATE NOT PART OF THE HISTORIC LANDSCAPE CONDITIONS OR WITHIN HISTORIC RANGE OF VARIABILITY, FOUND ON CONTEMPORARY LANDSCAPES ONLY

State E - Various noxious weeds and invasive plants makeup a significant portion of the herbaceous vegetation composition; not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

Semi-desert Grassland PNVT



Appendix C figure 8. Semi-desert grassland (SDG) PNVT pre-2011 Wallow Fire overstory vegetation structural states compared to post-2011 Wallow Fire overstory vegetation structural states

¹ Semi-desert Grassland (SDG) PNVT Overstory Vegetation Structural States. At 106,952 acres or approximately 5% of the forests this PNVT ranks 7th in order of size out of the 14 PNVTs on the A-SNFs

STRUCTURAL STATES PART OF THE HISTORIC LANDSCAPE CONDITIONS OR WITHIN HISTORIC RANGE OF VARIABILITY

State A - Herbaceous vegetation regeneration, recently burned, sparsely vegetated; with < 10% tree or shrub canopy cover; early successional development

State B - Perennial herbaceous vegetation, with < 10% tree or shrub canopy cover; mid successional development

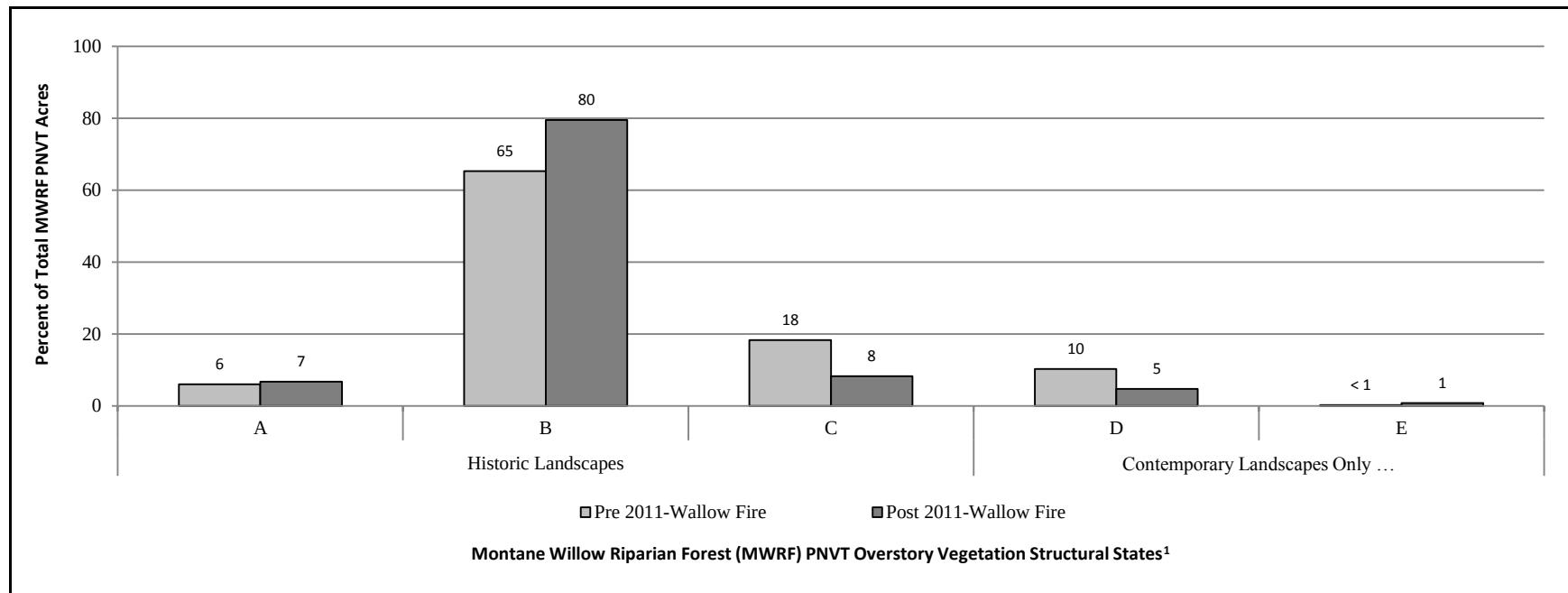
STRUCTURAL STATES NOT PART OF THE HISTORIC LANDSCAPE CONDITIONS OR WITHIN HISTORIC RANGE OF VARIABILITY, FOUND ON CONTEMPORARY LANDSCAPES ONLY

State C - Perennial herbaceous vegetation with shrubs, seedling and sapling size (< 5" diameter), small size (5"-9.9" diameter), and medium size (10"-19.9" diameter) trees with open (≥ 10% & ≤ 30%) canopy cover; late successional development

State D - Shrubs, seedling and sapling, small, medium, and large to very large size (≥ 20" diameter) trees with closed (> 30%) canopy cover, and large to very large size trees with open canopy cover with perennial herbaceous understory vegetation, mid successional development; not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

State E - Various noxious weeds and invasive plants makeup a significant portion of the herbaceous vegetation composition; not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

Montane/Subalpine Grasslands PNVT



Appendix C figure 9. Montane/subalpine grasslands (MSG) PNVT pre-2011 Wallow Fire overstory vegetation structural states compared to post-2011 Wallow Fire overstory vegetation structural states

¹ Montane/Subalpine Grasslands (MSG) PNVT Overstory Vegetation Structural States. At 51,559 acres or approximately 3% of the forests this PNVT ranks 9th in order of size out of the 14 PNVTs on the A-SNFs

STRUCTURAL STATES PART OF THE HISTORIC LANDSCAPE CONDITIONS OR WITHIN HISTORIC RANGE OF VARIABILITY

State A - Herbaceous vegetation regeneration, recently burned, sparsely vegetated; with < 10% tree or shrub canopy cover; early successional development

State B - Perennial herbaceous vegetation, with < 10% tree or shrub canopy cover; mid successional development

State C - Perennial herbaceous vegetation, with < 10% tree or shrub canopy cover; late successional development

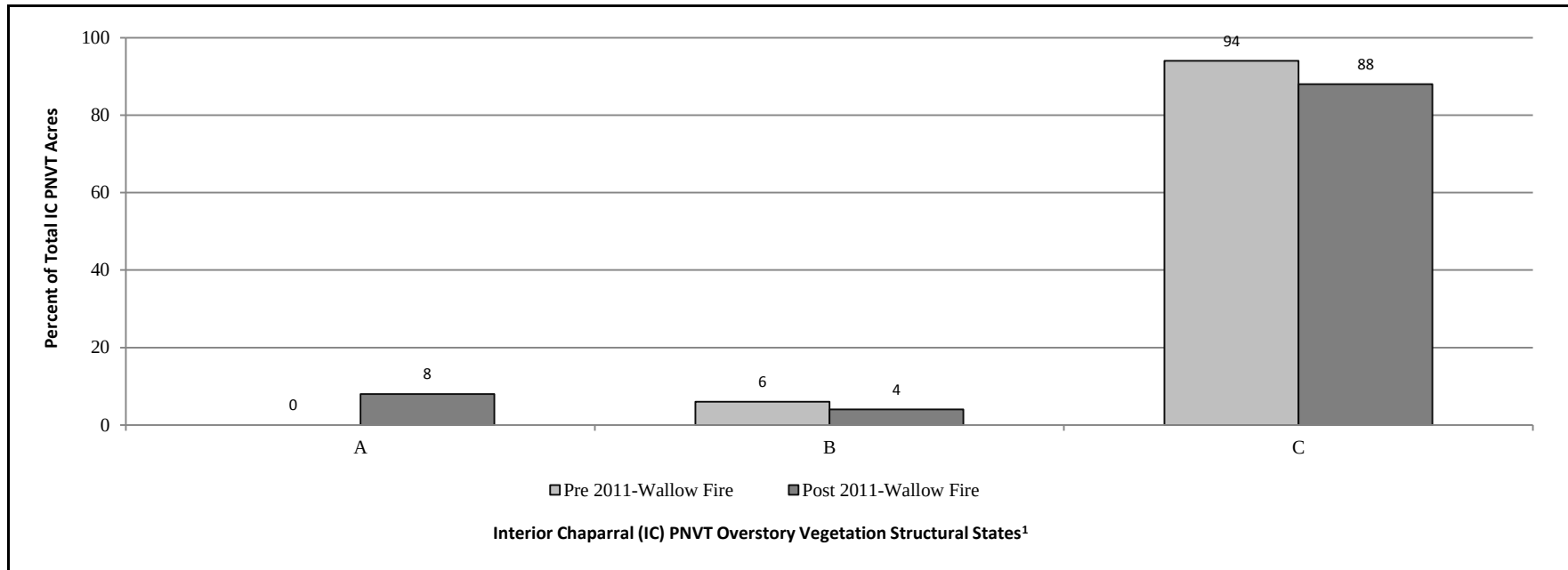
STRUCTURAL STATES NOT PART OF THE HISTORIC LANDSCAPE CONDITIONS OR WITHIN HISTORIC RANGE OF VARIABILITY, FOUND ON CONTEMPORARY LANDSCAPES ONLY

State D - Shrubs, seedling and sapling size (< 5" diameter), small size (5"-9.9" diameter), medium size (10"-19.9" diameter), and large to very large size (≥ 20" diameter) trees with open (≥ 10% & ≤ 30%) or closed (> 30%) canopy cover, with perennial herbaceous understory vegetation; not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

State E - Various noxious weeds and invasive plants makeup a significant portion of the herbaceous vegetation composition; not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

Chaparral PNVT

Interior Chaparral PNVT



Appendix C figure 10. Interior chaparral (IC) PNVT pre-2011 Wallow Fire overstory vegetation structural states compared to post-2011 Wallow Fire overstory vegetation structural states

¹ Interior Chaparral (IC) PNVT Overstory Vegetation Structural States. At 55,981 acres or approximately 3% of the forests this PNVT ranks 8th in order of size out of the 14 PNVTs on the A-SNFs

STRUCTURAL STATES PART OF THE HISTORIC LANDSCAPE CONDITIONS OR WITHIN HISTORIC RANGE OF VARIABILITY

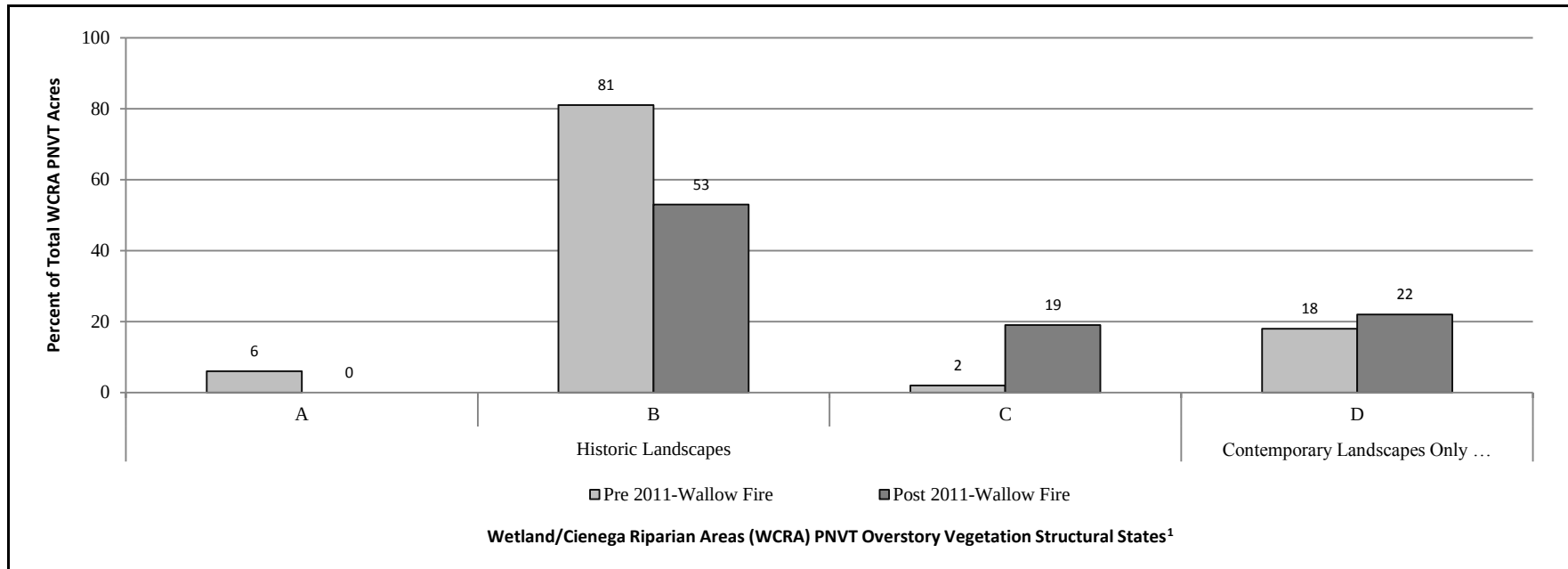
State A - Herbaceous vegetation regeneration, recently burned, sparsely vegetated; with < 10% shrub or tree canopy cover; early successional development

State B - Open perennial herbaceous vegetation, with shrubs, seedling and sapling size (< 5" diameter) and small size (5"-9.9" diameter) trees with open (≥ 10% & ≤ 30%) canopy cover; mid successional development

State C - Shrubs, seedling and sapling, small, medium size (10"-19.9" diameter), and large to very large size (≥ 20" diameter) trees with closed (> 30%) canopy cover, and medium and large to very large size (≥ 20" diameter) trees with open canopy cover and no herbaceous understory vegetation; late successional development

Riparian Areas/Riparian Forest PNVTs

Wetland/Cienega Riparian Areas PNVT



Appendix C figure 11. Wetland/cienega riparian areas (WCRA) PNVT pre-2011 Wallow Fire overstory vegetation structural states compared to post-2011 Wallow Fire overstory vegetation structural states

¹Wetland/Cienega Riparian Areas (WCRA) PNVT Overstory Vegetation Structural States. At 17,900 acres or approximately 0.9% of the forests this PNVT ranks 10th in order of size out of the 14 PNVTs on the A-SNFs

STRUCTURAL STATES PART OF THE HISTORIC LANDSCAPE CONDITIONS OR WITHIN HISTORIC RANGE OF VARIABILITY

State A - Herbaceous vegetation regeneration, recently burned, sparsely vegetated; with < 10% tree or shrub canopy cover; early successional development

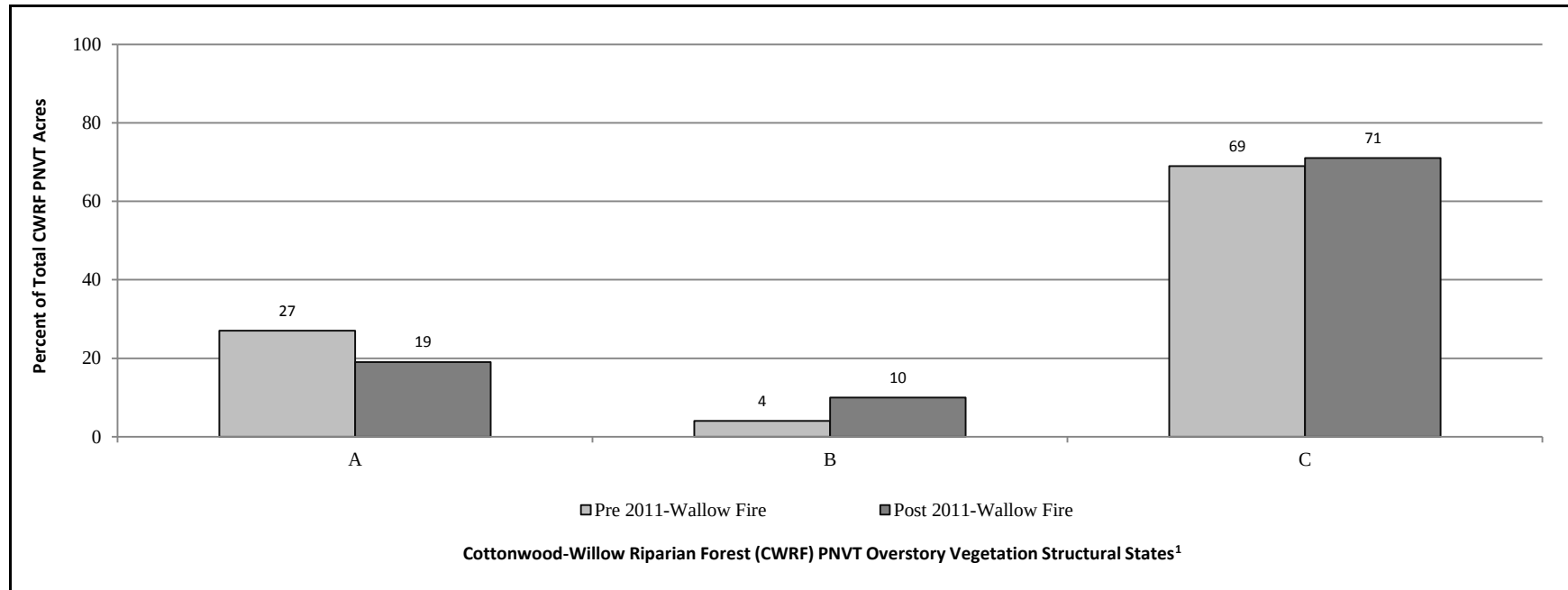
State B - Perennial herbaceous vegetation, with < 10% tree or shrub canopy cover; mid successional development

State C - Shrubs, and seedling and sapling size (< 5" diameter) trees with open (≥ 10% & ≤ 30%) or closed (> 30%) canopy cover, with perennial herbaceous understory vegetation; mid successional development

STRUCTURAL STATE NOT PART OF THE HISTORIC LANDSCAPE CONDITIONS OR WITHIN HISTORIC RANGE OF VARIABILITY, FOUND ON CONTEMPORARY LANDSCAPES ONLY

State D - Shrubs, small size (5"-9.9" diameter), medium size (10"-19.9" diameter), and large to very large size (≥ 20" diameter) trees with open or closed canopy cover, with herbaceous understory vegetation; late successional development; not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

Cottonwood-Willow Riparian Forest PNVT



Appendix C figure 12. Cottonwood-willow riparian forest (CWRF) PNVT pre-2011 Wallow Fire overstory vegetation structural states compared to post-2011 Wallow Fire overstory vegetation structural states

¹ Cottonwood-Willow Riparian Forest (CWRF) PNVT Overstory Vegetation Structural States. At 15,876 acres or approximately 0.8% of the forests this PNVT ranks 12th in order of size out of the 14 PNVTs on the A-SNFs

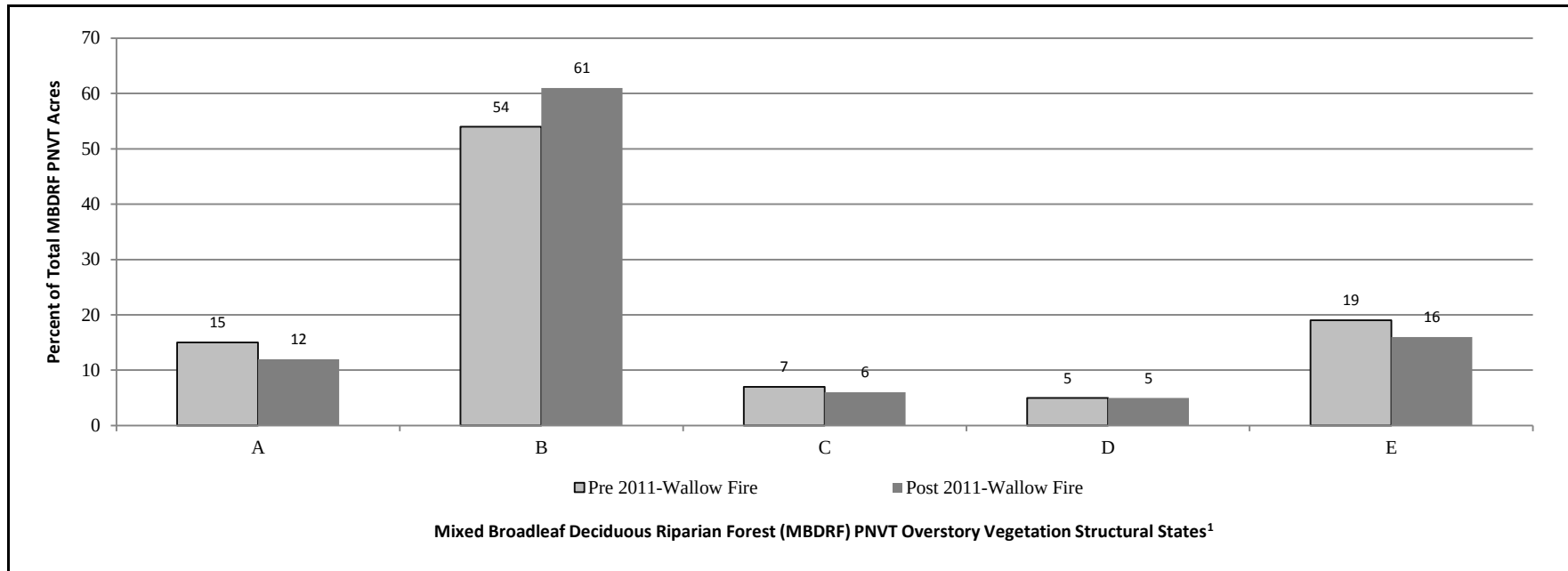
STRUCTURAL STATES PART OF THE HISTORIC LANDSCAPE CONDITIONS OR WITHIN HISTORIC RANGE OF VARIABILITY

State A - Herbaceous vegetation dominated with shrubs, seedling and sapling size (< 5" diameter) trees with open ($\geq 10\%$ & $\leq 30\%$) or closed ($> 30\%$) canopy cover; early successional development

State B - Tall shrubs and small size (5-9.9" diameter) trees with open or closed canopy cover; mid successional development

State C - Medium size (10-19.9" diameter) and large to very large ($\geq 20"$ diameter) size trees; multi-storied, with open or closed canopy cover; late successional development

Mixed Broadleaf Deciduous Riparian Forest PNVT



Appendix C figure 13. Mixed broadleaf deciduous riparian forest (MBDRF) PNVT pre-2011 Wallow Fire overstory vegetation structural states compared to post-2011 Wallow Fire overstory vegetation structural states

¹Mixed Broadleaf Deciduous Riparian Forest (MBDRF) PNVT Overstory Vegetation Structural States. At 9,657 acres or approximately 0.5% of the forests this PNVT ranks 13th in order of size out of the 14 PNVTs on the A-SNFs

STRUCTURAL STATES PART OF THE HISTORIC LANDSCAPE CONDITIONS OR WITHIN HISTORIC RANGE OF VARIABILITY

State A - Herbaceous vegetation regeneration, recently burned, sparsely vegetated; with < 10% tree or shrub canopy cover; early successional development

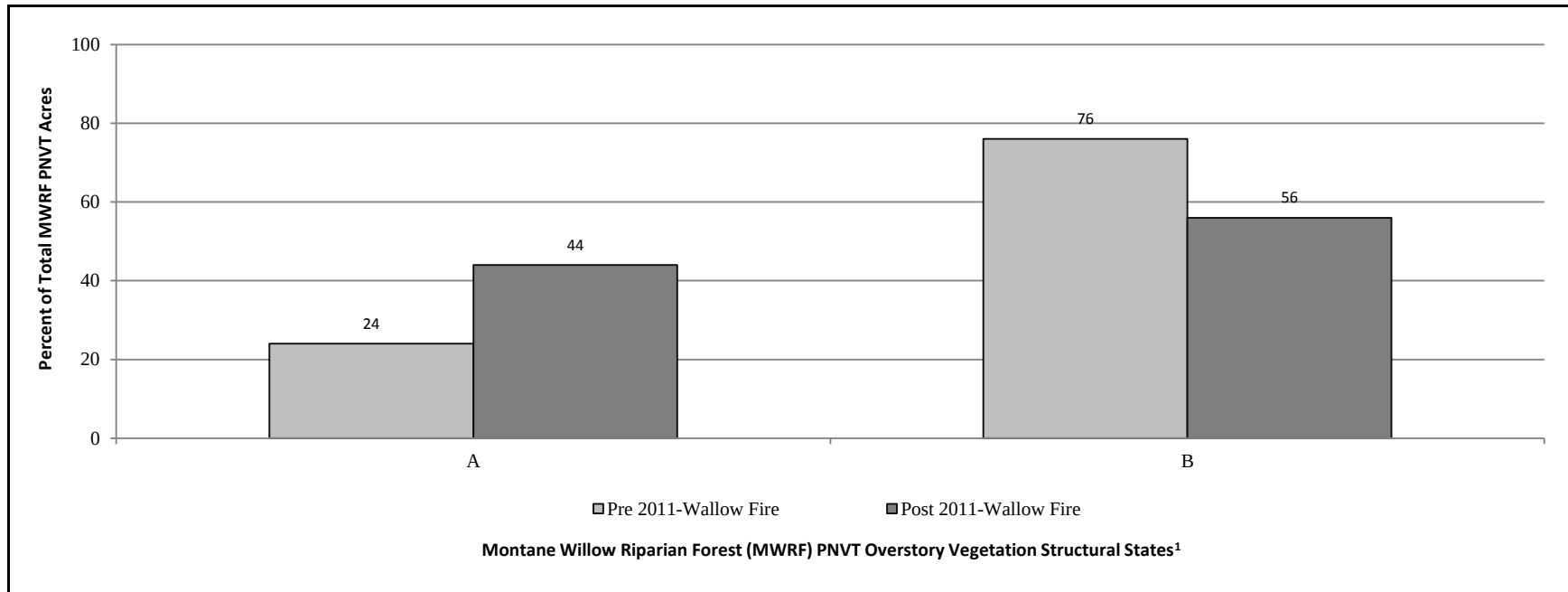
State B - Shrubs, seedling and sapling size (< 5" diameter), small size (5"-9.9" diameter), and medium size (10"-19.9" diameter) trees with closed (> 30%) canopy cover; mid successional development

State C - Shrubs, seedling and sapling, and small size trees with open (≥ 10% & ≤ 30%) canopy cover; mid successional development

State D - Shrubs, medium size, and large to very large size (≥ 20" diameter) trees; multi-storied, with open canopy cover; late successional development

State E - Shrubs, medium size, and large to very large size trees; multi-storied, with closed canopy cover; late successional development

Montane Willow Riparian Forest PNVNT



Appendix C figure 14. Montane willow riparian forest (MWRF) PNVNT pre-2011 Wallow Fire overstory vegetation structural states compared to post-2011 Wallow Fire overstory vegetation structural states

¹ Montane Willow Riparian Forest (MWRF) PNVNT Overstory Vegetation Structural States. At 4,808 acres or approximately 0.2% of the forests this PNVNT is the smallest on the A-SNFs

STRUCTURAL STATES PART OF THE HISTORIC LANDSCAPE CONDITIONS OR WITHIN HISTORIC RANGE OF VARIABILITY

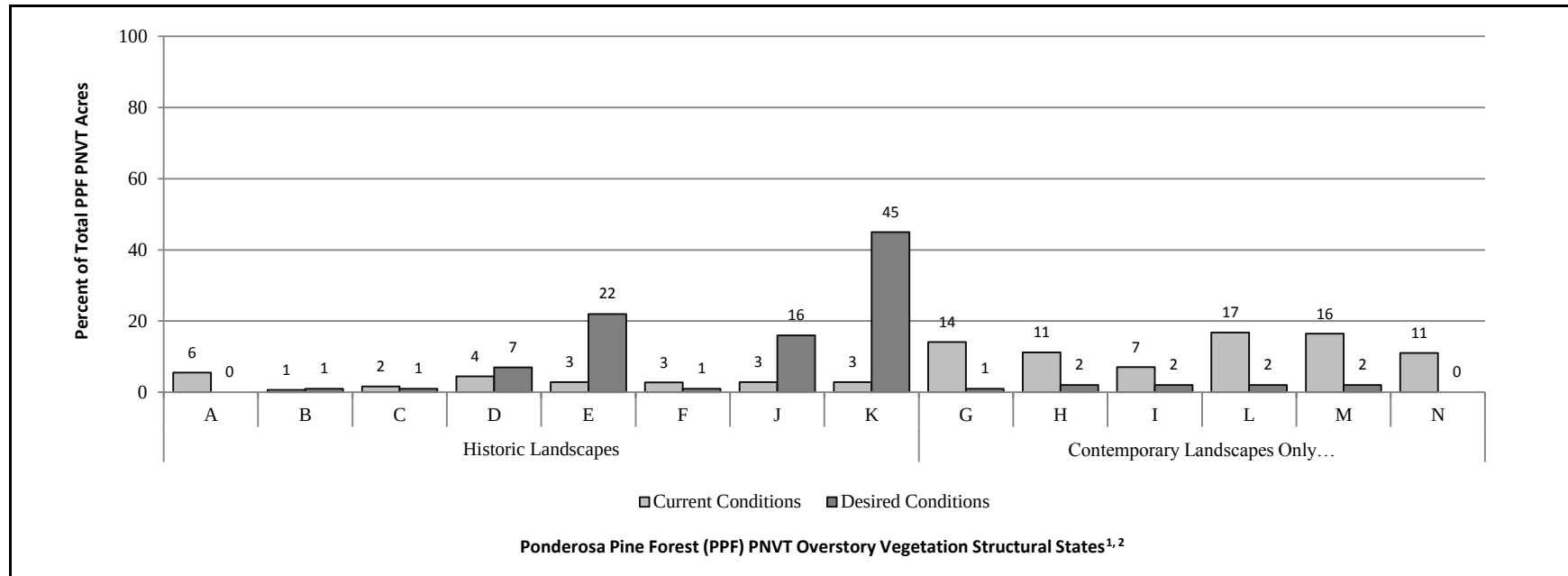
State A - Herbaceous vegetation regeneration, recently burned, and shrubs, and seedling and sapling size (< 5" diameter) trees with open ($\geq 10\%$ & $\leq 30\%$) canopy cover; early successional development

State B - Shrubs, seedling and sapling, small size (5"-9.9" diameter) trees with closed ($> 30\%$) canopy cover, and medium size (10"-19.9" diameter), and large to very large ($\geq 20"$ diameter) size trees with open or closed canopy cover; mid to late successional development

**Appendix D - Potential Natural Vegetation Types Current and Desired Condition
Overstory Structural States and Resulting Overstory Vegetation Structural States
by VDDT Model Year Runs over the 50-Year Modeling Period**

Forested PNVTs

Ponderosa Pine Forest PNVT



Appendix D figure 15. Ponderosa pine forest (PPF) PNVT current and desired overstory vegetation structural states

¹ Ponderosa Pine Forest (PPF) PNVT Overstory Vegetation Structural States. At 602,206 acres or approximately 30% of the forests this PNVT is the largest on the A-SNFs

STRUCTURAL STATES PART OF THE HISTORIC LANDSCAPE CONDITIONS OR WITHIN HISTORIC RANGE OF VARIABILITY

State A - Recently burned, grass, forb and shrub types with < 10% tree canopy cover; early successional development

State B - Seedling and sapling size (< 5" diameter) trees with open (≥ 10% & ≤ 30%) canopy cover; all tree types; early successional development

State C - Small size (5"-9.9" diameter) trees, with open canopy cover; all tree types; mid successional development

State D - Medium size (10"-19.9" diameter) trees, single storied, with open canopy cover; all tree types; late successional development

State E - Large to very large size (≥ 20" diameter) trees, single storied, with open canopy cover; all tree types; late successional development

State F - Seedling and sapling size trees with closed (> 30%) canopy cover; all tree types; early successional development

State J - Medium size trees, multi-storied, with open canopy cover; all tree types; late successional development

State K - Large to very large size trees, multi-storied, with open canopy cover; all tree types; late successional development

STRUCTURAL STATES NOT PART OF THE HISTORIC LANDSCAPE CONDITIONS OR WITHIN HISTORIC RANGE OF VARIABILITY, FOUND ON CONTEMPORARY LANDSCAPES ONLY

State G - Small size trees with closed canopy cover; all tree types; mid successional development; not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

State H - Medium size trees, single storied, with closed canopy cover; all shade tree types; late successional development; not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

State I - Large to very large size trees, single storied, with closed canopy cover; all tree types; late successional development; not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

State L - Medium size trees, multi-storied, with closed canopy cover; all tree types; late successional development; not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

State M - Large to very large size trees, multi-storied, with closed canopy cover; tree types; late successional development; not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

State N - Recently burned, grass, forb and shrub types with < 10% tree canopy cover; uncharacteristic early successional development due to fire; not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

² PPF PNVT has a 77% or high departure rating from Desired Conditions (DC) and a 94% or severe departure rating from Historical Range of Variability (HRV) making it the 2nd and 1st most departed PNVT on the A-SNFs for DC and HRV, respectively. Desired Conditions were provided by the Regional Office, and HRV was derived from the Nature Conservancy (Smith, 2006a)

Ponderosa Pine Forest PNVT Alternative A

Appendix D table 1. Alternative A ponderosa pine forest resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period

Model Year Runs	Ponderosa Pine Forest Overstory Vegetation Structural State														Total
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	
Number of acres in each vegetation state															
Desired Conditions	0	3,011	6,022	42,154	132,485	3,011	6,022	10,539	10,539	96,353	270,993	10,539	10,539	0	602,206
Initial Conditions	33,258	4,053	9,880	26,848	16,876	16,422	84,972	67,302	42,379	17,165	16,876	100,953	98,884	66,338	602,206
10 years	33,334	16,959	17,675	28,273	48,196	23,296	72,731	56,901	54,986	23,323	31,211	94,321	74,666	26,334	602,206
15-year planning period	28,136	16,486	20,731	28,274	62,122	27,835	73,356	57,592	55,166	25,162	36,020	90,333	65,837	15,156	602,206
20 years	21,540	15,059	22,251	27,380	73,213	32,174	75,283	53,769	63,550	24,935	37,183	86,489	59,017	10,362	602,206
30 years	13,695	11,225	20,141	23,826	97,100	35,293	77,435	51,950	62,451	24,782	39,092	86,161	54,525	4,528	602,206
40 years	8,768	9,230	19,908	21,926	122,278	35,874	75,177	46,524	64,272	25,540	38,351	83,074	49,290	1,993	602,206
50-year modeling period	7,560	9,715	18,555	23,409	130,256	32,265	74,389	47,220	64,033	25,621	42,427	80,754	44,621	1,380	602,206
Percent of total PNVT contributed by each vegetation state															
Desired Conditions	0	1	1	7	22	1	1	2	2	16	45	2	2	0	100
Initial Conditions	6	1	2	4	3	3	14	11	7	3	3	17	16	11	100
10 years	6	3	3	5	8	4	12	9	9	4	5	16	12	4	100
15-year planning period	5	3	3	5	10	5	12	10	9	4	6	15	11	3	100
20 years	4	3	4	5	12	5	13	9	11	4	6	14	10	2	100
30 years	2	2	3	4	16	6	13	9	10	4	6	14	9	1	100
40 years	1	2	3	4	20	6	12	8	11	4	6	14	8	0	100
50-year modeling period	1	2	3	4	22	5	12	8	11	4	7	13	7	0	100
Percent departure for each vegetation state from desired conditions															
Desired Conditions	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Initial Conditions	100	35	64	36	87	100	100	100	100	82	94	100	100	100	
10 years	100	100	100	33	64	100	100	100	100	76	88	100	100	100	
15-year planning period	100	100	100	33	53	100	100	100	100	74	87	100	100	100	
20 years	100	100	100	35	45	100	100	100	100	74	86	100	100	100	
30 years	100	100	100	43	27	100	100	100	100	74	86	100	100	100	
40 years	100	100	100	48	8	100	100	100	100	73	86	100	100	100	
50-year modeling period	100	100	100	44	2	100	100	100	100	73	84	100	100	100	

Ponderosa Pine Forest PNVT Alternative B Proposed High Acre Treatment Objectives

Appendix D table 2. Alternative B ponderosa pine forest resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period, for the proposed high acre treatment objectives

Model Year Runs	Ponderosa Pine Forest Overstory Vegetation Structural State														Total
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	
Number of acres in each vegetation state															
Desired Conditions	0	3,011	6,022	42,154	132,485	3,011	6,022	10,539	10,539	96,353	270,993	10,539	10,539	0	602,206
Initial Conditions	33,260	4,053	9,880	26,849	16,875	16,422	84,971	67,301	42,379	17,165	16,875	100,952	98,885	66,339	602,206
10 years	39,129	18,069	20,448	32,269	51,092	23,750	68,208	59,920	35,610	30,033	45,045	90,681	64,411	23,544	602,206
15-year planning period	32,198	21,409	23,404	33,737	65,383	29,747	64,859	56,157	32,232	34,974	53,402	85,584	55,638	13,482	602,206
20 years	26,259	19,778	24,379	35,523	72,385	34,730	65,519	53,600	29,206	36,951	66,137	82,362	46,830	8,548	602,206
30 years	18,795	17,909	27,589	32,322	84,155	38,690	72,640	45,081	25,318	40,674	81,350	77,674	36,666	3,342	602,206
40 years	15,377	16,922	26,522	32,138	89,262	39,748	73,960	44,701	21,802	41,343	90,404	73,300	34,992	1,734	602,206
50-year modeling period	13,696	17,280	29,489	34,031	90,601	39,890	74,765	39,178	19,899	43,903	95,608	70,019	32,884	964	602,206
Percent of total PNVT contributed by each vegetation state															
Desired Conditions	0	1	1	7	22	1	1	2	2	16	45	2	2	0	100
Initial Conditions	6	1	2	4	3	3	14	11	7	3	3	17	16	11	100
10 years	6	3	3	5	8	4	11	10	6	5	7	15	11	4	100
15-year planning period	5	4	4	6	11	5	11	9	5	6	9	14	9	2	100
20 years	4	3	4	6	12	6	11	9	5	6	11	14	8	1	100
30 years	3	3	5	5	14	6	12	7	4	7	14	13	6	1	100
40 years	3	3	4	5	15	7	12	7	4	7	15	12	6	0	100
50-year modeling period	2	3	5	6	15	7	12	7	3	7	16	12	5	0	100
Percent departure for each vegetation state from desired conditions															
Desired Conditions	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Initial Conditions	100	35	64	36	87	100	100	100	100	82	94	100	100	100	
10 years	100	100	100	20	51	100	100	100	100	64	80	100	100	100	
15-year planning period	100	100	100	16	45	100	100	100	100	62	76	100	100	100	
20 years	100	100	100	23	36	100	100	100	100	58	70	100	100	100	
30 years	100	100	100	24	33	100	100	100	100	57	67	100	100	100	
40 years	100	100	100	19	32	100	100	100	89	54	65	100	100	100	
50-year modeling period	100	35	100	36	87	100	100	100	100	82	94	100	100	100	

Ponderosa Pine Forest PNVT Alternative B Proposed Average Acre Treatment Objectives

Appendix D table 3. Alternative B ponderosa pine forest resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period, for the proposed average acre treatment objectives

Model Year Runs	Ponderosa Pine Forest Overstory Vegetation Structural State														Total
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	
Number of acres in each vegetation state															
Desired Conditions	0	3,011	6,022	42,154	132,485	3,011	6,022	10,539	10,539	96,353	270,993	10,539	10,539	0	602,206
Initial Conditions	33,258	4,053	9,880	26,848	16,876	16,422	84,972	67,302	42,379	17,165	16,876	100,953	98,884	66,338	602,206
10 years	35,689	17,295	19,180	28,981	43,034	23,454	72,258	62,298	39,869	25,935	37,473	97,574	74,530	24,636	602,206
15-year planning period	29,720	19,348	21,494	29,215	56,437	28,858	70,259	60,222	37,965	29,789	42,826	94,574	67,568	13,933	602,206
20 years	23,556	17,547	22,095	29,092	62,123	33,518	72,835	58,424	37,134	31,044	51,140	93,388	61,285	9,025	602,206
30 years	15,066	15,468	23,466	27,043	71,822	37,824	78,332	51,880	35,155	33,777	61,878	92,054	54,679	3,761	602,206
40 years	11,468	13,354	23,734	25,268	76,809	38,679	80,040	51,437	33,937	34,307	69,220	89,926	52,438	1,588	602,206
50-year modeling period	9,638	13,713	24,743	25,937	79,277	38,779	80,528	46,916	33,050	35,784	74,134	87,876	50,704	1,126	602,206
Percent of total PNVT contributed by each vegetation state															
Desired Conditions	0	1	1	7	22	1	1	2	2	16	45	2	2	0	100
Initial Conditions	6	1	2	4	3	3	14	11	7	3	3	17	16	11	100
10 years	6	3	3	5	7	4	12	10	7	4	6	16	12	4	100
15-year planning period	5	3	4	5	9	5	12	10	6	5	7	16	11	2	100
20 years	4	3	4	5	10	6	12	10	6	5	8	16	10	1	100
30 years	3	3	4	4	12	6	13	9	6	6	10	15	9	1	100
40 years	2	2	4	4	13	6	13	9	6	6	11	15	9	0	100
50-year modeling period	2	2	4	4	13	6	13	8	5	6	12	15	8	0	100
Percent departure for each vegetation state from desired conditions															
Desired Conditions	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Initial Conditions	100	35	64	36	87	100	100	100	100	82	94	100	100	100	
10 years	100	100	100	31	68	100	100	100	100	73	86	100	100	100	
15-year planning period	100	100	100	31	57	100	100	100	100	69	84	100	100	100	
20 years	100	100	100	31	53	100	100	100	100	68	81	100	100	100	
30 years	100	100	100	36	46	100	100	100	100	65	77	100	100	100	
40 years	100	100	100	40	42	100	100	100	100	64	74	100	100	100	
50-year modeling period	100	100	100	38	40	100	100	100	100	63	73	100	100	100	

Ponderosa Pine Forest PNVT Alternative B Proposed Low Acre Treatment Objectives

Appendix D table 4. Alternative B ponderosa pine forest resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period, for the proposed low acre treatment objectives

Model Year Runs	Ponderosa Pine Forest Overstory Vegetation Structural State														Total
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	
Number of acres in each vegetation state															
Desired Conditions	0	3,011	6,022	42,154	132,485	3,011	6,022	10,539	10,539	96,353	270,993	10,539	10,539	0	602,206
Initial Conditions	33,258	4,053	9,880	26,848	16,876	16,422	84,972	67,302	42,379	17,165	16,876	100,953	98,884	66,338	602,206
10 years	32,248	16,521	17,912	25,694	34,976	23,158	76,309	64,675	44,128	21,838	29,902	104,468	84,649	25,728	602,206
15-year planning period	27,242	17,287	19,583	24,693	47,491	27,969	75,658	64,286	43,697	24,604	32,249	103,565	79,498	14,385	602,206
20 years	20,856	15,319	19,814	22,665	51,869	32,309	80,160	63,255	45,066	25,142	36,150	104,426	75,749	9,503	602,206
30 years	11,337	13,027	19,343	21,764	59,490	36,958	84,024	58,679	44,993	26,881	42,406	106,433	72,691	4,181	602,206
40 years	7,559	9,785	20,945	18,399	64,357	37,610	86,120	58,174	46,072	27,272	48,035	106,553	69,885	1,442	602,206
50-year modeling period	5,580	10,146	19,998	17,843	67,953	37,668	86,291	54,655	46,201	27,665	52,661	105,732	68,524	1,288	602,206
Percent of total PNVT contributed by each vegetation state															
Desired Conditions	0	1	1	7	22	1	1	2	2	16	45	2	2	0	100
Initial Conditions	6	1	2	4	3	3	14	11	7	3	3	17	16	11	100
10 years	5	3	3	4	6	4	13	11	7	4	5	17	14	4	100
15-year planning period	5	3	3	4	8	5	13	11	7	4	5	17	13	2	100
20 years	3	3	3	4	9	5	13	11	7	4	6	17	13	2	100
30 years	2	2	3	4	10	6	14	10	7	4	7	18	12	1	100
40 years	1	2	3	3	11	6	14	10	8	5	8	18	12	0	100
50-year modeling period	1	2	3	3	11	6	14	9	8	5	9	18	11	0	100
Percent departure for each vegetation state from desired conditions															
Desired Conditions	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Initial Conditions	100	35	64	36	87	100	100	100	100	82	94	100	100	100	
10 years	100	100	100	39	74	100	100	100	100	77	89	100	100	100	
15-year planning period	100	100	100	41	64	100	100	100	100	74	88	100	100	100	
20 years	100	100	100	46	61	100	100	100	100	74	87	100	100	100	
30 years	100	100	100	48	55	100	100	100	100	72	84	100	100	100	
40 years	100	100	100	56	51	100	100	100	100	72	82	100	100	100	
50-year modeling period	100	100	100	58	49	100	100	100	100	71	81	100	100	100	

Ponderosa Pine Forest PNVT Alternative C Proposed High Acre Treatment Objectives

Appendix D table 5. Alternative C ponderosa pine forest resulting overstory period, for the proposed high acre treatment objectives vegetation structural state acreage by VDDT model year runs over the 50-year modeling

Model Year Runs	Ponderosa Pine Forest Overstory Vegetation Structural State														Total
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	
Number of acres in each vegetation state															
Desired Conditions	0	3,011	6,022	42,154	132,485	3,011	6,022	10,539	10,539	96,353	270,993	10,539	10,539	0	602,206
Initial Conditions	33,258	4,053	9,880	26,848	16,876	16,422	84,972	67,302	42,379	17,165	16,876	100,953	98,884	66,338	602,206
10 years	52,777	26,198	34,525	37,129	55,343	23,478	61,577	47,731	25,529	37,788	70,317	69,572	39,502	20,740	602,206
15-year planning period	49,890	25,449	29,282	37,932	67,396	32,403	65,545	42,136	20,058	43,577	82,144	64,590	29,407	12,398	602,206
20 years	43,264	25,692	33,277	39,935	75,748	39,288	67,741	41,666	14,847	43,497	86,646	58,921	23,582	8,103	602,206
30 years	38,475	26,074	36,856	37,721	85,534	42,119	72,802	39,265	10,534	41,757	89,979	57,729	18,761	4,601	602,206
40 years	36,534	25,703	36,807	37,135	88,444	44,403	77,079	39,497	8,595	42,922	86,032	58,100	17,871	3,084	602,206
50-year modeling period	35,654	23,842	35,922	36,582	92,613	43,905	80,231	39,864	8,262	43,835	86,009	54,198	18,631	2,653	602,206
Percent of total PNVT contributed by each vegetation state															
Desired Conditions	0	1	1	7	22	1	1	2	2	16	45	2	2	0	100
Initial Conditions	6	1	2	4	3	3	14	11	7	3	3	17	16	11	100
10 years	9	4	6	6	9	4	10	8	4	6	12	12	7	3	100
15-year planning period	8	4	5	6	11	5	11	7	3	7	14	11	5	2	100
20 years	7	4	6	7	13	7	11	7	2	7	14	10	4	1	100
30 years	6	4	6	6	14	7	12	7	2	7	15	10	3	1	100
40 years	6	4	6	6	15	7	13	7	1	7	14	10	3	1	100
50-year modeling period	6	4	6	6	15	7	13	7	1	7	14	9	3	0	100
Percent departure for each vegetation state from desired conditions															
Desired Conditions	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Initial Conditions	100	35	64	36	87	100	100	100	100	82	94	100	100	100	
10 years	100	100	100	12	58	100	100	100	100	61	74	100	100	100	
15-year planning period	100	100	100	10	49	100	100	100	90	55	70	100	100	100	
20 years	100	100	100	5	43	100	100	100	41	55	68	100	100	100	
30 years	100	100	100	11	35	100	100	100	0	57	67	100	78	100	
40 years	100	100	100	12	33	100	100	100	18	55	68	100	70	100	
50-year modeling period	100	100	100	13	30	100	100	100	22	55	68	100	77	100	

Ponderosa Pine Forest PNVT Alternative C Proposed Average Acre Treatment Objectives

Appendix D table 6. Alternative C ponderosa pine forest resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period, for the proposed average acre treatment objectives

Model Year Runs	Ponderosa Pine Forest Overstory Vegetation Structural State														Total
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	
Number of acres in each vegetation state															
Desired Conditions	0	3,011	6,022	42,154	132,485	3,011	6,022	10,539	10,539	96,353	270,993	10,539	10,539	0	602,206
Initial Conditions	33,258	4,053	9,880	26,848	16,876	16,422	84,972	67,302	42,379	17,165	16,876	100,953	98,884	66,338	602,206
10 years	43,609	22,104	26,531	31,333	46,140	24,294	68,268	54,773	34,343	30,282	49,891	86,989	61,521	22,128	602,206
15-year planning period	38,312	21,282	24,710	30,540	57,251	31,051	72,431	52,128	31,482	34,205	58,235	84,615	53,059	12,906	602,206
20 years	32,038	20,809	27,758	30,909	63,958	36,137	75,551	50,716	28,677	34,592	63,002	81,954	47,959	8,146	602,206
30 years	25,531	19,690	29,879	28,658	75,908	40,251	78,604	50,589	26,921	34,769	65,403	80,478	41,530	3,994	602,206
40 years	23,205	18,056	28,525	28,050	85,386	40,208	79,372	47,519	24,039	35,628	65,557	84,177	39,912	2,571	602,206
50-year modeling period	21,619	16,309	28,496	26,993	90,444	39,076	82,695	46,908	23,389	35,960	68,170	80,366	39,638	2,143	602,206
Percent of total PNVT contributed by each vegetation state															
Desired Conditions	0	1	1	7	22	1	1	2	2	16	45	2	2	0	100
Initial Conditions	6	1	2	4	3	3	14	11	7	3	3	17	16	11	100
10 years	7	4	4	5	8	4	11	9	6	5	8	14	10	4	100
15-year planning period	6	4	4	5	10	5	12	9	5	6	10	14	9	2	100
20 years	5	3	5	5	11	6	13	8	5	6	10	14	8	1	100
30 years	4	3	5	5	13	7	13	8	4	6	11	13	7	1	100
40 years	4	3	5	5	14	7	13	8	4	6	11	14	7	0	100
50-year modeling period	4	3	5	4	15	6	14	8	4	6	11	13	7	0	100
Percent departure for each vegetation state from desired conditions															
Desired Conditions	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Initial Conditions	100	35	64	36	87	100	100	100	100	82	94	100	100	100	
10 years	100	100	100	26	65	100	100	100	100	69	82	100	100	100	
15-year planning period	100	100	100	28	57	100	100	100	100	65	79	100	100	100	
20 years	100	100	100	27	52	100	100	100	100	64	77	100	100	100	
30 years	100	100	100	32	43	100	100	100	100	64	76	100	100	100	
40 years	100	100	100	33	36	100	100	100	100	63	76	100	100	100	
50-year modeling period	100	100	100	36	32	100	100	100	100	63	75	100	100	100	

Ponderosa Pine Forest PNVT Alternative C Proposed Low Acre Treatment Objectives

Appendix D table 7. Alternative C ponderosa pine forest resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period, for the proposed low acre treatment objectives

Model Year Runs	Ponderosa Pine Forest Overstory Vegetation Structural State														Total
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	
Number of acres in each vegetation state															
Desired Conditions	0	3,011	6,022	42,154	132,485	3,011	6,022	10,539	10,539	96,353	270,993	10,539	10,539	0	602,206
Initial Conditions	33,258	4,053	9,880	26,848	16,876	16,422	84,972	67,302	42,379	17,165	16,876	100,953	98,884	66,338	602,206
10 years	43,609	22,104	26,531	31,333	46,140	24,294	68,268	54,773	34,343	30,282	49,891	86,989	61,521	22,128	602,206
15-year planning period	34,441	18,009	18,538	25,537	36,937	25,110	74,959	61,815	43,157	22,776	29,465	104,405	83,539	23,517	602,206
20 years	26,734	17,115	20,139	23,148	47,106	29,699	79,318	62,119	42,905	24,833	34,326	104,641	76,710	13,414	602,206
30 years	20,812	15,926	22,239	21,883	52,168	32,985	83,362	59,766	42,508	25,688	39,359	104,988	72,336	8,188	602,206
40 years	12,588	13,306	22,901	19,596	66,281	38,384	84,405	61,913	43,309	27,781	40,828	103,228	64,299	3,388	602,206
50-year modeling period	9,876	10,410	20,243	18,966	82,329	36,012	81,666	55,542	39,484	28,335	45,082	110,253	61,952	2,058	602,206
Percent of total PNVT contributed by each vegetation state															
Desired Conditions	0	1	1	7	22	1	1	2	2	16	45	2	2	0	100
Initial Conditions	6	1	2	4	3	3	14	11	7	3	3	17	16	11	100
10 years	6	3	3	4	6	4	12	10	7	4	5	17	14	4	100
15-year planning period	4	3	3	4	8	5	13	10	7	4	6	17	13	2	100
20 years	3	3	4	4	9	5	14	10	7	4	7	17	12	1	100
30 years	2	2	4	3	11	6	14	10	7	5	7	17	11	1	100
40 years	2	2	3	3	14	6	14	9	7	5	7	18	10	0	100
50-year modeling period	1	1	4	3	15	6	14	9	6	5	8	18	10	0	100
Percent departure for each vegetation state from desired conditions															
Desired Conditions	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Initial Conditions	100	35	64	36	87	100	100	100	100	82	94	100	100	100	
10 years	100	100	100	39	72	100	100	100	100	76	89	100	100	100	
15-year planning period	100	100	100	45	64	100	100	100	100	74	87	100	100	100	
20 years	100	100	100	48	61	100	100	100	100	73	85	100	100	100	
30 years	100	100	100	54	50	100	100	100	100	71	85	100	100	100	
40 years	100	100	100	55	38	100	100	100	100	71	83	100	100	100	
50-year modeling period	100	100	100	59	33	100	100	100	100	71	81	100	100	100	

Ponderosa Pine Forest PNVT Alternative D Proposed High Acre Treatment Objectives

Appendix D table 8. Alternative D ponderosa pine forest resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period, for the proposed high acre treatment objectives

Model Year Runs	Ponderosa Pine Forest Overstory Vegetation Structural State														Total
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	
Number of acres in each vegetation state															
Desired Conditions	0	3,011	6,022	42,154	132,485	3,011	6,022	10,539	10,539	96,353	270,993	10,539	10,539	0	602,206
Initial Conditions	33,258	4,053	9,880	26,848	16,876	16,422	84,972	67,302	42,379	17,165	16,876	100,953	98,884	66,338	602,206
10 years	36,516	16,754	19,718	30,181	59,534	20,250	54,363	52,484	97,316	22,821	24,400	79,664	60,699	27,506	602,206
15-year planning period	31,708	18,739	22,671	29,648	81,395	20,444	49,682	46,546	113,781	23,802	24,767	71,147	50,346	17,529	602,206
20 years	26,982	17,150	22,359	29,637	106,867	21,937	47,690	42,412	118,874	22,958	26,090	63,971	43,658	11,622	602,206
30 years	17,839	14,045	20,024	23,392	157,466	21,200	42,439	36,807	118,289	22,230	27,189	59,577	35,499	6,212	602,206
40 years	12,042	10,621	18,543	20,846	197,874	18,930	39,940	31,726	116,118	19,640	29,231	50,463	33,109	3,124	602,206
50-year modeling period	9,800	9,858	15,611	18,677	234,063	16,095	34,565	27,883	104,478	17,127	36,017	44,532	30,731	2,768	602,206
Percent of total PNVT contributed by each vegetation state															
Desired Conditions	0	1	1	7	22	1	1	2	2	16	45	2	2	0	100
Initial Conditions	6	1	2	4	3	3	14	11	7	3	3	17	16	11	100
10 years	6	3	3	5	10	3	9	9	16	4	4	13	10	5	100
15-year planning period	5	3	4	5	14	3	8	8	19	4	4	12	8	3	100
20 years	4	3	4	5	18	4	8	7	20	4	4	11	7	2	100
30 years	3	2	3	4	26	4	7	6	20	4	5	10	6	1	100
40 years	2	2	3	3	33	3	7	5	19	3	5	8	5	1	100
50-year modeling period	2	2	3	3	39	3	6	5	17	3	6	7	5	0	100
Percent departure for each vegetation state from desired conditions															
Desired Conditions	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Initial Conditions	100	35	64	36	87	100	100	100	100	82	94	100	100	100	
10 years	100	100	100	28	55	100	100	100	100	76	91	100	100	100	
15-year planning period	100	100	100	30	39	100	100	100	100	75	91	100	100	100	
20 years	100	100	100	30	19	100	100	100	100	76	90	100	100	100	
30 years	100	100	100	45	19	100	100	100	100	77	90	100	100	100	
40 years	100	100	100	51	49	100	100	100	100	80	89	100	100	100	
50-year modeling period	100	100	100	56	77	100	100	100	100	82	87	100	100	100	

Ponderosa Pine Forest PNVT Alternative D Proposed Average Acre Treatment Objectives

Appendix D table 9. Alternative D ponderosa pine forest resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period, for the proposed average acre treatment objectives

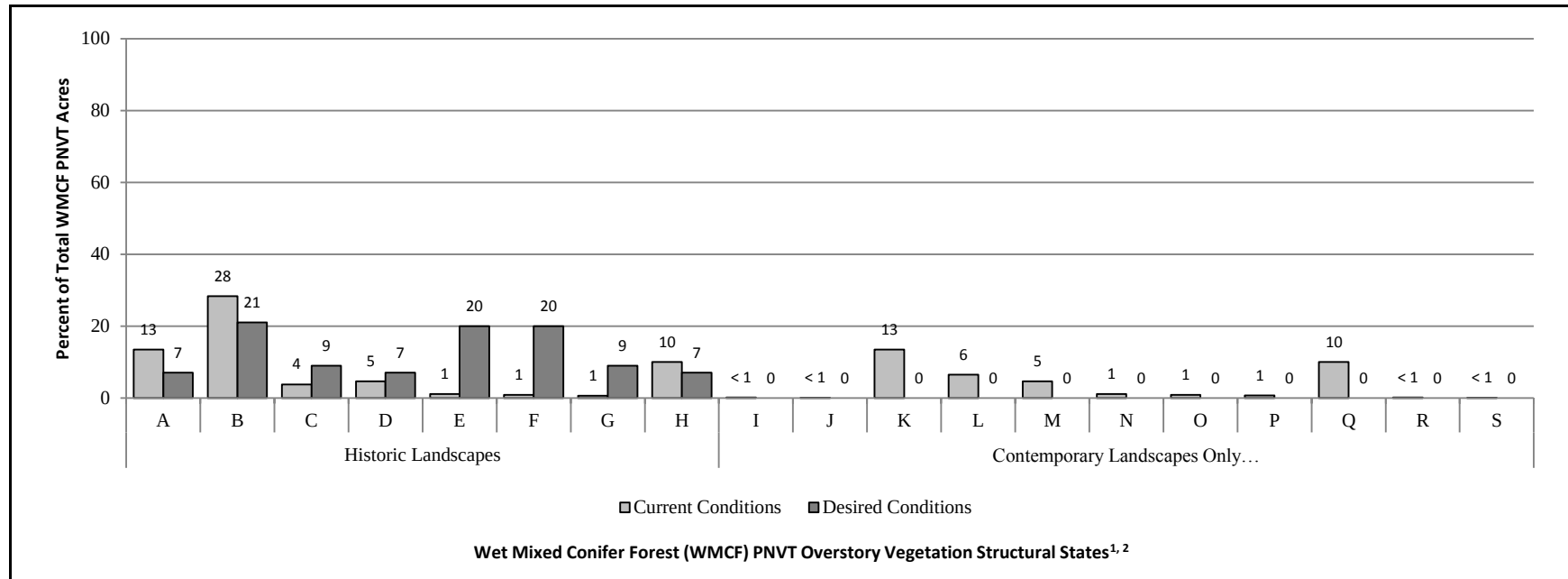
Model Year Runs	Ponderosa Pine Forest Overstory Vegetation Structural State														Total
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	
Number of acres in each vegetation state															
Desired Conditions	0	3,011	6,022	42,154	132,485	3,011	6,022	10,539	10,539	96,353	270,993	10,539	10,539	0	602,206
Initial Conditions	33,258	4,053	9,880	26,848	16,876	16,422	84,972	67,302	42,379	17,165	16,876	100,953	98,884	66,338	602,206
10 years	35,731	15,642	19,798	27,231	48,729	21,949	63,559	58,848	75,554	21,904	24,464	91,193	71,398	26,207	602,206
15-year planning period	29,696	16,790	20,571	26,256	65,525	23,254	63,069	54,887	85,690	22,617	25,917	86,619	64,751	16,564	602,206
20 years	24,259	14,857	21,695	25,873	83,176	26,512	61,119	51,150	91,571	22,701	26,317	82,547	59,374	11,055	602,206
30 years	14,382	12,679	20,054	21,836	119,140	25,394	57,854	47,136	93,647	22,892	26,406	82,072	53,090	5,625	602,206
40 years	9,884	9,748	18,065	19,942	147,410	24,974	57,078	42,893	92,150	21,993	29,447	75,370	50,006	3,245	602,206
50-year modeling period	7,310	8,614	16,486	17,607	171,907	22,239	53,160	38,901	89,829	20,363	33,852	72,521	47,376	2,041	602,206
Percent of total PNVT contributed by each vegetation state															
Desired Conditions	0	1	1	7	22	1	1	2	2	16	45	2	2	0	100
Initial Conditions	6	1	2	4	3	3	14	11	7	3	3	17	16	11	100
10 years	6	3	3	5	10	3	9	9	16	4	4	13	10	5	100
15-year planning period	5	3	4	5	14	3	8	8	19	4	4	12	8	3	100
20 years	4	3	4	5	18	4	8	7	20	4	4	11	7	2	100
30 years	3	2	3	4	26	4	7	6	20	4	5	10	6	1	100
40 years	2	2	3	3	33	3	7	5	19	3	5	8	5	1	100
50-year modeling period	2	2	3	3	39	3	6	5	17	3	6	7	5	0	100
Percent departure for each vegetation state from desired conditions															
Desired Conditions	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Initial Conditions	100	35	64	36	87	100	100	100	100	82	94	100	100	100	
10 years	100	100	100	35	63	100	100	100	100	77	91	100	100	100	
15-year planning period	100	100	100	38	51	100	100	100	100	77	90	100	100	100	
20 years	100	100	100	39	37	100	100	100	100	76	90	100	100	100	
30 years	100	100	100	48	10	100	100	100	100	76	90	100	100	100	
40 years	100	100	100	53	11	100	100	100	100	77	89	100	100	100	
50-year modeling period	100	100	100	58	30	100	100	100	100	79	88	100	100	100	

Ponderosa Pine Forest PNVT Alternative D Proposed Low Acre Treatment Objectives

Appendix D table 10. Alternative D ponderosa pine forest resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period, for the proposed low acre treatment objectives

Model Year Runs	Ponderosa Pine Forest Overstory Vegetation Structural State														Total
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	
Number of acres in each vegetation state															
Desired Conditions	0	3,011	6,022	42,154	132,485	3,011	6,022	10,539	10,539	96,353	270,993	10,539	10,539	0	602,206
Initial Conditions	33,258	4,053	9,880	26,848	16,876	16,422	84,972	67,302	42,379	17,165	16,876	100,953	98,884	66,338	602,206
10 years	34,946	14,530	19,878	24,281	37,923	23,647	72,754	65,212	53,793	20,986	24,529	102,722	82,097	24,908	602,206
15-year planning period	27,683	14,841	18,470	22,863	49,655	26,064	76,455	63,229	57,599	21,432	27,068	102,091	79,155	15,600	602,206
20 years	21,536	12,564	21,032	22,108	59,485	31,087	74,549	59,889	64,268	22,443	26,543	101,124	75,090	10,488	602,206
30 years	10,926	11,312	20,083	20,281	80,814	29,588	73,269	57,464	69,005	23,554	25,623	104,568	70,682	5,037	602,206
40 years	7,725	8,875	17,586	19,039	96,946	31,019	74,217	54,059	68,183	24,346	29,664	100,278	66,902	3,366	602,206
50-year modeling period	4,820	7,370	17,360	16,537	109,751	28,384	71,754	49,919	75,180	23,598	31,687	100,510	64,020	1,315	602,206
Percent of total PNVT contributed by each vegetation state															
Desired Conditions	0	1	1	7	22	1	1	2	2	16	45	2	2	0	100
Initial Conditions	6	1	2	4	3	3	14	11	7	3	3	17	16	11	100
10 years	6	2	3	4	6	4	12	11	9	3	4	17	14	4	100
15-year planning period	5	2	3	4	8	4	13	10	10	4	4	17	13	3	100
20 years	4	2	3	4	10	5	12	10	11	4	4	17	12	2	100
30 years	2	2	3	3	13	5	12	10	11	4	4	17	12	1	100
40 years	1	1	3	3	16	5	12	9	11	4	5	17	11	1	100
50-year modeling period	1	1	3	3	18	5	12	8	12	4	5	17	11	0	100
Percent departure for each vegetation state from desired conditions															
Desired Conditions	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Initial Conditions	100	35	64	36	87	100	100	100	100	82	94	100	100	100	
10 years	100	100	100	42	71	100	100	100	100	78	91	100	100	100	
15-year planning period	100	100	100	46	63	100	100	100	100	78	90	100	100	100	
20 years	100	100	100	48	55	100	100	100	100	77	90	100	100	100	
30 years	100	100	100	52	39	100	100	100	100	76	91	100	100	100	
40 years	100	100	100	55	27	100	100	100	100	75	89	100	100	100	
50-year modeling period	100	100	100	61	17	100	100	100	100	76	88	100	100	100	

Wet Mixed Conifer Forest PNVT



Appendix D figure 16. Wet mixed conifer forest (WMCF) PNVT current and desired overstory vegetation structural states

¹ Wet Mixed Conifer Forest (WMCF) PNVT Overstory Vegetation Structural States. At 177,995 acres or approximately 9% of the forests this PNVT ranks 5th in order of size out of the 14 PNVTs on the A-SNFs

STRUCTURAL STATES PART OF THE HISTORIC LANDSCAPE CONDITIONS OR WITHIN HISTORIC RANGE OF VARIABILITY

State A - Recently burned, grass, forb and shrub types, with < 10% tree canopy cover; early successional development; with aspen regeneration

State B - Seedling and sapling (< 5" diameter), small (5"-9.9" diameter), medium (10"-19.9" diameter), large to very large (≥ 20" diameter) size trees, with open (≥ 10% & ≤ 30%) or closed (> 30%) canopy cover, consisting of all aspen, deciduous tree mix, and evergreen-deciduous mix tree types; with aspen regeneration

State C - Seedling and sapling, and small size trees, with closed canopy cover; with a plurality of shade tolerant/mixed shade tolerant tree types; with aspen regeneration. Also includes seedling and sapling, and small size trees, with open canopy cover, with a plurality of a plurality of shade tolerant tree types; with aspen regeneration

State D - Medium size trees, single or multi-storied, with closed canopy cover; with a plurality of shade tolerant/mixed shade tolerant tree types; with aspen regeneration. Also includes medium size trees, single or multi-storied, with open canopy cover; with a plurality of shade tolerant tree types; with aspen regeneration

State E - Large to very large size trees, single storied, with closed canopy cover; with a plurality of shade tolerant tree types; with aspen regeneration. Also includes large to very large size trees, single storied, with closed canopy cover; with a plurality of shade intolerant tree types; with aspen regeneration

State F - Large to very large size trees, multi-storied, with closed canopy cover; with a plurality of shade tolerant tree types; with aspen regeneration. Also includes large to very large size trees, multi-storied, with closed canopy cover; with a plurality of shade intolerant tree types; with aspen regeneration

State G - Seedling and sapling, and small size trees, with open canopy cover; with a plurality of shade intolerant tree types; with aspen regeneration

State H - Medium size trees, single or multi-storied, with open canopy cover; with a plurality of shade intolerant tree types; with aspen regeneration. Also includes medium size trees, single or multi-storied, with closed canopy cover; with a plurality of shade intolerant tree types; with aspen regeneration

STRUCTURAL STATES NOT PART OF THE HISTORIC LANDSCAPE CONDITIONS OR WITHIN HISTORIC RANGE OF VARIABILITY, FOUND ON CONTEMPORARY LANDSCAPES ONLY

State I - Large to very large size trees, single storied, with open canopy cover; with a plurality of shade tolerant tree types; with aspen regeneration. This state was not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

State J - Large to very large size trees, multi-storied, with open canopy cover; with a plurality of shade tolerant tree types; with aspen regeneration. Also includes large to very large size trees, multi-storied, with open canopy cover; with a plurality of shade intolerant tree types; with aspen regeneration. This state was not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

State K - Recently burned, grass, forb and shrub types, with < 10% tree canopy cover; early successional development. This state exists with elk and no or limited aspen regeneration; not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

State L - Seedling and sapling, and small size trees, with closed canopy cover; with a plurality of shade intolerant tree types. This state exists with elk and no or limited aspen regeneration; not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

State M - Medium size trees, single or multi-storied, with closed canopy cover; with a plurality of shade tolerant/mixed shade tolerant tree types. Also includes medium size trees, single or multi-storied, with open canopy cover; with a plurality of shade tolerant tree types. This state exists with elk and no or limited aspen regeneration. This state was not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

State N - Large to very large size trees, single storied, with closed canopy cover; with a plurality of shade tolerant tree types. Also includes large to very large size trees, single storied, with closed canopy cover; with a plurality of shade intolerant tree types. This state exists with elk and no or limited aspen regeneration; not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

State O - Large to very large size trees, multi-storied, with closed canopy cover; with a plurality of shade tolerant tree types. Also includes large to very large size trees, multi-storied, with closed canopy cover; with a plurality of shade intolerant tree types. This state exists with elk and no or limited aspen regeneration; not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

State P - Seedling and sapling, and small size trees, with open canopy cover; with a plurality of shade intolerant tree types. This state exists with elk and no or limited aspen regeneration; not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

State Q - Medium size trees, single or multi-storied, with open canopy cover; with a plurality of shade intolerant tree types. Also includes medium size trees, single or multi-storied, with closed canopy cover; with a plurality of shade intolerant tree types. This state exists with elk and no or limited aspen regeneration; not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

State R - Large to very large size trees, single storied, with open canopy cover; with a plurality of shade intolerant tree types. This state exists with elk and no or limited aspen regeneration; not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

State S - Large to very large size trees, multi-storied, with open canopy cover; with a plurality of shade tolerant tree types. Also includes large to very large size trees, multi-storied, with open canopy cover; with a plurality of shade intolerant tree types. This state exists with elk and no or limited aspen regeneration; not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

² WMCF PNVT has a 54% or moderate departure rating from Desired Conditions (DC) and a 61% or high departure rating from Historic Range of Variability (HRV) making it tied with montane/subalpine grasslands for the 6th most departed PNVT for DC; and 7th most departed PNVT for HRV on the A-SNFs. Desired Conditions were provided by the Regional Office, and HRV was derived from the Nature Conservancy (Smith, 2006b)

Wet Mixed Conifer Forest PNVT Alternative A

Appendix D table 11. Alternative A wet mixed conifer forest resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period

Model Year Runs	Wet Mixed Conifer Forest Overstory Vegetation Structural State																			Total
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	
Number of acres in each vegetation state																				
Desired Conditions	12,460	37,379	16,020	12,460	35,599	35,599	16,020	12,460	0	0	0	0	0	0	0	0	0	0	0	177,995
Initial Conditions	23,958	50,355	6,721	8,185	1,925	1,512	1,079	17,813	167	131	23,958	11,381	8,185	1,925	1,512	1,079	17,813	167	131	177,995
10 years	195	46,600	12,933	12,954	1,423	2,970	4,576	9,478	3,450	2,870	1,645	20,806	11,672	1,211	3,806	28,120	8,670	2,080	2,535	177,995
15-year planning period	340	44,345	15,016	13,355	1,472	3,909	5,716	7,992	4,406	3,694	549	23,615	12,476	1,162	5,181	22,450	7,224	2,091	3,004	177,995
20 years	99	42,235	15,154	15,743	1,549	4,957	7,389	7,454	4,479	3,384	540	23,519	14,539	1,141	5,357	18,660	6,576	2,258	2,963	177,995
30 years	180	36,964	17,194	17,383	1,949	5,890	9,433	7,582	6,059	4,678	504	20,580	15,478	856	6,667	14,197	5,955	2,933	3,514	177,995
40 years	140	33,551	19,851	19,492	1,960	7,493	10,825	7,649	6,931	4,457	495	17,001	15,574	1,061	7,006	11,640	5,870	2,854	4,146	177,995
50-year modeling period	176	31,601	20,818	21,687	2,146	7,375	12,376	8,204	7,582	5,629	572	14,754	14,187	1,260	6,969	9,684	6,315	2,858	3,802	177,995
Percent of total PNVT contributed by each vegetation state																				
Desired Conditions	7	21	9	7	20	20	9	7	0	0	0	0	0	0	0	0	0	0	0	100
Initial Conditions	13	28	4	5	1	1	1	10	0	0	13	6	5	1	1	1	10	0	0	100
10 years	0	26	7	7	1	2	3	5	2	2	1	12	7	1	2	16	5	1	1	100
15-year planning period	0	25	8	8	1	2	3	4	2	2	0	13	7	1	3	13	4	1	2	100
20 years	0	24	9	9	1	3	4	4	3	2	0	13	8	1	3	10	4	1	2	100
30 years	0	21	10	10	1	3	5	4	3	3	0	12	9	0	4	8	3	2	2	100
40 years	0	19	11	11	1	4	6	4	4	3	0	10	9	1	4	7	3	2	2	100
50-year modeling period	0	18	12	12	1	4	7	5	4	3	0	8	8	1	4	5	4	2	2	100
Percent departure for each vegetation state from desired conditions																				
Desired Conditions	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Initial Conditions	100	35	58	34	95	96	93	43	100	100	100	100	100	100	100	100	100	100	100	100
10 years	100	25	19	4	96	92	71	24	100	100	100	100	100	100	100	100	100	100	100	100
15-year planning period	100	19	6	7	96	89	64	36	100	100	100	100	100	100	100	100	100	100	100	100
20 years	100	13	5	26	96	86	54	40	100	100	100	100	100	100	100	100	100	100	100	100
30 years	100	1	7	40	95	83	41	39	100	100	100	100	100	100	100	100	100	100	100	100
40 years	100	10	24	56	94	79	32	39	100	100	100	100	100	100	100	100	100	100	100	100
50-year modeling period	100	15	30	74	94	79	23	34	100	100	100	100	100	100	100	100	100	100	100	100

Wet Mixed Conifer Forest PNVT Alternative B Proposed High Acre Treatment Objectives

Appendix D table 12. Alternative B wet mixed conifer forest resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period, for the proposed high acre treatment objectives

Model Year Runs	Wet Mixed Conifer Forest Overstory Vegetation Structural State																			Total
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	
Number of acres in each vegetation state																				
Desired Conditions	12,460	37,379	16,020	12,460	35,599	35,599	16,020	12,460	0	0	0	0	0	0	0	0	0	0	0	177,995
Initial Conditions	23,958	50,355	6,721	8,185	1,925	1,512	1,079	17,813	167	131	23,958	11,381	8,185	1,925	1,512	1,079	17,813	167	131	177,995
10 years	219	46,004	11,021	15,406	1,907	3,858	4,160	9,354	2,814	3,934	1,834	18,760	11,769	1,406	4,752	27,131	9,887	1,435	2,344	177,995
15-year planning period	248	42,748	12,532	18,151	1,779	5,152	5,577	8,081	3,317	4,417	796	19,845	13,331	1,287	5,537	21,725	8,499	2,005	2,966	177,995
20 years	274	39,713	13,555	20,993	2,092	5,707	6,228	7,855	4,192	5,389	631	19,108	13,773	1,307	6,444	17,405	7,755	1,871	3,705	177,995
30 years	206	34,817	14,570	24,439	2,246	8,341	8,073	8,854	4,859	6,042	518	15,233	14,849	1,511	7,545	11,959	7,083	2,515	4,335	177,995
40 years	195	30,644	15,064	26,664	2,563	9,473	9,439	9,460	6,119	7,151	412	12,608	13,805	1,506	8,722	9,409	6,659	2,575	5,528	177,995
50-year modeling period	163	28,742	17,068	28,355	2,981	11,020	10,407	9,710	6,416	7,662	490	10,539	11,868	1,538	8,743	7,702	6,163	2,944	5,485	177,995
Percent of total PNVT contributed by each vegetation state																				
Desired Conditions	7	21	9	7	20	20	9	7	0	0	0	0	0	0	0	0	0	0	0	100
Initial Conditions	13	28	4	5	1	1	1	10	0	0	13	6	5	1	1	1	10	0	0	100
10 years	0	26	6	9	1	2	2	5	2	2	1	11	7	1	3	15	6	1	1	100
15-year planning period	0	24	7	10	1	3	3	5	2	2	0	11	7	1	3	12	5	1	2	100
20 years	0	22	8	12	1	3	3	4	2	3	0	11	8	1	4	10	4	1	2	100
30 years	0	20	8	14	1	5	5	5	3	3	0	9	8	1	4	7	4	1	2	100
40 years	0	17	8	15	1	5	5	5	3	4	0	7	8	1	5	5	4	1	3	100
50-year modeling period	0	16	10	16	2	6	6	5	4	4	0	6	7	1	5	4	3	2	3	100
Percent departure for each vegetation state from desired conditions																				
Desired Conditions	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Initial Conditions	100	35	58	34	95	96	93	43	100	100	100	100	100	100	100	100	100	100	100	100
10 years	100	19	17	10	95	89	65	40	100	100	100	100	100	100	100	100	100	100	100	100
15-year planning period	100	7	2	34	95	86	58	46	100	100	100	100	100	100	100	100	100	100	100	100
20 years	100	1	2	43	94	83	53	43	100	100	100	100	100	100	100	100	100	100	100	100
30 years	100	16	14	66	94	78	41	41	100	100	100	100	100	100	100	100	100	100	100	100
40 years	100	25	26	75	94	75	32	38	100	100	100	100	100	100	100	100	100	100	100	100
50-year modeling period	100	34	33	84	93	71	24	32	100	100	100	100	100	100	100	100	100	100	100	100

Wet Mixed Conifer Forest PNVT Alternative B Proposed Average Acre Treatment Objectives

Appendix D table 13. Alternative B wet mixed conifer forest resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period, for the proposed average acre treatment objectives

Model Year Runs	Wet Mixed Conifer Forest Overstory Vegetation Structural State																			Total
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	
Number of acres in each vegetation state																				
Desired Conditions	12,460	37,379	16,020	12,460	35,599	35,599	16,020	12,460	0	0	0	0	0	0	0	0	0	0	0	177,995
Initial Conditions	23,958	50,355	6,721	8,185	1,925	1,512	1,079	17,813	167	131	23,958	11,381	8,185	1,925	1,512	1,079	17,813	167	131	177,995
10 years	166	46,308	12,276	13,358	1,599	3,393	4,085	8,689	2,597	3,846	1,676	20,479	12,226	1,241	4,455	27,929	9,753	1,577	2,341	177,995
15-year planning period	199	43,142	14,234	15,223	1,405	4,268	5,414	7,033	3,217	4,148	630	23,111	13,612	1,226	5,448	22,414	8,498	1,860	2,914	177,995
20 years	183	40,245	15,256	16,916	1,502	4,934	6,506	6,713	3,677	4,777	513	23,291	14,556	1,083	6,194	18,083	7,932	1,916	3,718	177,995
30 years	176	35,860	16,897	18,974	1,550	6,828	8,187	7,268	3,975	4,975	429	20,762	16,002	1,225	7,266	13,463	7,435	2,451	4,272	177,995
40 years	168	31,983	18,135	20,708	1,752	7,288	9,431	7,487	4,685	5,675	410	17,784	16,482	1,460	8,532	11,126	7,149	2,498	5,242	177,995
50-year modeling period	138	29,357	19,943	21,851	2,010	8,379	10,568	7,676	5,063	6,004	428	15,893	15,280	1,454	8,798	9,382	7,060	2,868	5,842	177,995
Percent of total PNVT contributed by each vegetation state																				
Desired Conditions	7	21	9	7	20	20	9	7	0	0	0	0	0	0	0	0	0	0	0	100
Initial Conditions	13	28	4	5	1	1	1	10	0	0	13	6	5	1	1	1	10	0	0	100
10 years	0	26	7	8	1	2	2	5	1	2	1	12	7	1	3	16	5	1	1	100
15-year planning period	0	24	8	9	1	2	3	4	2	2	0	13	8	1	3	13	5	1	2	100
20 years	0	23	9	10	1	3	4	4	2	3	0	13	8	1	3	10	4	1	2	100
30 years	0	20	9	11	1	4	5	4	2	3	0	12	9	1	4	8	4	1	2	100
40 years	0	18	10	12	1	4	5	4	3	3	0	10	9	1	5	6	4	1	3	100
50-year modeling period	0	16	11	12	1	5	6	4	3	3	0	9	9	1	5	5	4	2	3	100
Percent departure for each vegetation state from desired conditions																				
Desired Conditions	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Initial Conditions	100	35	58	34	95	96	93	43	100	100	100	100	100	100	100	100	100	100	100	100
10 years	100	22	16	1	96	90	70	38	100	100	100	100	100	100	100	100	100	100	100	100
15-year planning period	100	12	1	16	96	88	63	49	100	100	100	100	100	100	100	100	100	100	100	100
20 years	100	4	2	23	96	86	55	49	100	100	100	100	100	100	100	100	100	100	100	100
30 years	100	8	17	37	96	82	45	48	100	100	100	100	100	100	100	100	100	100	100	100
40 years	100	18	29	47	96	80	37	47	100	100	100	100	100	100	100	100	100	100	100	100
50-year modeling period	100	27	38	54	95	77	28	43	100	100	100	100	100	100	100	100	100	100	100	100

Wet Mixed Conifer Forest PNVT Alternative B Proposed Low Acre Treatment Objectives

Appendix D table 14. Alternative B wet mixed conifer forest resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period, for the proposed low acre treatment objectives

Model Year Runs	Wet Mixed Conifer Forest Overstory Vegetation Structural State																			Total
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	
Number of acres in each vegetation state																				
Desired Conditions	12,460	37,379	16,020	12,460	35,599	35,599	16,020	12,460	0	0	0	0	0	0	0	0	0	0	0	177,995
Initial Conditions	23,958	50,355	6,721	8,185	1,925	1,512	1,079	17,813	167	131	23,958	11,381	8,185	1,925	1,512	1,079	17,813	167	131	177,995
10 years	113	46,612	13,532	11,311	1,291	2,927	4,011	8,024	2,380	3,759	1,518	22,199	12,683	1,076	4,157	28,726	9,618	1,720	2,338	177,995
15-year planning period	149	43,535	15,936	12,295	1,032	3,384	5,250	5,985	3,116	3,878	463	26,377	13,893	1,166	5,359	23,104	8,496	1,716	2,861	177,995
20 years	92	40,777	16,956	12,839	912	4,161	6,784	5,571	3,161	4,166	395	27,473	15,338	859	5,944	18,762	8,110	1,962	3,732	177,995
30 years	145	36,904	19,224	13,508	854	5,316	8,300	5,682	3,090	3,909	341	26,292	17,155	938	6,988	14,966	7,786	2,387	4,210	177,995
40 years	142	33,322	21,207	14,752	940	5,102	9,423	5,514	3,251	4,200	408	22,961	19,159	1,414	8,342	12,843	7,638	2,422	4,955	177,995
50-year modeling period	113	29,972	22,817	15,347	1,038	5,739	10,730	5,642	3,710	4,346	367	21,247	18,693	1,370	8,852	11,063	7,957	2,792	6,199	177,995
Percent of total PNVT contributed by each vegetation state																				
Desired Conditions	7	21	9	7	20	20	9	7	0	0	0	0	0	0	0	0	0	0	0	100
Initial Conditions	13	28	4	5	1	1	1	10	0	0	13	6	5	1	1	1	10	0	0	100
10 years	0	26	8	6	1	2	2	5	1	2	1	12	7	1	2	16	5	1	1	100
15-year planning period	0	24	9	7	1	2	3	3	2	2	0	15	8	1	3	13	5	1	2	100
20 years	0	23	10	7	1	2	4	3	2	2	0	15	9	0	3	11	5	1	2	100
30 years	0	21	11	8	0	3	5	3	2	2	0	15	10	1	4	8	4	1	2	100
40 years	0	19	12	8	1	3	5	3	2	2	0	13	11	1	5	7	4	1	3	100
50-year modeling period	0	17	13	9	1	3	6	3	2	2	0	12	11	1	5	6	4	2	3	100
Percent departure for each vegetation state from desired conditions																				
Desired Conditions	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Initial Conditions	100	35	58	34	95	96	93	43	100	100	100	100	100	100	100	100	100	100	100	100
10 years	100	25	16	9	96	92	75	36	100	100	100	100	100	100	100	100	100	100	100	100
15-year planning period	100	16	1	1	97	90	67	52	100	100	100	100	100	100	100	100	100	100	100	100
20 years	100	9	6	3	97	88	58	55	100	100	100	100	100	100	100	100	100	100	100	100
30 years	100	1	20	8	98	85	48	54	100	100	100	100	100	100	100	100	100	100	100	100
40 years	100	11	32	18	97	86	41	56	100	100	100	100	100	100	100	100	100	100	100	100
50-year modeling period	100	20	42	23	97	84	33	55	100	100	100	100	100	100	100	100	100	100	100	100

Wet Mixed Conifer Forest PNVT Alternative C Proposed High Acre Treatment Objectives

Appendix D table 15. Alternative C wet mixed conifer forest resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period, for the proposed high acre treatment objectives

Model Year Runs	Wet Mixed Conifer Forest Overstory Vegetation Structural State																			Total
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	
Number of acres in each vegetation state																				
Desired Conditions	12,460	37,379	16,020	12,460	35,599	35,599	16,020	12,460	0	0	0	0	0	0	0	0	0	0	0	177,995
Initial Conditions	23,958	50,355	6,721	8,185	1,925	1,512	1,079	17,813	167	131	23,958	11,381	8,185	1,925	1,512	1,079	17,813	167	131	177,995
10 years	1,528	40,845	14,391	8,522	1,519	3,645	6,814	5,604	3,349	10,192	4,648	21,228	10,439	1,044	3,906	31,991	4,732	1,034	2,562	177,995
15-year planning period	1,634	36,197	16,134	9,309	1,397	4,709	7,835	4,984	4,040	11,198	3,133	24,574	11,785	811	4,738	27,472	4,021	1,097	2,927	177,995
20 years	1,448	32,331	16,880	9,958	1,395	5,541	9,515	5,384	4,343	10,704	3,195	26,209	13,225	813	5,134	24,020	3,883	1,127	2,889	177,995
30 years	1,443	26,538	18,073	10,976	1,316	7,053	11,214	5,739	4,927	11,461	2,615	26,037	13,955	940	6,083	21,199	3,788	1,209	3,427	177,995
40 years	1,310	22,610	19,609	11,915	1,587	7,721	12,184	5,976	5,229	11,568	2,649	24,976	15,244	1,004	6,609	19,055	3,790	1,170	3,787	177,995
50-year modeling period	1,274	20,189	20,299	11,934	1,651	8,112	13,388	6,057	5,779	12,113	2,354	23,342	16,099	1,009	7,399	18,040	3,762	1,315	3,879	177,995
Percent of total PNVT contributed by each vegetation state																				
Desired Conditions	7	21	9	7	20	20	9	7	0	0	0	0	0	0	0	0	0	0	0	100
Initial Conditions	13	28	4	5	1	1	1	10	0	0	13	6	5	1	1	1	10	0	0	100
10 years	1	23	8	5	1	2	4	3	2	6	3	12	6	1	2	18	3	1	1	100
15-year planning period	1	20	9	5	1	3	4	3	2	6	2	14	7	0	3	15	2	1	2	100
20 years	1	18	9	6	1	3	5	3	2	6	2	15	7	0	3	13	2	1	2	100
30 years	1	15	10	6	1	4	6	3	3	6	1	15	8	1	3	12	2	1	2	100
40 years	1	13	11	7	1	4	7	3	3	6	1	14	9	1	4	11	2	1	2	100
50-year modeling period	1	11	11	7	1	5	8	3	3	7	1	13	9	1	4	10	2	1	2	100
Percent departure for each vegetation state from desired conditions																				
Desired Conditions	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Initial Conditions	100	35	58	34	95	96	93	43	100	100	100	100	100	100	100	100	100	100	100	100
10 years	100	9	10	32	96	90	57	55	100	100	100	100	100	100	100	100	100	100	100	100
15-year planning period	100	3	1	25	96	87	51	60	100	100	100	100	100	100	100	100	100	100	100	100
20 years	100	14	5	20	96	84	41	57	100	100	100	100	100	100	100	100	100	100	100	100
30 years	100	29	13	12	96	80	30	54	100	100	100	100	100	100	100	100	100	100	100	100
40 years	100	40	22	4	96	78	24	52	100	100	100	100	100	100	100	100	100	100	100	100
50-year modeling period	100	46	27	4	95	77	16	51	100	100	100	100	100	100	100	100	100	100	100	100

Wet Mixed Conifer Forest PNVT Alternative C Proposed Average Acre Treatment Objectives

Appendix D table 16. Alternative C wet mixed conifer forest resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period, for the proposed average acre treatment objectives

Model Year Runs	Wet Mixed Conifer Forest Overstory Vegetation Structural State																			Total
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	
Number of acres in each vegetation state																				
Desired Conditions	12,460	37,379	16,020	12,460	35,599	35,599	16,020	12,460	0	0	0	0	0	0	0	0	0	0	0	177,995
Initial Conditions	23,958	50,355	6,721	8,185	1,925	1,512	1,079	17,813	167	131	23,958	11,381	8,185	1,925	1,512	1,079	17,813	167	131	177,995
10 years	1,528	40,845	14,391	8,522	1,519	3,645	6,814	5,604	3,349	10,192	4,648	21,228	10,439	1,044	3,906	31,991	4,732	1,034	2,562	177,995
15-year planning period	1,634	36,197	16,134	9,309	1,397	4,709	7,835	4,984	4,040	11,198	3,133	24,574	11,785	811	4,738	27,472	4,021	1,097	2,927	177,995
20 years	1,448	32,331	16,880	9,958	1,395	5,541	9,515	5,384	4,343	10,704	3,195	26,209	13,225	813	5,134	24,020	3,883	1,127	2,889	177,995
30 years	1,443	26,538	18,073	10,976	1,316	7,053	11,214	5,739	4,927	11,461	2,615	26,037	13,955	940	6,083	21,199	3,788	1,209	3,427	177,995
40 years	1,310	22,610	19,609	11,915	1,587	7,721	12,184	5,976	5,229	11,568	2,649	24,976	15,244	1,004	6,609	19,055	3,790	1,170	3,787	177,995
50-year modeling period	1,274	20,189	20,299	11,934	1,651	8,112	13,388	6,057	5,779	12,113	2,354	23,342	16,099	1,009	7,399	18,040	3,762	1,315	3,879	177,995
Percent of total PNVT contributed by each vegetation state																				
Desired Conditions	7	21	9	7	20	20	9	7	0	0	0	0	0	0	0	0	0	0	0	100
Initial Conditions	13	28	4	5	1	1	1	10	0	0	13	6	5	1	1	1	10	0	0	100
10 years	0	24	8	5	1	2	3	4	2	4	2	12	6	1	2	17	4	1	1	100
15-year planning period	1	22	9	6	1	2	4	3	2	4	1	14	7	1	3	14	3	1	2	100
20 years	0	21	10	6	1	3	5	3	2	4	1	15	8	1	3	12	3	1	2	100
30 years	0	18	11	6	1	3	6	3	2	5	1	15	9	1	4	10	3	1	2	100
40 years	0	16	11	7	1	4	6	3	2	5	1	14	10	1	4	9	3	1	2	100
50-year modeling period	0	14	12	7	1	4	7	3	3	5	1	13	10	1	5	9	3	1	3	100
Percent departure for each vegetation state from desired conditions																				
Desired Conditions	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Initial Conditions	100	35	58	34	95	96	93	43	100	100	100	100	100	100	100	100	100	100	100	100
10 years	100	17	10	24	96	91	64	48	100	100	100	100	100	100	100	100	100	100	100	100
15-year planning period	100	6	0	18	97	89	58	56	100	100	100	100	100	100	100	100	100	100	100	100
20 years	100	2	6	15	97	87	48	57	100	100	100	100	100	100	100	100	100	100	100	100
30 years	100	17	19	8	97	84	37	58	100	100	100	100	100	100	100	100	100	100	100	100
40 years	100	26	27	3	97	82	32	57	100	100	100	100	100	100	100	100	100	100	100	100
50-year modeling period	100	34	34	1	96	81	23	57	100	100	100	100	100	100	100	100	100	100	100	100

Wet Mixed Conifer Forest PNVT Alternative C Proposed Low Acre Treatment Objectives

Appendix D table 17. Alternative C wet mixed conifer forest resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period, for the proposed low acre treatment objectives

Model Year Runs	Wet Mixed Conifer Forest Overstory Vegetation Structural State																			Total
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	
Number of acres in each vegetation state																				
Desired Conditions	12,460	37,379	16,020	12,460	35,599	35,599	16,020	12,460	0	0	0	0	0	0	0	0	0	0	0	177,995
Initial Conditions	23,958	50,355	6,721	8,185	1,925	1,512	1,079	17,813	167	131	23,958	11,381	8,185	1,925	1,512	1,079	17,813	167	131	177,995
10 years	236	46,362	14,317	10,339	1,188	3,077	4,840	7,478	2,350	4,373	1,527	22,171	12,234	1,215	3,960	29,059	9,282	1,318	2,668	177,995
15-year planning period	248	43,413	16,046	11,026	1,019	3,476	5,672	5,901	3,124	4,374	842	26,655	14,823	1,141	4,785	22,976	7,752	1,680	3,039	177,995
20 years	295	40,849	17,225	11,236	844	3,813	7,127	5,418	3,312	4,774	492	27,901	15,663	1,247	5,794	19,792	6,882	1,871	3,460	177,995
30 years	252	35,868	20,128	11,893	761	4,581	8,829	4,707	3,526	4,659	767	26,872	17,976	1,022	7,709	15,707	6,560	2,238	3,939	177,995
40 years	223	32,838	21,118	12,359	887	5,329	9,741	4,798	3,469	4,933	618	24,316	18,975	1,324	8,138	14,111	7,168	2,593	5,057	177,995
50-year modeling period	253	29,330	22,679	13,241	1,001	5,513	11,353	4,680	3,969	5,244	526	22,609	19,407	1,480	8,882	12,669	7,247	2,449	5,463	177,995
Percent of total PNVT contributed by each vegetation state																				
Desired Conditions	7	21	9	7	20	20	9	7	0	0	0	0	0	0	0	0	0	0	0	100
Initial Conditions	13	28	4	5	1	1	1	10	0	0	13	6	5	1	1	1	10	0	0	100
10 years	0	26	8	6	1	2	3	4	1	2	1	12	7	1	2	16	5	1	1	100
15-year planning period	0	24	9	6	1	2	3	3	2	2	0	15	8	1	3	13	4	1	2	100
20 years	0	23	10	6	0	2	4	3	2	3	0	16	9	1	3	11	4	1	2	100
30 years	0	20	11	7	0	3	5	3	2	3	0	15	10	1	4	9	4	1	2	100
40 years	0	18	12	7	0	3	5	3	2	3	0	14	11	1	5	8	4	1	3	100
50-year modeling period	0	16	13	7	1	3	6	3	2	3	0	13	11	1	5	7	4	1	3	100
Percent departure for each vegetation state from desired conditions																				
Desired Conditions	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Initial Conditions	100	35	58	34	95	96	93	43	100	100	100	100	100	100	100	100	100	100	100	100
10 years	100	24	11	17	97	91	70	40	100	100	100	100	100	100	100	100	100	100	100	100
15-year planning period	100	16	0	12	97	90	65	53	100	100	100	100	100	100	100	100	100	100	100	100
20 years	100	9	8	10	98	89	56	57	100	100	100	100	100	100	100	100	100	100	100	100
30 years	100	4	26	5	98	87	45	62	100	100	100	100	100	100	100	100	100	100	100	100
40 years	100	12	32	1	98	85	39	61	100	100	100	100	100	100	100	100	100	100	100	100
50-year modeling period	100	22	42	6	97	85	29	62	100	100	100	100	100	100	100	100	100	100	100	100

Wet Mixed Conifer Forest PNVT Alternative D Proposed High Acre Treatment Objectives

Appendix D table 18. Alternative D wet mixed conifer forest resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period, for the proposed high acre treatment objectives

Model Year Runs	Wet Mixed Conifer Forest Overstory Vegetation Structural State																			Total
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	
Number of acres in each vegetation state																				
Desired Conditions	12,460	37,379	16,020	12,460	35,599	35,599	16,020	12,460	0	0	0	0	0	0	0	0	0	0	0	177,995
Initial Conditions	23,958	50,355	6,721	8,185	1,925	1,512	1,079	17,813	167	131	23,958	11,381	8,185	1,925	1,512	1,079	17,813	167	131	177,995
10 years	549	42,560	11,190	14,586	1,803	3,998	4,708	12,318	4,426	5,214	3,027	18,144	9,656	1,009	4,079	25,375	10,159	2,304	2,890	177,995
15-year planning period	513	38,488	13,334	16,647	2,075	5,404	5,767	11,322	6,579	5,992	1,827	19,235	10,356	1,115	4,935	19,584	8,594	2,681	3,547	177,995
20 years	483	34,268	14,637	18,209	2,103	7,195	8,081	11,715	7,529	6,955	1,313	17,953	11,088	1,191	5,316	15,269	7,879	2,782	4,028	177,995
30 years	422	29,031	16,628	22,158	2,675	8,954	9,268	12,159	9,320	8,097	1,237	14,194	10,405	1,272	6,984	11,131	6,683	2,736	4,639	177,995
40 years	491	24,700	17,607	24,647	3,252	10,783	10,657	13,196	10,525	9,091	1,247	11,433	9,289	1,321	6,974	8,628	6,302	3,166	4,689	177,995
50-year modeling period	425	21,776	18,552	26,761	2,915	12,399	11,540	14,051	10,884	9,953	964	9,455	8,234	1,470	6,679	7,516	5,618	3,706	5,098	177,995
Percent of total PNVT contributed by each vegetation state																				
Desired Conditions	7	21	9	7	20	20	9	7	0	0	0	0	0	0	0	0	0	0	0	100
Initial Conditions	13	28	4	5	1	1	1	10	0	0	13	6	5	1	1	1	10	0	0	100
10 years	0	24	6	8	1	2	3	7	2	3	2	10	5	1	2	14	6	1	2	100
15-year planning period	0	22	7	9	1	3	3	6	4	3	1	11	6	1	3	11	5	2	2	100
20 years	0	19	8	10	1	4	5	7	4	4	1	10	6	1	3	9	4	2	2	100
30 years	0	16	9	12	2	5	5	7	5	5	1	8	6	1	4	6	4	2	3	100
40 years	0	14	10	14	2	6	6	7	6	5	1	6	5	1	4	5	4	2	3	100
50-year modeling period	0	12	10	15	2	7	6	8	6	6	1	5	5	1	4	4	3	2	3	100
Percent departure for each vegetation state from desired conditions																				
Desired Conditions	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Initial Conditions	100	35	58	34	95	96	93	43	100	100	100	100	100	100	100	100	100	100	100	100
10 years	100	3	17	34	94	85	64	9	100	100	100	100	100	100	100	100	100	100	100	100
15-year planning period	100	8	9	46	94	80	50	6	100	100	100	100	100	100	100	100	100	100	100	100
20 years	100	22	4	78	92	75	42	2	100	100	100	100	100	100	100	100	100	100	100	100
30 years	100	34	10	98	91	70	33	6	100	100	100	100	100	100	100	100	100	100	100	100
40 years	100	42	16	100	92	65	28	13	100	100	100	100	100	100	100	100	100	100	100	100
50-year modeling period	100	3	17	34	94	85	64	9	100	100	100	100	100	100	100	100	100	100	100	100

Wet Mixed Conifer Forest PNVT Alternative D Proposed Average Acre Treatment Objectives

Appendix D table 19. Alternative D wet mixed conifer forest resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period, for the proposed average acre treatment objectives

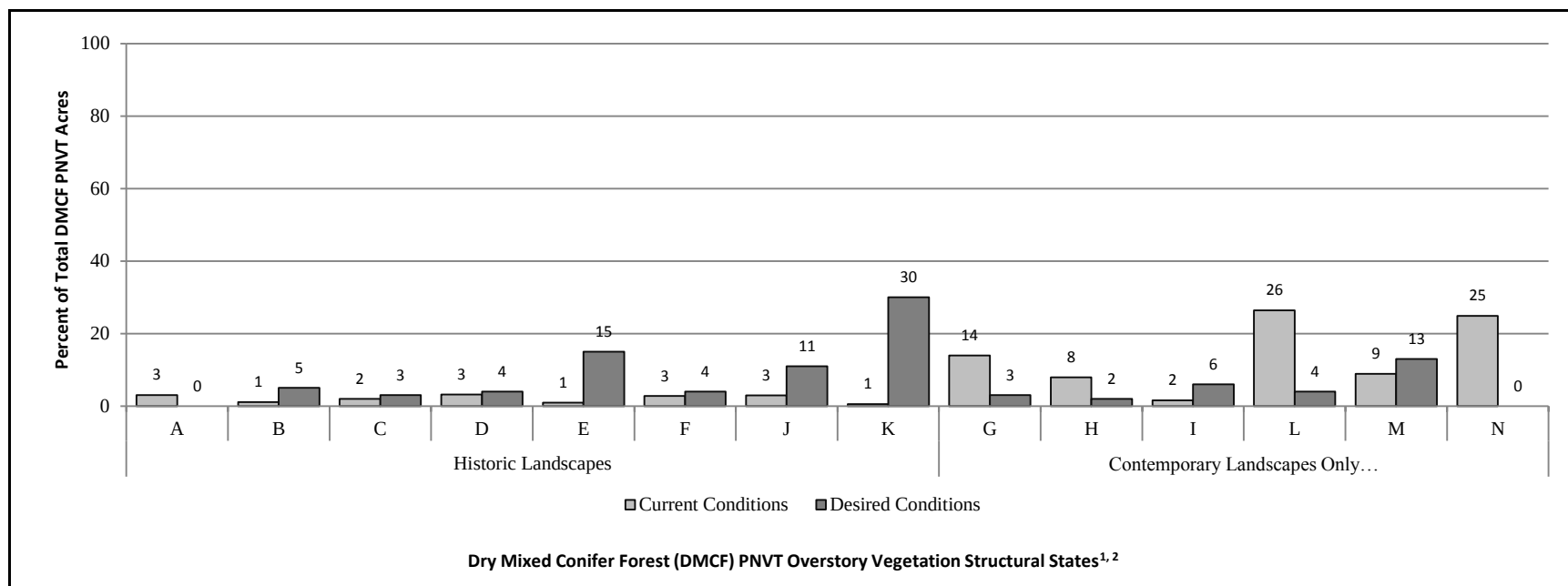
Model Year Runs	Wet Mixed Conifer Forest Overstory Vegetation Structural State																			Total
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	
Number of acres in each vegetation state																				
Desired Conditions	12,460	37,379	16,020	12,460	35,599	35,599	16,020	12,460	0	0	0	0	0	0	0	0	0	0	0	177,995
Initial Conditions	23,958	50,355	6,721	8,185	1,925	1,512	1,079	17,813	167	131	23,958	11,381	8,185	1,925	1,512	1,079	17,813	167	131	177,995
10 years	363	44,111	12,039	13,620	1,521	3,488	4,266	10,510	3,343	3,953	2,338	20,406	10,762	1,094	4,014	27,175	10,340	1,934	2,716	177,995
15-year planning period	334	40,497	14,117	14,836	1,536	4,639	5,525	9,105	4,916	4,739	1,288	22,673	12,220	1,134	4,906	21,138	8,699	2,400	3,294	177,995
20 years	296	37,095	15,519	16,102	1,584	5,691	7,173	9,220	5,543	5,294	943	22,037	13,224	1,119	5,681	17,231	7,987	2,447	3,809	177,995
30 years	304	32,113	17,307	18,743	2,077	7,090	8,580	9,407	6,849	5,980	873	19,364	13,544	1,316	7,261	12,713	7,428	2,502	4,544	177,995
40 years	334	28,723	18,483	20,875	2,291	8,278	9,794	9,685	7,424	6,489	885	16,528	13,580	1,181	7,559	10,468	7,425	3,106	4,888	177,995
50-year modeling period	300	25,597	19,613	22,242	2,172	9,527	11,220	10,244	7,927	7,200	727	14,408	13,031	1,501	7,659	9,116	6,616	3,477	5,416	177,995
Percent of total PNVT contributed by each vegetation state																				
Desired Conditions	7	21	9	7	20	20	9	7	0	0	0	0	0	0	0	0	0	0	0	100
Initial Conditions	13	28	4	5	1	1	1	10	0	0	13	6	5	1	1	1	10	0	0	100
10 years	0	25	7	8	1	2	2	6	2	2	1	11	6	1	2	15	6	1	2	100
15-year planning period	0	23	8	8	1	3	3	5	3	3	1	13	7	1	3	12	5	1	2	100
20 years	0	21	9	9	1	3	4	5	3	3	1	12	7	1	3	10	4	1	2	100
30 years	0	18	10	11	1	4	5	5	4	3	0	11	8	1	4	7	4	1	3	100
40 years	0	16	10	12	1	5	6	5	4	4	0	9	8	1	4	6	4	2	3	100
50-year modeling period	0	14	11	12	1	5	6	6	4	4	0	8	7	1	4	5	4	2	3	100
Percent departure for each vegetation state from desired conditions																				
Desired Conditions	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Initial Conditions	100	35	58	34	95	96	93	43	100	100	100	100	100	100	100	100	100	100	100	100
10 years	100	3	17	34	94	85	64	9	100	100	100	100	100	100	100	100	100	100	100	100
15-year planning period	100	8	9	46	94	80	50	6	100	100	100	100	100	100	100	100	100	100	100	100
20 years	100	22	4	78	92	75	42	2	100	100	100	100	100	100	100	100	100	100	100	100
30 years	100	34	10	98	91	70	33	6	100	100	100	100	100	100	100	100	100	100	100	100
40 years	100	42	16	100	92	65	28	13	100	100	100	100	100	100	100	100	100	100	100	100
50-year modeling period	100	3	17	34	94	85	64	9	100	100	100	100	100	100	100	100	100	100	100	100

Wet Mixed Conifer Forest PNVT Alternative D Proposed Low Acre Treatment Objectives

Appendix D table 20. Alternative D wet mixed conifer forest resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period, for the proposed low acre treatment objectives

Model Year Runs	Wet Mixed Conifer Forest Overstory Vegetation Structural State																			Total
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	
Number of acres in each vegetation state																				
Desired Conditions	12,460	37,379	16,020	12,460	35,599	35,599	16,020	12,460	0	0	0	0	0	0	0	0	0	0	0	177,995
Initial Conditions	23,958	50,355	6,721	8,185	1,925	1,512	1,079	17,813	167	131	23,958	11,381	8,185	1,925	1,512	1,079	17,813	167	131	177,995
10 years	178	45,662	12,887	12,654	1,239	2,979	3,823	8,703	2,259	2,693	1,650	22,669	11,868	1,179	3,950	28,975	10,521	1,563	2,542	177,995
15-year planning period	155	42,505	14,900	13,025	997	3,875	5,282	6,888	3,254	3,486	750	26,111	14,083	1,153	4,877	22,691	8,803	2,119	3,041	177,995
20 years	109	39,923	16,401	13,995	1,065	4,187	6,264	6,726	3,558	3,634	572	26,121	15,360	1,046	6,045	19,193	8,094	2,113	3,589	177,995
30 years	186	35,194	17,986	15,328	1,480	5,226	7,891	6,655	4,379	3,862	509	24,534	16,684	1,360	7,539	14,295	8,173	2,267	4,449	177,995
40 years	178	32,745	19,359	17,104	1,330	5,774	8,931	6,173	4,323	3,886	524	21,623	17,870	1,041	8,144	12,308	8,548	3,045	5,087	177,995
50-year modeling period	176	29,418	20,673	17,724	1,430	6,655	10,901	6,438	4,971	4,448	490	19,360	17,829	1,532	8,640	10,715	7,613	3,248	5,735	177,995
Percent of total PNVT contributed by each vegetation state																				
Desired Conditions	7	21	9	7	20	20	9	7	0	0	0	0	0	0	0	0	0	0	0	100
Initial Conditions	13	28	4	5	1	1	1	10	0	0	13	6	5	1	1	1	10	0	0	100
10 years	0	26	7	7	1	2	2	5	1	2	1	13	7	1	2	16	6	1	1	100
15-year planning period	0	24	8	7	1	2	3	4	2	2	0	15	8	1	3	13	5	1	2	100
20 years	0	22	9	8	1	2	4	4	2	2	0	15	9	1	3	11	5	1	2	100
30 years	0	20	10	9	1	3	4	4	2	2	0	14	9	1	4	8	5	1	2	100
40 years	0	18	11	10	1	3	5	3	2	2	0	12	10	1	5	7	5	2	3	100
50-year modeling period	0	17	12	10	1	4	6	4	3	2	0	11	10	1	5	6	4	2	3	100
Percent departure for each vegetation state from desired conditions																				
Desired Conditions	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Initial Conditions	100	35	58	34	95	96	93	43	100	100	100	100	100	100	100	100	100	100	100	100
10 years	100	22	20	2	97	92	76	30	100	100	100	100	100	100	100	100	100	100	100	100
15-year planning period	100	14	7	5	97	89	67	45	100	100	100	100	100	100	100	100	100	100	100	100
20 years	100	7	2	12	97	88	61	46	100	100	100	100	100	100	100	100	100	100	100	100
30 years	100	6	12	23	96	85	51	47	100	100	100	100	100	100	100	100	100	100	100	100
40 years	100	12	21	37	96	84	44	50	100	100	100	100	100	100	100	100	100	100	100	100
50-year modeling period	100	21	29	42	96	81	32	48	100	100	100	100	100	100	100	100	100	100	100	100

Dry Mixed Conifer Forest PNVT



Appendix D figure 17. Dry mixed conifer forest (DMCF) PNVT current and desired overstory vegetation structural states

¹ Dry Mixed Conifer Forest (DMCF) PNVT Overstory Vegetation Structural States. At 147,885 acres or approximately 7% of the forests this PNVT ranks 6th in order of size out of the 14 PNVTs on the A-SNFs

STRUCTURAL STATES PART OF THE HISTORIC LANDSCAPE CONDITIONS OR WITHIN HISTORIC RANGE OF VARIABILITY

State A - Recently burned, grass, forb and shrub types with < 10% tree canopy cover; early successional development

State B - Seedling and sapling size (< 5" diameter) trees with open (≥ 10% & ≤ 30%) canopy cover; all tree types; early successional development

State C - Small size (5"-9.9" diameter) trees, with open canopy cover; all tree types; mid successional development

State D - Medium size (10"-19.9" diameter) trees, single storied, with open canopy cover; all tree types; late successional development

State E - Large to very large size (≥ 20" diameter) trees, single storied, with open canopy cover; all tree types; late successional development

State F - Seedling and sapling size trees with closed (> 30%) canopy cover; all tree types; early successional development

State J - Medium size trees, multi-storied, with open canopy cover; all tree types; late successional development

State K - Large to very large size trees, multi-storied, with open canopy cover; all tree types; late successional development

STRUCTURAL STATES NOT PART OF THE HISTORIC LANDSCAPE CONDITIONS OR WITHIN HISTORIC RANGE OF VARIABILITY, FOUND ON CONTEMPORARY LANDSCAPES ONLY

State G - Small size trees, with closed canopy cover; all tree types; mid successional development; not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

State H - Medium size trees, single storied, with closed canopy cover; all shade tree types; late successional development; not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

State I - Large to very large size trees, single storied, with closed canopy cover; all tree types; late successional development; not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

State L - Medium size trees, multi-storied, with closed canopy cover; all tree types; late successional development; not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

State M - Large to very large size trees, multi-storied, with closed canopy cover; tree types; late successional development; not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

State N - Recently burned, grass, forb and shrub types with < 10% tree canopy cover; uncharacteristic early successional development due to fire; not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

² DMCF PNVT has a 67% or high departure rating from Desired Conditions (DC) and a 77% or high departure rating from Historical Range of Variability (HRV) making it tied with Great Basin grassland for the 3rd most departed PNVT for DC; and 3rd most departed PNVT for HRV on the A-SNFs. Desired Conditions were provided by the Regional Office, and HRV was derived from LANDFIRE (2007a)

Dry Mixed Conifer Forest PNVT Alternative A

Appendix D table 21. Alternative A dry mixed conifer forest resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period

Model Year Runs	Dry Mixed Conifer Forest Overstory Vegetation Structural State														Total
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	
Number of acres in each vegetation state															
Desired Conditions	0	7,394	4,437	9,864	19,713	5,915	4,437	4,111	8,222	19,708	39,436	8,222	16,425	0	147,885
Initial Conditions	4,507	1,653	2,944	5,514	1,196	4,059	20,598	20,281	4,567	3,526	1,196	30,422	10,657	36,766	147,885
10 years	5,452	1,077	1,026	4,438	5,242	33,524	16,020	16,251	6,026	5,061	4,573	24,089	10,804	14,301	147,885
15-year planning period	3,678	1,341	954	4,317	6,753	40,252	16,397	14,024	6,385	5,120	6,146	23,214	10,788	8,519	147,885
20 years	2,780	1,177	954	3,818	8,359	41,941	17,751	12,836	6,731	4,917	6,800	22,201	11,777	5,844	147,885
30 years	1,420	1,474	1,226	3,955	10,087	43,563	18,367	10,839	6,875	4,732	9,156	21,363	12,546	2,283	147,885
40 years	1,162	1,564	1,212	3,423	11,366	42,348	19,239	9,585	6,445	4,751	10,338	20,499	14,379	1,567	147,885
50-year modeling period	1,054	1,748	1,288	3,223	13,047	40,170	19,424	9,053	6,642	4,683	11,564	20,347	14,484	1,160	147,885
Percent of total PNVT contributed by each vegetation state															
Desired Conditions	0	5	3	4	15	4	3	2	6	11	30	4	13	0	100
Initial Conditions	3	1	2	3	1	3	14	8	2	3	1	26	9	25	100
10 years	4	1	1	3	4	23	11	11	4	3	3	16	7	10	100
15-year planning period	2	1	1	3	5	27	11	9	4	3	4	16	7	6	100
20 years	2	1	1	3	6	28	12	9	5	3	5	15	8	4	100
30 years	1	1	1	3	7	29	12	7	5	3	6	14	8	2	100
40 years	1	1	1	2	8	29	13	6	4	3	7	14	10	1	100
50-year modeling period	1	1	1	2	9	27	13	6	4	3	8	14	10	1	100
Percent departure for each vegetation state from desired conditions															
Desired Conditions	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Initial Conditions	100	78	34	44	94	31	100	100	44	82	97	100	35	100	
10 years	100	85	77	55	73	100	100	100	27	74	88	100	34	100	
15-year planning period	100	82	78	56	66	100	100	100	22	74	84	100	34	100	
20 years	100	84	78	61	58	100	100	100	18	75	83	100	28	100	
30 years	100	80	72	60	49	100	100	100	16	76	77	100	24	100	
40 years	100	79	73	65	42	100	100	100	22	76	74	100	12	100	
50-year modeling period	100	76	71	67	34	100	100	100	19	76	71	100	12	100	

Dry Mixed Conifer Forest PNVT Alternative B Proposed High Acre Treatment Objectives

Appendix D table 22. Alternative B dry mixed conifer forest resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period, for the proposed high acre treatment objectives

Model Year Runs	Dry Mixed Conifer Forest Overstory Vegetation Structural State														Total
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	
Number of acres in each vegetation state															
Desired Conditions	0	7,394	4,437	9,864	19,713	5,915	4,437	4,111	8,222	19,708	39,436	8,222	16,425	0	147,885
Initial Conditions	4,507	1,653	2,944	5,514	1,196	4,059	20,598	20,281	4,567	3,526	1,196	30,422	10,657	36,766	147,885
10 years	5,619	1,868	1,206	5,084	5,248	34,107	15,205	13,639	5,415	7,075	9,820	20,537	9,969	13,094	147,885
15-year planning period	4,080	1,973	1,191	4,595	6,377	40,748	15,163	11,275	5,781	7,586	13,328	18,613	9,711	7,464	147,885
20 years	2,517	1,372	960	4,137	7,051	43,986	16,887	9,781	5,475	7,247	15,995	17,451	10,659	4,369	147,885
30 years	1,491	1,546	1,160	3,531	8,181	43,607	19,260	7,640	5,622	6,474	20,487	15,286	11,750	1,851	147,885
40 years	1,041	1,433	1,097	3,023	8,766	41,562	20,250	6,733	5,613	5,478	24,708	14,612	12,685	884	147,885
50-year modeling period	984	1,371	1,227	2,978	9,626	40,019	19,722	6,115	5,439	5,129	26,211	14,269	14,203	592	147,885
Percent of total PNVT contributed by each vegetation state															
Desired Conditions	0	5	3	4	15	4	3	2	6	11	30	4	13	0	100
Initial Conditions	3	1	2	3	1	3	14	8	2	3	1	26	9	25	100
10 years	4	1	1	3	4	23	10	9	4	5	7	14	7	4	100
15-year planning period	3	1	1	3	4	28	10	8	4	5	9	13	7	3	100
20 years	2	1	1	3	5	30	11	7	4	5	11	12	7	2	100
30 years	1	1	1	2	6	29	13	5	4	4	14	10	8	1	100
40 years	1	1	1	2	6	28	14	5	4	4	17	10	9	1	100
50-year modeling period	1	1	1	2	7	27	13	4	4	3	18	10	10	1	100
Percent departure for each vegetation state from desired conditions															
Desired Conditions	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Initial Conditions	100	78	34	44	94	31	100	100	44	82	97	100	35	100	
10 years	100	75	73	48	73	100	100	100	34	64	75	100	39	100	
15-year planning period	100	73	73	53	68	100	100	100	30	62	66	100	41	100	
20 years	100	81	78	58	64	100	100	100	33	63	59	100	35	100	
30 years	100	79	74	64	58	100	100	86	32	67	48	86	28	100	
40 years	100	81	75	69	56	100	100	64	32	72	37	78	23	100	
50-year modeling period	100	81	72	70	51	100	100	49	34	74	34	74	14	100	

Dry Mixed Conifer Forest PNVT Alternative B Proposed Average Acre Treatment Objectives

Appendix D table 23. Alternative B dry mixed conifer forest resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period, for the proposed average acre treatment objectives

Model Year Runs	Dry Mixed Conifer Forest Overstory Vegetation Structural State														Total
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	
Number of acres in each vegetation state															
Desired Conditions	0	7,394	4,437	9,864	19,713	5,915	4,437	4,111	8,222	19,708	39,436	8,222	16,425	0	147,885
Initial Conditions	4,507	1,653	2,944	5,514	1,196	4,059	20,598	20,281	4,567	3,526	1,196	30,422	10,657	36,766	147,885
10 years	5,438	1,373	1,072	4,568	5,095	34,160	16,318	14,693	5,798	5,761	6,731	22,907	10,664	13,307	147,885
15-year planning period	3,697	1,334	1,021	4,036	6,269	40,859	16,690	12,534	6,317	6,014	9,130	21,234	10,901	7,849	147,885
20 years	2,404	1,114	893	3,571	7,164	43,755	17,921	11,179	6,371	5,919	10,980	20,357	11,429	4,829	147,885
30 years	1,339	1,184	1,070	2,963	8,640	43,798	20,131	9,018	6,599	5,458	14,253	18,772	12,624	2,034	147,885
40 years	815	1,107	1,001	2,631	9,627	41,935	21,332	8,081	6,815	4,802	17,052	18,043	13,730	915	147,885
50-year modeling period	731	1,115	1,099	2,439	10,477	40,284	21,151	7,204	6,738	4,626	18,416	17,990	14,992	623	147,885
Percent of total PNVT contributed by each vegetation state															
Desired Conditions	0	5	3	4	15	4	3	2	6	11	30	4	13	0	100
Initial Conditions	3	1	2	3	1	3	14	8	2	3	1	26	9	25	100
10 years	4	1	1	3	3	23	11	10	4	4	5	15	7	9	100
15-year planning period	2	1	1	3	4	28	11	8	4	4	6	14	7	5	100
20 years	2	1	1	2	5	30	12	8	4	4	7	14	8	3	100
30 years	1	1	1	2	6	30	14	6	4	4	10	13	9	1	100
40 years	1	1	1	2	7	28	14	5	5	3	12	12	9	1	100
50-year modeling period	0	1	1	2	7	27	14	5	5	3	12	12	10	0	100
Percent departure for each vegetation state from desired conditions															
Desired Conditions	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Initial Conditions	100	78	34	44	94	31	100	100	44	82	97	100	35	100	
10 years	100	81	76	54	74	100	100	100	29	71	83	100	35	100	
15-year planning period	100	82	77	59	68	100	100	100	23	69	77	100	34	100	
20 years	100	85	80	64	64	100	100	100	23	70	72	100	30	100	
30 years	100	84	76	70	56	100	100	100	20	72	64	100	23	100	
40 years	100	85	77	73	51	100	100	97	17	76	57	100	16	100	
50-year modeling period	100	85	75	75	47	100	100	75	18	77	53	100	9	100	

Dry Mixed Conifer Forest PNVT Alternative B Proposed Low Acre Treatment Objectives

Appendix D table 24. Alternative B dry mixed conifer forest resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period, for the proposed low acre treatment objectives

Model Year Runs	Dry Mixed Conifer Forest Overstory Vegetation Structural State														Total
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	
Number of acres in each vegetation state															
Desired Conditions	0	7,394	4,437	9,864	19,713	5,915	4,437	4,111	8,222	19,708	39,436	8,222	16,425	0	147,885
Initial Conditions	4,507	1,653	2,944	5,514	1,196	4,059	20,598	20,281	4,567	3,526	1,196	30,422	10,657	36,766	147,885
10 years	5,258	878	938	4,052	4,942	34,214	17,431	15,748	6,181	4,447	3,642	25,278	11,359	13,520	147,885
15-year planning period	3,315	695	851	3,476	6,161	40,969	18,216	13,794	6,853	4,442	4,932	23,854	12,091	8,234	147,885
20 years	2,292	857	825	3,004	7,277	43,525	18,955	12,577	7,267	4,591	5,964	23,263	12,199	5,289	147,885
30 years	1,188	823	980	2,396	9,100	43,989	21,002	10,395	7,577	4,442	8,019	22,258	13,499	2,216	147,885
40 years	588	781	905	2,239	10,489	42,308	22,413	9,429	8,017	4,127	9,395	21,474	14,775	945	147,885
50-year modeling period	478	859	971	1,900	11,328	40,550	22,580	8,293	8,037	4,123	10,620	21,711	15,781	654	147,885
Percent of total PNVT contributed by each vegetation state															
Desired Conditions	0	5	3	4	15	4	3	2	6	11	30	4	13	0	100
Initial Conditions	3	1	2	3	1	3	14	8	2	3	1	26	9	25	100
10 years	4	1	1	3	3	23	12	11	4	3	2	17	8	9	100
15-year planning period	2	0	1	2	4	28	12	9	5	3	3	16	8	6	100
20 years	2	1	1	2	5	29	13	9	5	3	4	16	8	4	100
30 years	1	1	1	2	6	30	14	7	5	3	5	15	9	1	100
40 years	0	1	1	2	7	29	15	6	5	3	6	15	10	1	100
50-year modeling period	0	1	1	1	8	27	15	6	5	3	7	15	11	0	100
Percent departure for each vegetation state from desired conditions															
Desired Conditions	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Initial Conditions	100	78	34	44	94	31	100	100	44	82	97	100	35	100	
10 years	100	88	79	59	75	100	100	100	25	77	91	100	31	100	
15-year planning period	100	91	81	65	69	100	100	100	17	77	87	100	26	100	
20 years	100	88	81	70	63	100	100	100	12	77	85	100	26	100	
30 years	100	89	78	76	54	100	100	100	8	77	80	100	18	100	
40 years	100	89	80	77	47	100	100	100	2	79	76	100	10	100	
50-year modeling period	100	88	78	81	43	100	100	100	2	79	73	100	4	100	

Dry Mixed Conifer Forest PNVT Alternative C Proposed High Acre Treatment Objectives

Appendix D table 25. Alternative C dry mixed conifer forest resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period, for the proposed high acre treatment objectives

Model Year Runs	Dry Mixed Conifer Forest Overstory Vegetation Structural State														Total
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	
Number of acres in each vegetation state															
Desired Conditions	0	7,394	4,437	9,864	19,713	5,915	4,437	4,111	8,222	19,708	39,436	8,222	16,425	0	147,885
Initial Conditions	4,507	1,653	2,944	5,514	1,196	4,059	20,598	20,281	4,567	3,526	1,196	30,422	10,657	36,766	147,885
10 years	6,329	2,169	1,001	5,010	2,587	37,009	15,294	10,047	4,385	10,124	16,374	16,304	8,696	12,558	147,885
15-year planning period	4,333	1,907	1,284	4,457	2,886	44,402	15,856	8,075	4,103	9,195	20,048	14,484	9,079	7,778	147,885
20 years	3,486	2,090	1,183	4,388	3,429	47,218	16,406	6,967	4,151	8,375	21,743	13,669	9,908	4,872	147,885
30 years	2,571	1,788	1,468	3,692	4,140	47,657	18,930	5,645	4,304	7,271	24,741	12,765	10,827	2,086	147,885
40 years	2,261	1,770	1,306	3,462	4,548	46,486	20,060	5,439	4,337	6,527	26,111	12,370	12,064	1,145	147,885
50-year modeling period	2,485	1,956	1,282	3,289	5,397	44,017	20,128	4,867	4,664	6,207	27,931	11,986	12,943	736	147,885
Percent of total PNVT contributed by each vegetation state															
Desired Conditions	0	5	3	4	15	4	3	2	6	11	30	4	13	0	100
Initial Conditions	3	1	2	3	1	3	14	8	2	3	1	26	9	25	100
10 years	4	1	1	3	2	25	10	7	3	7	11	11	6	8	100
15-year planning period	3	1	1	3	2	30	11	5	3	6	14	10	6	5	100
20 years	2	1	1	3	2	32	11	5	3	6	15	9	7	3	100
30 years	2	1	1	2	3	32	13	4	3	5	17	9	7	1	100
40 years	2	1	1	2	3	31	14	4	3	4	18	8	8	1	100
50-year modeling period	2	1	1	2	4	30	14	3	3	4	19	8	9	0	100
Percent departure for each vegetation state from desired conditions															
Desired Conditions	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Initial Conditions	100	78	34	44	94	31	100	100	44	82	97	100	35	100	
10 years	100	71	77	49	87	100	100	100	47	49	58	98	47	100	
15-year planning period	100	74	71	55	85	100	100	96	50	53	49	76	45	100	
20 years	100	72	73	56	83	100	100	69	50	58	45	66	40	100	
30 years	100	76	67	63	79	100	100	37	48	63	37	55	34	100	
40 years	100	76	71	65	77	100	100	32	47	67	34	50	27	100	
50-year modeling period	100	74	71	67	73	100	100	18	43	69	29	46	21	100	

Dry Mixed Conifer Forest PNVT Alternative C Proposed Average Acre Treatment Objectives

Appendix D table 26. Alternative C dry mixed conifer forest resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period, for the proposed average acre treatment objectives

Model Year Runs	Dry Mixed Conifer Forest Overstory Vegetation Structural State														Total
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	
Number of acres in each vegetation state															
Desired Conditions	0	7,394	4,437	9,864	19,713	5,915	4,437	4,111	8,222	19,708	39,436	8,222	16,425	0	147,885
Initial Conditions	4,507	1,653	2,944	5,514	1,196	4,059	20,598	20,281	4,567	3,526	1,196	30,422	10,657	36,766	147,885
10 years	5,863	1,500	853	4,522	2,205	35,307	16,412	13,296	5,472	7,543	10,500	21,347	10,115	12,949	147,885
15-year planning period	3,760	1,367	1,090	3,986	2,453	42,633	16,909	11,370	5,474	7,134	12,974	20,055	10,747	7,933	147,885
20 years	2,936	1,329	995	3,876	2,863	45,099	17,791	10,273	5,713	6,748	14,521	19,074	11,682	4,985	147,885
30 years	1,836	1,223	1,167	3,259	3,474	45,479	19,896	8,663	6,263	6,079	17,110	18,713	12,606	2,118	147,885
40 years	1,465	1,187	1,150	2,969	3,777	43,955	21,113	7,865	6,431	5,749	18,780	18,104	14,303	1,038	147,885
50-year modeling period	1,566	1,262	1,132	2,720	4,680	41,934	20,939	7,257	6,554	5,509	20,279	17,786	15,561	706	147,885
Percent of total PNVT contributed by each vegetation state															
Desired Conditions	0	5	3	4	15	4	3	2	6	11	30	4	13	0	100
Initial Conditions	3	1	2	3	1	3	14	8	2	3	1	26	9	25	100
10 years	4	1	1	3	1	24	11	9	4	5	7	14	7	9	100
15-year planning period	3	1	1	3	2	29	11	8	4	5	9	14	7	5	100
20 years	2	1	1	3	2	30	12	7	4	5	10	13	8	3	100
30 years	1	1	1	2	2	31	13	6	4	4	12	13	9	1	100
40 years	1	1	1	2	3	30	14	5	4	4	13	12	10	1	100
50-year modeling period	1	1	1	2	3	28	14	5	4	4	14	12	11	0	100
Percent departure for each vegetation state from desired conditions															
Desired Conditions	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Initial Conditions	100	78	34	44	94	31	100	100	44	82	97	100	35	100	
10 years	100	80	81	54	89	100	100	100	33	62	73	100	38	100	
15-year planning period	100	82	75	60	88	100	100	100	33	64	67	100	35	100	
20 years	100	82	78	61	85	100	100	100	31	66	63	100	29	100	
30 years	100	83	74	67	82	100	100	100	24	69	57	100	23	100	
40 years	100	84	74	70	81	100	100	91	22	71	52	100	13	100	
50-year modeling period	100	83	74	72	76	100	100	77	20	72	49	100	5	100	

Dry Mixed Conifer Forest PNVT Alternative C Proposed Low Acre Treatment Objectives

Appendix D table 27. Alternative C dry mixed conifer forest resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period, for the proposed low acre treatment objectives

Model Year Runs	Dry Mixed Conifer Forest Overstory Vegetation Structural State														Total
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	
Number of acres in each vegetation state															
Desired Conditions	0	7,394	4,437	9,864	19,713	5,915	4,437	4,111	8,222	19,708	39,436	8,222	16,425	0	147,885
Initial Conditions	4,507	1,653	2,944	5,514	1,196	4,059	20,598	20,281	4,567	3,526	1,196	30,422	10,657	36,766	147,885
10 years	5,397	831	705	4,034	1,824	33,605	17,531	16,546	6,559	4,962	4,626	26,391	11,535	13,341	147,885
15-year planning period	3,188	827	896	3,515	2,020	40,865	17,963	14,666	6,845	5,073	5,900	25,626	12,414	8,088	147,885
20 years	2,386	567	807	3,363	2,297	42,981	19,177	13,579	7,275	5,122	7,298	24,480	13,457	5,097	147,885
30 years	1,100	658	866	2,827	2,807	43,301	20,863	11,680	8,222	4,888	9,479	24,661	14,385	2,149	147,885
40 years	669	603	993	2,475	3,006	41,424	22,167	10,292	8,526	4,971	11,449	23,839	16,542	931	147,885
50-year modeling period	647	569	981	2,152	3,962	39,851	21,751	9,647	8,445	4,811	12,628	23,587	18,180	676	147,885
Percent of total PNVT contributed by each vegetation state															
Desired Conditions	0	5	3	4	15	4	3	2	6	11	30	4	13	0	100
Initial Conditions	3	1	2	3	1	3	14	8	2	3	1	26	9	25	100
10 years	4	1	0	3	1	23	12	11	4	3	3	18	8	9	100
15-year planning period	2	1	1	2	1	28	12	10	5	3	4	17	8	5	100
20 years	2	0	1	2	2	29	13	9	5	3	5	17	9	3	100
30 years	1	0	1	2	2	29	14	8	6	3	6	17	10	1	100
40 years	0	0	1	2	2	28	15	7	6	3	8	16	11	1	100
50-year modeling period	1	1	4	3	15	6	14	9	6	5	8	18	10	0	100
Percent departure for each vegetation state from desired conditions															
Desired Conditions	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Initial Conditions	100	78	34	44	94	31	100	100	44	82	97	100	35	100	
10 years	100	89	84	59	91	100	100	100	20	75	88	100	30	100	
15-year planning period	100	89	80	64	90	100	100	100	17	74	85	100	24	100	
20 years	100	92	82	66	88	100	100	100	12	74	81	100	18	100	
30 years	100	91	80	71	86	100	100	100	0	75	76	100	12	100	
40 years	100	92	78	75	85	100	100	100	4	75	71	100	1	100	
50-year modeling period	100	92	78	78	80	100	100	100	3	76	68	100	11	100	

Dry Mixed Conifer Forest PNVT Alternative D Proposed High Acre Treatment Objectives

Appendix D table 28. Alternative D dry mixed conifer forest resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period, for the proposed high acre treatment objectives

Model Year Runs	Dry Mixed Conifer Forest Overstory Vegetation Structural State														Total
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	
Number of acres in each vegetation state															
Desired Conditions	0	7,394	4,437	9,864	19,713	5,915	4,437	4,111	8,222	19,708	39,436	8,222	16,425	0	147,885
Initial Conditions	4,507	1,653	2,944	5,514	1,196	4,059	20,598	20,281	4,567	3,526	1,196	30,422	10,657	36,766	147,885
10 years	5,618	2,146	1,189	6,981	3,829	31,811	13,828	14,094	14,018	5,554	4,908	20,991	9,749	13,170	147,885
15-year planning period	3,844	2,353	1,198	7,152	5,081	36,038	13,581	12,487	16,144	6,610	6,141	19,042	9,629	8,584	147,885
20 years	2,589	2,242	1,368	6,997	6,620	37,099	14,620	10,886	17,441	6,743	7,433	18,226	10,367	5,254	147,885
30 years	1,788	2,335	1,476	7,034	8,864	36,271	14,142	10,226	17,899	6,670	9,301	17,854	11,805	2,220	147,885
40 years	1,456	2,269	1,298	6,243	11,557	34,972	14,121	9,322	17,206	6,236	11,080	17,828	12,956	1,344	147,885
50-year modeling period	1,125	2,682	1,268	6,446	12,236	33,457	13,829	9,475	16,188	6,165	12,070	18,363	13,638	942	147,885
Percent of total PNVT contributed by each vegetation state															
Desired Conditions	0	5	3	4	15	4	3	2	6	11	30	4	13	0	100
Initial Conditions	3	1	2	3	1	3	14	8	2	3	1	26	9	25	100
10 years	4	1	1	5	3	22	9	10	9	4	3	14	7	9	100
15-year planning period	3	2	1	5	3	24	9	8	11	4	4	13	7	6	100
20 years	2	2	1	5	4	25	10	7	12	5	5	12	7	4	100
30 years	1	2	1	5	6	25	10	7	12	5	6	12	8	2	100
40 years	1	2	1	4	8	24	10	6	12	4	7	12	9	1	100
50-year modeling period	1	2	1	4	8	23	9	6	11	4	8	12	9	1	100
Percent departure for each vegetation state from desired conditions															
Desired Conditions	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Initial Conditions	100	78	34	44	94	31	100	100	44	82	97	100	35	100	
10 years	100	71	73	29	81	100	100	100	70	72	88	100	41	100	
15-year planning period	100	68	73	27	74	100	100	100	96	66	84	100	41	100	
20 years	100	70	69	29	66	100	100	100	100	66	81	100	37	100	
30 years	100	68	67	29	55	100	100	100	100	66	76	100	28	100	
40 years	100	69	71	37	41	100	100	100	100	68	72	100	21	100	
50-year modeling period	100	64	71	35	38	100	100	100	97	69	69	100	17	100	

Dry Mixed Conifer Forest PNVT Alternative D Proposed Average Acre Treatment Objectives

Appendix D table 29. Alternative D dry mixed conifer forest resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period, for the proposed average acre treatment objectives

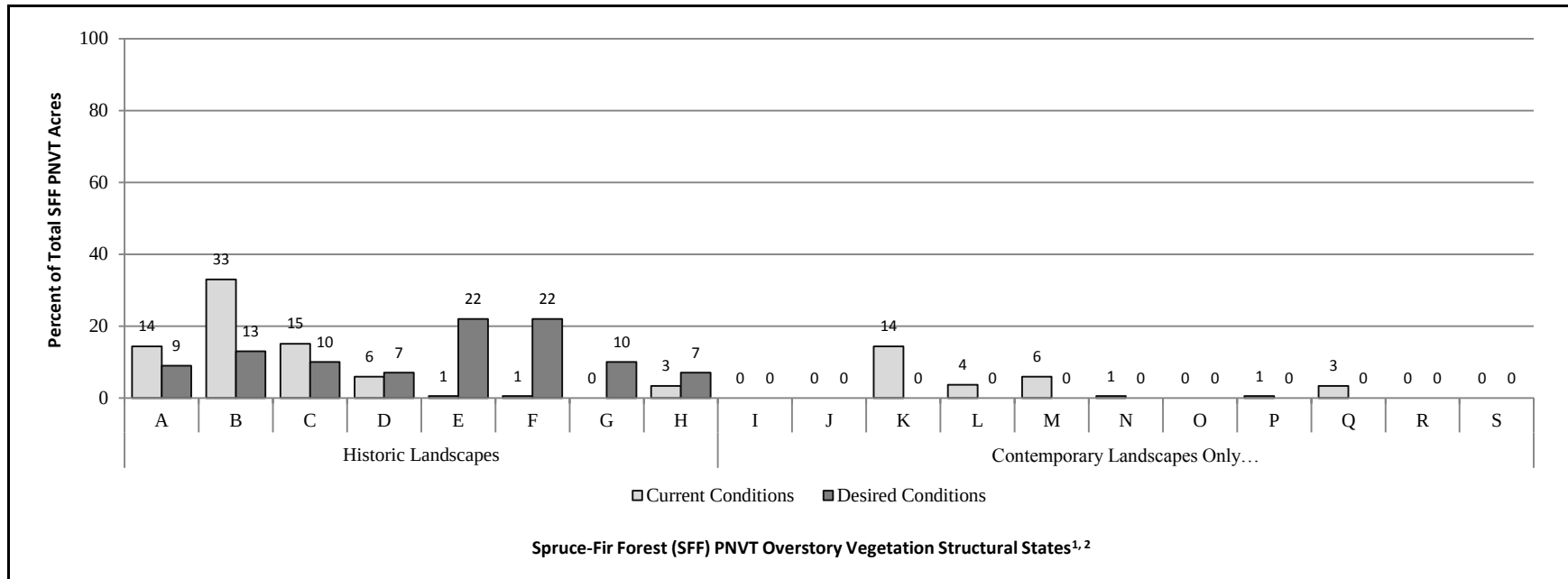
Model Year Runs	Dry Mixed Conifer Forest Overstory Vegetation Structural State														Total
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	
Number of acres in each vegetation state															
Desired Conditions	0	7,394	4,437	9,864	19,713	5,915	4,437	4,111	8,222	19,708	39,436	8,222	16,425	0	147,885
Initial Conditions	4,507	1,653	2,944	5,514	1,196	4,059	20,598	20,281	4,567	3,526	1,196	30,422	10,657	36,766	147,885
10 years	5,332	1,530	1,022	5,756	2,899	32,691	15,502	15,776	10,676	5,032	4,003	23,714	10,489	13,484	147,885
15-year planning period	3,700	1,708	1,046	5,856	3,730	37,911	15,234	14,090	11,873	5,586	5,133	22,557	10,861	8,600	147,885
20 years	2,499	1,566	1,061	5,536	4,682	39,347	16,575	12,837	13,160	5,664	6,092	21,564	11,862	5,441	147,885
30 years	1,464	1,674	1,197	5,331	6,003	39,089	16,775	11,851	13,637	5,738	7,828	21,663	13,423	2,213	147,885
40 years	1,245	1,559	1,103	4,790	7,794	37,415	17,335	10,340	13,754	5,698	9,133	21,545	14,881	1,294	147,885
50-year modeling period	840	1,803	1,171	4,790	8,564	35,431	17,219	10,193	13,463	5,376	10,477	22,229	15,480	848	147,885
Percent of total PNVT contributed by each vegetation state															
Desired Conditions	0	5	3	4	15	4	3	2	6	11	30	4	13	0	100
Initial Conditions	3	1	2	3	1	3	14	8	2	3	1	26	9	25	100
10 years	4	1	1	4	2	22	10	11	7	3	3	16	7	9	100
15-year planning period	3	1	1	4	3	26	10	10	8	4	3	15	7	6	100
20 years	2	1	1	4	3	27	11	9	9	4	4	15	8	4	100
30 years	1	1	1	4	4	26	11	8	9	4	5	15	9	1	100
40 years	1	1	1	3	5	25	12	7	9	4	6	15	10	1	100
50-year modeling period	1	1	1	3	6	24	12	7	9	4	7	15	10	1	100
Percent departure for each vegetation state from desired conditions															
Desired Conditions	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Initial Conditions	100	78	34	44	94	31	100	100	44	82	97	100	35	100	
10 years	100	79	77	42	85	100	100	100	30	74	90	100	36	100	
15-year planning period	100	77	76	41	81	100	100	100	44	72	87	100	34	100	
20 years	100	79	76	44	76	100	100	100	60	71	85	100	28	100	
30 years	100	77	73	46	70	100	100	100	66	71	80	100	18	100	
40 years	100	79	75	51	60	100	100	100	67	71	77	100	9	100	
50-year modeling period	100	76	74	51	57	100	100	100	64	73	73	100	6	100	

Dry Mixed Conifer Forest PNVT Alternative D Proposed Low Acre Treatment Objectives

Appendix D table 30. Alternative D dry mixed conifer forest resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period, for the proposed low acre treatment objectives

Model Year Runs	Dry Mixed Conifer Forest Overstory Vegetation Structural State														Total
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	
Number of acres in each vegetation state															
Desired Conditions	0	7,394	4,437	9,864	19,713	5,915	4,437	4,111	8,222	19,708	39,436	8,222	16,425	0	147,885
Initial Conditions	4,507	1,653	2,944	5,514	1,196	4,059	20,598	20,281	4,567	3,526	1,196	30,422	10,657	36,766	147,885
10 years	5,045	914	856	4,532	1,970	33,571	17,176	17,458	7,334	4,511	3,097	26,436	11,228	13,798	147,885
15-year planning period	3,556	1,062	894	4,559	2,380	39,784	16,886	15,692	7,603	4,563	4,126	26,073	12,093	8,616	147,885
20 years	2,410	890	754	4,075	2,743	41,595	18,529	14,788	8,880	4,585	4,750	24,901	13,357	5,627	147,885
30 years	1,141	1,013	917	3,628	3,141	41,907	19,408	13,475	9,375	4,805	6,356	25,473	15,041	2,206	147,885
40 years	1,034	849	909	3,337	4,032	39,858	20,549	11,358	10,302	5,160	7,185	25,263	16,806	1,243	147,885
50-year modeling period	555	924	1,075	3,135	4,892	37,404	20,609	10,911	10,739	4,586	8,885	26,095	17,322	753	147,885
Percent of total PNVT contributed by each vegetation state															
Desired Conditions	0	5	3	4	15	4	3	2	6	11	30	4	13	0	100
Initial Conditions	3	1	2	3	1	3	14	8	2	3	1	26	9	25	100
10 years	3	1	1	3	1	23	12	12	5	3	2	18	8	9	100
15-year planning period	2	1	1	3	2	27	11	11	5	3	3	18	8	6	100
20 years	2	1	1	3	2	28	13	10	6	3	3	17	9	4	100
30 years	1	1	1	2	2	28	13	9	6	3	4	17	10	1	100
40 years	1	1	1	2	3	27	14	8	7	3	5	17	11	1	100
50-year modeling period	0	1	1	2	3	25	14	7	7	3	6	18	12	1	100
Percent departure for each vegetation state from desired conditions															
Desired Conditions	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Initial Conditions	100	78	34	44	94	31	100	100	44	82	97	100	35	100	
10 years	100	88	81	54	90	100	100	100	11	77	92	100	32	100	
15-year planning period	100	86	80	54	88	100	100	100	8	77	90	100	26	100	
20 years	100	88	83	59	86	100	100	100	8	77	88	100	19	100	
30 years	100	86	79	63	84	100	100	100	14	76	84	100	8	100	
40 years	100	89	80	66	80	100	100	100	25	74	82	100	2	100	
50-year modeling period	100	88	76	68	75	100	100	100	31	77	77	100	5	100	

Spruce-Fir Forest PNVT



Appendix D figure 18. Spruce-fir forest (SFF) PNVT current and desired overstory vegetation structural states

¹ Spruce-Fir Forest (SFF) PNVT Overstory Vegetation Structural States. At 17,667 acres or approximately 0.9% of the forests this PNVT ranks 11th in order of size out of the 14 PNVTs on the A-SNFs

STRUCTURAL STATES PART OF THE HISTORIC LANDSCAPE CONDITIONS OR WITHIN HISTORIC RANGE OF VARIABILITY

State A - Recently burned, grass, forb and shrub types, with < 10% tree canopy cover; early successional development; with aspen regeneration

State B - Seedling and sapling (< 5" diameter), small (5"-9.9" diameter), medium (10"-19.9" diameter), large to very large (≥ 20" diameter) size trees, with open (≥ 10% & ≤ 30%) or closed (> 30%) canopy cover, consisting of all aspen, deciduous tree mix, and evergreen-deciduous mix tree types; with aspen regeneration

State C - Seedling and sapling, and small size trees, with closed canopy cover; with a plurality of shade tolerant/mixed shade tolerant tree types; with aspen regeneration. Also includes seedling and sapling, and small size trees, with open canopy cover, with a plurality of shade tolerant tree types; with aspen regeneration

State D - Medium size trees, single or multi-storied, with closed canopy cover; with a plurality of shade tolerant/mixed shade tolerant tree types; with aspen regeneration. Also includes medium size trees, single or multi-storied, with open canopy cover; with a plurality of shade tolerant tree types; with aspen regeneration

State E - Large to very large size trees, single storied, with closed canopy cover; with a plurality of shade tolerant tree types; with aspen regeneration. Also includes large to very large size trees, single storied, with closed canopy cover; with a plurality of shade intolerant tree types; with aspen regeneration

State F - Large to very large size trees, multi-storied, with closed canopy cover; with a plurality of shade tolerant tree types; with aspen regeneration. Also includes large to very large size trees, multi-storied, with closed canopy cover; with a plurality of shade intolerant tree types; with aspen regeneration

State G - Seedling and sapling, and small size trees, with open canopy cover; with a plurality of shade intolerant tree types; with aspen regeneration

State H - Medium size trees, single or multi-storied, with open canopy cover; with a plurality of shade intolerant tree types; with aspen regeneration. Also includes medium size trees, single or multi-storied, with closed canopy cover; with a plurality of shade intolerant tree types; with aspen regeneration

STRUCTURAL STATES NOT PART OF THE HISTORIC LANDSCAPE CONDITIONS OR WITHIN HISTORIC RANGE OF VARIABILITY, FOUND ON CONTEMPORARY LANDSCAPES ONLY

State I - Large to very large size trees, single storied, with open canopy cover; with a plurality of shade tolerant tree types; with aspen regeneration. Also includes large to very large size trees, single storied, with open canopy cover; with a plurality of shade intolerant tree types; with aspen regeneration. This state was not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

State J - Large to very large size trees, multi-storied, with open canopy cover; with a plurality of shade tolerant tree types; with aspen regeneration. Also includes large to very large size trees, multi-storied, with open canopy cover; with a plurality of shade intolerant tree types; with aspen regeneration. This state was not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

State K - Recently burned, grass, forb and shrub types, with < 10% tree canopy cover; early successional development. This state exists with elk and no or limited aspen regeneration; not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

State L - Seedling and sapling, and small size trees, with closed canopy cover; with a plurality of shade intolerant tree types. This state exists with elk and no or limited aspen regeneration; not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

State M - Medium size trees, single or multi-storied, with closed canopy cover; with a plurality of shade tolerant/mixed shade tolerant tree types. Also includes medium size trees, single or multi-storied, with open canopy cover; with a plurality of shade tolerant tree types. This state exists with elk and no or limited aspen regeneration; not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

State N - Large to very large size trees, single storied, with closed canopy cover; with a plurality of shade tolerant tree types. Also includes large to very large size trees, single storied, with closed canopy cover; with a plurality of shade intolerant tree types. This state exists with elk and no or limited aspen regeneration; not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

State O - Large to very large size trees, multi-storied, with closed canopy cover; with a plurality of shade tolerant tree types. Also includes large to very large size trees, multi-storied, with closed canopy cover; with a plurality of shade intolerant tree types. This state exists with elk and no or limited aspen regeneration; not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

State P - Seedling and sapling, and small size trees, with open canopy cover; with a plurality of shade intolerant tree types; with aspen regeneration. This state exists with elk and no or limited aspen regeneration; not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

State Q - Medium size trees, single or multi-storied, with open canopy cover; with a plurality of shade intolerant tree types. Also includes medium size trees, single or multi-storied, with a plurality of closed canopy cover; with shade intolerant tree types. This state exists with elk and no or limited aspen regeneration; not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

State R - Large to very large size trees, single storied, with open canopy cover; with a plurality of shade tolerant tree types. Also includes large to very large size trees, single storied, with open canopy cover; with a plurality of shade intolerant tree types. This state exists with elk and no or limited aspen regeneration; not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

State S - Large to very large size trees, multi-storied, with open canopy cover; with a plurality of shade tolerant tree types. Also includes large to very large size trees, multi-storied, with open canopy cover; with a plurality of shade intolerant tree types. This state exists with elk and no or limited aspen regeneration; not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

² SFF PNVNT has a 59% or moderate departure rating from Desired Conditions (DC) and a 62% or high departure rating from Historical Range of Variability (HRV) making it the 5th most departed PNVNT on the A-SNFs for DC and the 6th most departed for HRV. Desired Conditions were provided by the Regional Office, and reference conditions were derived from the Nature Conservancy (Smith, 2006c)

Spruce-Fir Forest PNVT Alternative A

Appendix D table 31. Alternative A spruce-fir forest resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period

Model Year Runs	Spruce-Fir Forest Overstory Vegetation Structural State																			Total
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	
Number of acres in each vegetation state																				
Desired Conditions	1,590	2,297	1,767	1,237	3,887	3,887	1,767	1,237	0	0	0	0	0	0	0	0	0	0	0	17,667
Initial Conditions	2,537	5,830	2,664	1,040	88	88	0	592	0	0	2,537	648	1,040	88	0	88	592	0	0	17,667
10 years	32	6,370	1,219	863	131	142	357	594	368	265	102	4,052	858	70	140	723	884	335	162	17,667
15-year planning period	30	6,226	1,171	941	161	175	362	505	482	367	81	3,965	946	96	184	508	829	384	254	17,667
20 years	34	6,032	1,224	999	185	217	333	489	586	418	68	3,661	1,038	87	218	409	920	474	274	17,667
30 years	35	5,677	1,229	1,124	226	289	368	502	693	570	46	3,167	1,094	154	281	385	825	659	342	17,667
40 years	29	5,523	1,202	1,084	317	332	379	532	828	610	49	2,808	1,112	183	329	309	856	769	415	17,667
50-year modeling period	25	5,317	1,169	1,072	325	323	385	524	1,056	722	60	2,549	972	193	330	311	889	893	552	17,667
Percent of total PNVT contributed by each vegetation state																				
Desired Conditions	9	13	10	7	22	22	10	7	0	0	0	0	0	0	0	0	0	0	0	100
Initial Conditions	14	33	15	6	1	1	0	3	0	0	14	4	6	1	0	1	3	0	0	100
10 years	0	36	7	5	1	1	2	3	2	1	1	23	5	0	1	4	5	2	1	100
15-year planning period	0	35	7	5	1	1	2	3	3	2	0	22	5	1	1	3	5	2	1	100
20 years	0	34	7	6	1	1	2	3	3	2	0	21	6	0	1	2	5	3	2	100
30 years	0	32	7	6	1	2	2	3	4	3	0	18	6	1	2	2	5	4	2	100
40 years	0	31	7	6	2	2	2	3	5	3	0	16	6	1	2	2	5	4	2	100
50-year modeling period	0	30	7	6	2	2	2	3	6	4	0	14	6	1	2	2	5	5	3	100
Percent departure for each vegetation state from desired conditions																				
Desired Conditions	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Initial Conditions	100	100	25	51	98	98	96	2	100	100	100	100	100	100	100	100	100	100	100	100
10 years	100	100	31	30	97	96	80	52	100	100	100	100	100	100	100	100	100	100	100	100
15-year planning period	100	100	34	24	96	95	80	59	100	100	100	100	100	100	100	100	100	100	100	100
20 years	100	100	31	19	95	94	81	60	100	100	100	100	100	100	100	100	100	100	100	100
30 years	100	100	30	9	94	93	79	59	100	100	100	100	100	100	100	100	100	100	100	100
40 years	100	100	32	12	92	91	79	57	100	100	100	100	100	100	100	100	100	100	100	100
50-year modeling period	100	100	34	13	92	92	78	58	100	100	100	100	100	100	100	100	100	100	100	100

Spruce-Fir Forest PNVT Alternative B Proposed High Acre Treatment Objectives

Appendix D table 32. Alternative B spruce-fir forest resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period, for the proposed high acre treatment objectives

Model Year Runs	Spruce-Fir Forest Overstory Vegetation Structural State																			Total
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	
Number of acres in each vegetation state																				
Desired Conditions	1,590	2,297	1,767	1,237	3,887	3,887	1,767	1,237	0	0	0	0	0	0	0	0	0	0	0	17,667
Initial Conditions	2,537	5,830	2,664	1,040	88	88	0	592	0	0	2,537	648	1,040	88	0	88	592	0	0	17,667
10 years	35	6,022	1,017	1,174	199	189	554	823	606	404	96	3,230	871	86	157	650	1,042	313	200	17,667
15-year planning period	25	5,836	1,008	1,386	242	238	531	752	785	574	60	2,759	947	105	220	453	1,026	452	268	17,667
20 years	33	5,604	895	1,515	332	282	546	809	1,008	665	56	2,327	960	111	243	389	1,030	526	335	17,667
30 years	29	5,198	861	1,544	400	425	533	875	1,477	869	42	1,655	835	156	259	288	1,003	749	468	17,667
40 years	26	4,937	864	1,549	450	512	537	897	1,776	1,097	44	1,223	657	195	308	204	957	877	558	17,667
50-year modeling period	29	4,715	885	1,599	503	575	499	810	1,972	1,243	43	1,017	512	181	336	181	958	979	631	17,667
Percent of total PNVT contributed by each vegetation state																				
Desired Conditions	9	13	10	7	22	22	10	7	0	0	0	0	0	0	0	0	0	0	0	100
Initial Conditions	14	33	15	6	1	1	0	3	0	0	14	4	6	1	0	1	3	0	0	100
10 years	0	34	6	7	1	1	3	5	3	2	1	18	5	0	1	4	6	2	1	100
15-year planning period	0	33	6	8	1	1	3	4	4	3	0	16	5	1	1	3	6	3	2	100
20 years	0	32	5	9	2	2	3	5	6	4	0	13	5	1	1	2	6	3	2	100
30 years	0	29	5	9	2	2	3	5	8	5	0	9	5	1	1	2	6	4	3	100
40 years	0	28	5	9	3	3	3	5	10	6	0	7	4	1	2	1	5	5	3	100
50-year modeling period	0	27	5	9	3	3	3	5	11	7	0	6	3	1	2	1	5	6	4	100
Percent departure for each vegetation state from desired conditions																				
Desired Conditions	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Initial Conditions	100	100	25	51	98	98	96	2	100	100	100	100	100	100	100	100	100	100	100	100
10 years	100	100	42	5	95	95	69	33	100	100	100	100	100	100	100	100	100	100	100	100
15-year planning period	100	100	43	12	94	94	70	39	100	100	100	100	100	100	100	100	100	100	100	100
20 years	100	100	49	22	91	93	69	35	100	100	100	100	100	100	100	100	100	100	100	100
30 years	100	100	51	25	90	89	70	29	100	100	100	100	100	100	100	100	100	100	100	100
40 years	100	100	51	25	88	87	70	27	100	100	100	100	100	100	100	100	100	100	100	100
50-year modeling period	100	100	50	29	87	85	72	35	100	100	100	100	100	100	100	100	100	100	100	100

Spruce-Fir Forest PNVT Alternative B Proposed Average Acre Treatment Objectives

Appendix D table 33. Alternative B spruce-fir forest resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period, for the proposed average acre treatment objectives

Model Year Runs	Spruce-Fir Forest Overstory Vegetation Structural State																			Total
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	
Number of acres in each vegetation state																				
Desired Conditions	1,590	2,297	1,767	1,237	3,887	3,887	1,767	1,237	0	0	0	0	0	0	0	0	0	0	0	17,667
Initial Conditions	2,537	5,830	2,664	1,040	88	88	0	592	0	0	2,537	648	1,040	88	0	88	592	0	0	17,667
10 years	34	6,206	1,149	989	173	154	470	720	474	313	85	3,636	827	80	149	686	1,035	305	193	17,667
15-year planning period	16	6,053	1,142	1,137	205	209	457	628	624	428	41	3,329	942	97	195	465	999	451	247	17,667
20 years	22	5,831	1,103	1,222	261	229	475	674	766	510	47	2,936	1,004	102	235	392	1,011	521	326	17,667
30 years	22	5,453	1,056	1,271	304	342	473	704	1,105	673	37	2,378	971	146	263	315	993	716	446	17,667
40 years	18	5,176	1,074	1,298	367	410	462	718	1,330	832	33	1,971	849	182	311	257	964	889	524	17,667
50-year modeling period	19	5,024	1,085	1,337	390	456	464	671	1,454	964	32	1,683	742	196	346	220	991	983	609	17,667
Percent of total PNVT contributed by each vegetation state																				
Desired Conditions	9	13	10	7	22	22	10	7	0	0	0	0	0	0	0	0	0	0	0	100
Initial Conditions	14	33	15	6	1	1	0	3	0	0	14	4	6	1	0	1	3	0	0	100
10 years	0	35	7	6	1	1	3	4	3	2	0	21	5	0	1	4	6	2	1	100
15-year planning period	0	34	6	6	1	1	3	4	4	2	0	19	5	1	1	3	6	3	1	100
20 years	0	33	6	7	1	1	3	4	4	3	0	17	6	1	1	2	6	3	2	100
30 years	0	31	6	7	2	2	3	4	6	4	0	13	5	1	1	2	6	4	3	100
40 years	0	29	6	7	2	2	3	4	8	5	0	11	5	1	2	1	5	5	3	100
50-year modeling period	0	28	6	8	2	3	3	4	8	5	0	10	4	1	2	1	6	6	3	100
Percent departure for each vegetation state from desired conditions																				
Desired Conditions	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Initial Conditions	100	100	25	51	98	98	96	2	100	100	100	100	100	100	100	100	100	100	100	100
10 years	100	100	35	20	96	96	73	42	100	100	100	100	100	100	100	100	100	100	100	100
15-year planning period	100	100	35	8	95	95	74	49	100	100	100	100	100	100	100	100	100	100	100	100
20 years	100	100	38	1	93	94	73	46	100	100	100	100	100	100	100	100	100	100	100	100
30 years	100	100	40	3	92	91	73	43	100	100	100	100	100	100	100	100	100	100	100	100
40 years	100	100	39	5	91	89	74	42	100	100	100	100	100	100	100	100	100	100	100	100
50-year modeling period	100	100	39	8	90	88	74	46	100	100	100	100	100	100	100	100	100	100	100	100

Spruce-Fir Forest PNVT Alternative B Proposed Low Acre Treatment Objectives

Appendix D table 34. Appendix D table 34. Alternative B spruce-fir forest resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period, for the proposed low acre treatment objectives

Model Year Runs	Spruce-Fir Forest Overstory Vegetation Structural State																			Total
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	
Number of acres in each vegetation state																				
Desired Conditions	1,590	2,297	1,767	1,237	3,887	3,887	1,767	1,237	0	0	0	0	0	0	0	0	0	0	0	17,667
Initial Conditions	2,537	5,830	2,664	1,040	88	88	0	592	0	0	2,537	648	1,040	88	0	88	592	0	0	17,667
10 years	34	6,382	1,281	803	147	119	387	617	341	221	73	4,042	783	74	142	721	1,028	296	187	17,667
15-year planning period	7	6,271	1,275	888	168	180	384	505	463	283	23	3,900	937	89	169	477	972	450	227	17,667
20 years	10	6,058	1,311	930	189	175	405	539	524	355	37	3,545	1,049	92	228	395	992	516	317	17,667
30 years	14	5,708	1,251	999	207	259	413	532	733	478	32	3,101	1,106	137	266	341	983	683	423	17,667
40 years	10	5,416	1,284	1,048	284	308	387	539	884	568	22	2,720	1,041	170	314	311	970	901	491	17,667
50-year modeling period	9	5,334	1,285	1,074	277	338	430	532	936	685	21	2,349	971	211	355	259	1,025	986	588	17,667
Percent of total PNVT contributed by each vegetation state																				
Desired Conditions	9	13	10	7	22	22	10	7	0	0	0	0	0	0	0	0	0	0	0	100
Initial Conditions	14	33	15	6	1	1	0	3	0	0	14	4	6	1	0	1	3	0	0	100
10 years	0	36	7	5	1	1	2	3	2	1	0	23	4	0	1	4	6	2	1	100
15-year planning period	0	35	7	5	1	1	2	3	3	2	0	22	5	1	1	3	6	3	1	100
20 years	0	34	7	5	1	1	2	3	3	2	0	20	6	1	1	2	6	3	2	100
30 years	0	32	7	6	1	1	2	3	4	3	0	18	6	1	2	2	6	4	2	100
40 years	0	31	7	6	2	2	2	3	5	3	0	15	6	1	2	2	5	5	3	100
50-year modeling period	0	30	7	6	2	2	2	3	5	4	0	13	5	1	2	1	6	6	3	100
Percent departure for each vegetation state from desired conditions																				
Desired Conditions	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Initial Conditions	100	100	25	51	98	98	96	2	100	100	100	100	100	100	100	100	100	100	100	100
10 years	100	100	28	35	96	97	78	50	100	100	100	100	100	100	100	100	100	100	100	100
15-year planning period	100	100	28	28	96	95	78	59	100	100	100	100	100	100	100	100	100	100	100	100
20 years	100	100	26	25	95	95	77	56	100	100	100	100	100	100	100	100	100	100	100	100
30 years	100	100	29	19	95	93	77	57	100	100	100	100	100	100	100	100	100	100	100	100
40 years	100	100	27	15	93	92	78	56	100	100	100	100	100	100	100	100	100	100	100	100
50-year modeling period	100	100	27	13	93	91	76	57	100	100	100	100	100	100	100	100	100	100	100	100

Spruce-Fir Forest PNVT Alternative C Proposed High Acre Treatment Objectives

Appendix D table 35. Alternative C spruce-fir forest resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period, for the proposed high acre treatment objectives

Model Year Runs	Spruce-Fir Forest Overstory Vegetation Structural State																			Total
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	
Number of acres in each vegetation state																				
Desired Conditions	1,590	2,297	1,767	1,237	3,887	3,887	1,767	1,237	0	0	0	0	0	0	0	0	0	0	0	17,667
Initial Conditions	2,537	5,830	2,664	1,040	88	88	0	592	0	0	2,537	648	1,040	88	0	88	592	0	0	17,667
10 years	53	5,822	889	1,285	232	207	554	893	679	528	169	3,010	838	110	148	729	1,040	284	196	17,667
15-year planning period	44	5,404	880	1,507	280	281	556	966	978	675	122	2,521	868	119	201	564	1,062	384	254	17,667
20 years	39	5,186	754	1,650	361	381	543	983	1,249	754	100	2,106	879	126	235	412	1,022	530	359	17,667
30 years	33	4,797	758	1,787	476	482	536	1,055	1,636	1,003	67	1,444	690	153	275	290	1,000	728	459	17,667
40 years	41	4,542	739	1,691	551	546	517	989	2,037	1,232	67	1,112	603	161	314	188	927	914	496	17,667
50-year modeling period	33	4,266	747	1,708	608	656	486	961	2,242	1,435	70	899	457	185	318	181	793	991	631	17,667
Percent of total PNVT contributed by each vegetation state																				
Desired Conditions	9	13	10	7	22	22	10	7	0	0	0	0	0	0	0	0	0	0	0	100
Initial Conditions	14	33	15	6	1	1	0	3	0	0	14	4	6	1	0	1	3	0	0	100
10 years	0	33	5	7	1	1	3	5	4	3	1	17	5	1	1	4	6	2	1	100
15-year planning period	0	31	5	9	2	2	3	5	6	4	1	14	5	1	1	3	6	2	1	100
20 years	0	29	4	9	2	2	3	6	7	4	1	12	5	1	1	2	6	3	2	100
30 years	0	27	4	10	3	3	3	6	9	6	0	8	4	1	2	2	6	4	3	100
40 years	0	26	4	10	3	3	3	6	12	7	0	6	3	1	2	1	5	5	3	100
50-year modeling period	0	24	4	10	3	4	3	5	13	8	0	5	3	1	2	1	4	6	4	100
Percent departure for each vegetation state from desired conditions																				
Desired Conditions	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Initial Conditions	100	100	25	51	98	98	96	2	100	100	100	100	100	100	100	100	100	100	100	100
10 years	100	100	50	4	94	95	69	28	100	100	100	100	100	100	100	100	100	100	100	100
15-year planning period	100	100	50	22	93	93	69	22	100	100	100	100	100	100	100	100	100	100	100	100
20 years	100	100	57	33	91	90	69	21	100	100	100	100	100	100	100	100	100	100	100	100
30 years	100	100	57	44	88	88	70	15	100	100	100	100	100	100	100	100	100	100	100	100
40 years	100	100	58	37	86	86	71	20	100	100	100	100	100	100	100	100	100	100	100	100
50-year modeling period	100	100	58	38	84	83	72	22	100	100	100	100	100	100	100	100	100	100	100	100

Spruce-Fir Forest PNVT Alternative C Proposed Average Acre Treatment Objectives

Appendix D table 36. Alternative C spruce-fir forest resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period, for the proposed average acre treatment objectives

Model Year Runs	Spruce-Fir Forest Overstory Vegetation Structural State																			Total
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	
Number of acres in each vegetation state																				
Desired Conditions	1,590	2,297	1,767	1,237	3,887	3,887	1,767	1,237	0	0	0	0	0	0	0	0	0	0	0	17,667
Initial Conditions	2,537	5,830	2,664	1,040	88	88	0	592	0	0	2,537	648	1,040	88	0	88	592	0	0	17,667
10 years	39	6,066	1,060	1,042	192	170	479	731	519	364	137	3,607	822	93	144	692	1,049	289	174	17,667
15-year planning period	32	5,735	1,073	1,194	237	219	472	755	741	479	84	3,232	938	99	181	521	1,037	396	244	17,667
20 years	27	5,551	1,001	1,298	279	289	471	768	893	534	74	2,932	964	118	221	413	974	527	331	17,667
30 years	26	5,179	983	1,413	362	362	470	792	1,189	740	53	2,324	901	147	267	342	991	691	435	17,667
40 years	27	4,931	1,006	1,325	423	424	455	758	1,474	901	50	1,970	833	155	301	263	981	878	510	17,667
50-year modeling period	25	4,669	989	1,383	434	512	455	737	1,627	1,045	55	1,679	743	199	331	229	943	997	616	17,667
Percent of total PNVT contributed by each vegetation state																				
Desired Conditions	9	13	10	7	22	22	10	7	0	0	0	0	0	0	0	0	0	0	0	100
Initial Conditions	14	33	15	6	1	1	0	3	0	0	14	4	6	1	0	1	3	0	0	100
10 years	0	34	6	6	1	1	3	4	3	2	1	20	5	1	1	4	6	2	1	100
15-year planning period	0	32	6	7	1	1	3	4	4	3	0	18	5	1	1	3	6	2	1	100
20 years	0	31	6	7	2	2	3	4	5	3	0	17	5	1	1	2	6	3	2	100
30 years	0	29	6	8	2	2	3	4	7	4	0	13	5	1	2	2	6	4	2	100
40 years	0	28	6	7	2	2	3	4	8	5	0	11	5	1	2	1	6	5	3	100
50-year modeling period	0	26	6	8	2	3	3	4	9	6	0	10	4	1	2	1	5	6	3	100
Percent departure for each vegetation state from desired conditions																				
Desired Conditions	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Initial Conditions	100	100	25	51	98	98	96	2	100	100	100	100	100	100	100	100	100	100	100	100
10 years	100	100	40	16	95	96	73	41	100	100	100	100	100	100	100	100	100	100	100	100
15-year planning period	100	100	39	3	94	94	73	39	100	100	100	100	100	100	100	100	100	100	100	100
20 years	100	100	43	5	93	93	73	38	100	100	100	100	100	100	100	100	100	100	100	100
30 years	100	100	44	14	91	91	73	36	100	100	100	100	100	100	100	100	100	100	100	100
40 years	100	100	43	7	89	89	74	39	100	100	100	100	100	100	100	100	100	100	100	100
50-year modeling period	100	100	44	12	89	87	74	40	100	100	100	100	100	100	100	100	100	100	100	100

Spruce-Fir Forest PNVT Alternative C Proposed Low Acre Treatment Objectives

Appendix D table 37. Alternative C spruce-fir forest resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period, for the proposed low acre treatment objectives

Model Year Runs	Spruce-Fir Forest Overstory Vegetation Structural State																			Total
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	
Number of acres in each vegetation state																				
Desired Conditions	1,590	2,297	1,767	1,237	3,887	3,887	1,767	1,237	0	0	0	0	0	0	0	0	0	0	0	17,667
Initial Conditions	2,537	5,830	2,664	1,040	88	88	0	592	0	0	2,537	648	1,040	88	0	88	592	0	0	17,667
10 years	24	6,309	1,232	798	152	132	404	568	360	201	105	4,204	805	75	141	655	1,057	294	151	17,667
15-year planning period	21	6,065	1,266	882	194	157	387	543	503	283	46	3,943	1,007	78	160	478	1,013	408	233	17,667
20 years	15	5,917	1,249	946	197	198	399	553	538	315	47	3,758	1,050	110	207	415	926	524	303	17,667
30 years	20	5,562	1,207	1,038	247	243	405	530	742	477	39	3,205	1,111	140	258	394	983	654	411	17,667
40 years	14	5,320	1,274	959	295	302	393	527	911	571	33	2,828	1,063	149	289	338	1,035	842	524	17,667
50-year modeling period	16	5,073	1,231	1,059	261	368	424	513	1,013	655	40	2,458	1,028	212	343	276	1,093	1,002	601	17,667
Percent of total PNVT contributed by each vegetation state																				
Desired Conditions	9	13	10	7	22	22	10	7	0	0	0	0	0	0	0	0	0	0	0	100
Initial Conditions	14	33	15	6	1	1	0	3	0	0	14	4	6	1	0	1	3	0	0	100
10 years	0	36	7	5	1	1	2	3	2	1	1	24	5	0	1	4	6	2	1	100
15-year planning period	0	34	7	5	1	1	2	3	3	2	0	22	6	0	1	3	6	2	1	100
20 years	0	33	7	5	1	1	2	3	3	2	0	21	6	1	1	2	5	3	2	100
30 years	0	31	7	6	1	1	2	3	4	3	0	18	6	1	1	2	6	4	2	100
40 years	0	30	7	5	2	2	2	3	5	3	0	16	6	1	2	2	6	5	3	100
50-year modeling period	0	29	7	6	1	2	2	3	6	4	0	14	6	1	2	2	6	6	3	100
Percent departure for each vegetation state from desired conditions																				
Desired Conditions	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Initial Conditions	100	100	25	51	98	98	96	2	100	100	100	100	100	100	100	100	100	100	100	100
10 years	100	100	30	35	96	97	77	54	100	100	100	100	100	100	100	100	100	100	100	100
15-year planning period	100	100	28	29	95	96	78	56	100	100	100	100	100	100	100	100	100	100	100	100
20 years	100	100	29	24	95	95	77	55	100	100	100	100	100	100	100	100	100	100	100	100
30 years	100	100	32	16	94	94	77	57	100	100	100	100	100	100	100	100	100	100	100	100
40 years	100	100	28	22	92	92	78	57	100	100	100	100	100	100	100	100	100	100	100	100
50-year modeling period	100	100	30	14	93	91	76	59	100	100	100	100	100	100	100	100	100	100	100	100

Spruce-Fir Forest PNVT Alternative D Proposed High Acre Treatment Objectives

Appendix D table 38. Alternative D spruce-fir forest resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period, for the proposed high acre treatment objectives

Model Year Runs	Spruce-Fir Forest Overstory Vegetation Structural State																			Total
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	
Number of acres in each vegetation state																				
Desired Conditions	1,590	2,297	1,767	1,237	3,887	3,887	1,767	1,237	0	0	0	0	0	0	0	0	0	0	0	17,667
Initial Conditions	2,537	5,830	2,664	1,040	88	88	0	592	0	0	2,537	648	1,040	88	0	88	592	0	0	17,667
10 years	31	5,860	814	1,331	248	204	501	1,009	752	351	156	2,837	855	78	192	694	1,241	290	226	17,667
15-year planning period	31	5,489	835	1,577	256	296	514	963	1,059	568	85	2,245	932	90	219	455	1,324	470	257	17,667
20 years	39	5,320	809	1,769	347	374	522	951	1,279	681	84	1,665	834	113	242	354	1,314	601	368	17,667
30 years	49	4,791	744	1,822	439	521	513	1,005	1,820	928	70	1,137	625	176	310	224	1,191	774	528	17,667
40 years	37	4,422	646	1,834	574	574	555	1,001	2,201	1,218	56	793	463	209	325	210	957	994	600	17,667
50-year modeling period	38	4,250	672	1,683	661	663	536	1,006	2,545	1,381	49	573	319	228	313	124	864	1,097	665	17,667
Percent of total PNVT contributed by each vegetation state																				
Desired Conditions	9	13	10	7	22	22	10	7	0	0	0	0	0	0	0	0	0	0	0	100
Initial Conditions	14	33	15	6	1	1	0	3	0	0	14	4	6	1	0	1	3	0	0	100
10 years	0	33	5	8	1	1	3	6	4	2	1	16	5	0	1	4	7	2	1	100
15-year planning period	0	31	5	9	1	2	3	5	6	3	0	13	5	1	1	3	7	3	1	100
20 years	0	30	5	10	2	2	3	5	7	4	0	9	5	1	1	2	7	3	2	100
30 years	0	27	4	10	2	3	3	6	10	5	0	6	4	1	2	1	7	4	3	100
40 years	0	25	4	10	3	3	3	6	12	7	0	4	3	1	2	1	5	6	3	100
50-year modeling period	0	24	4	10	4	4	3	6	14	8	0	3	2	1	2	1	5	6	4	100
Percent departure for each vegetation state from desired conditions																				
Desired Conditions	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Initial Conditions	100	100	25	51	98	98	96	2	100	100	100	100	100	100	100	100	100	100	100	100
10 years	100	100	54	8	94	95	72	18	100	100	100	100	100	100	100	100	100	100	100	100
15-year planning period	100	100	53	27	93	92	71	22	100	100	100	100	100	100	100	100	100	100	100	100
20 years	100	100	54	43	91	90	70	23	100	100	100	100	100	100	100	100	100	100	100	100
30 years	100	100	58	47	89	87	71	19	100	100	100	100	100	100	100	100	100	100	100	100
40 years	100	100	63	48	85	85	69	19	100	100	100	100	100	100	100	100	100	100	100	100
50-year modeling period	100	100	62	36	83	83	70	19	100	100	100	100	100	100	100	100	100	100	100	100

Spruce-Fir Forest PNVT Alternative D Proposed Average Acre Treatment Objectives

Appendix D table 39. Alternative D spruce-fir forest resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period, for the proposed average acre treatment objectives

Model Year Runs	Spruce-Fir Forest Overstory Vegetation Structural State																			Total
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	
Number of acres in each vegetation state																				
Desired Conditions	1,590	2,297	1,767	1,237	3,887	3,887	1,767	1,237	0	0	0	0	0	0	0	0	0	0	0	17,667
Initial Conditions	2,537	5,830	2,664	1,040	88	88	0	592	0	0	2,537	648	1,040	88	0	88	592	0	0	17,667
10 years	29	6,133	993	1,055	196	176	451	823	548	288	112	3,424	869	75	158	682	1,164	288	210	17,667
15-year planning period	21	5,822	1,033	1,251	225	236	456	786	778	427	63	3,015	925	88	187	445	1,215	435	260	17,667
20 years	26	5,648	1,031	1,391	275	296	462	766	952	498	49	2,533	920	103	227	388	1,178	592	332	17,667
30 years	34	5,311	978	1,416	333	381	472	775	1,318	712	44	1,998	837	150	287	270	1,104	769	480	17,667
40 years	25	4,920	989	1,490	432	448	487	773	1,592	862	42	1,586	741	211	317	257	996	926	573	17,667
50-year modeling period	24	4,790	941	1,393	500	509	496	809	1,847	1,004	34	1,278	615	205	328	189	979	1,078	648	17,667
Percent of total PNVT contributed by each vegetation state																				
Desired Conditions	9	13	10	7	22	22	10	7	0	0	0	0	0	0	0	0	0	0	0	100
Initial Conditions	14	33	15	6	1	1	0	3	0	0	14	4	6	1	0	1	3	0	0	100
10 years	0	35	6	6	1	1	3	5	3	2	1	19	5	0	1	4	7	2	1	100
15-year planning period	0	33	6	7	1	1	3	4	4	2	0	17	5	0	1	3	7	2	1	100
20 years	0	32	6	8	2	2	3	4	5	3	0	14	5	1	1	2	7	3	2	100
30 years	0	30	6	8	2	2	3	4	7	4	0	11	5	1	2	2	6	4	3	100
40 years	0	28	6	8	2	3	3	4	9	5	0	9	4	1	2	1	6	5	3	100
50-year modeling period	0	27	5	8	3	3	3	5	10	6	0	7	3	1	2	1	6	6	4	100
Percent departure for each vegetation state from desired conditions																				
Desired Conditions	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Initial Conditions	100	100	25	51	98	98	96	2	100	100	100	100	100	100	100	100	100	100	100	100
10 years	100	100	44	15	95	95	74	33	100	100	100	100	100	100	100	100	100	100	100	100
15-year planning period	100	100	42	1	94	94	74	36	100	100	100	100	100	100	100	100	100	100	100	100
20 years	100	100	42	12	93	92	74	38	100	100	100	100	100	100	100	100	100	100	100	100
30 years	100	100	45	14	91	90	73	37	100	100	100	100	100	100	100	100	100	100	100	100
40 years	100	100	44	20	89	88	72	38	100	100	100	100	100	100	100	100	100	100	100	100
50-year modeling period	100	100	47	13	87	87	72	35	100	100	100	100	100	100	100	100	100	100	100	100

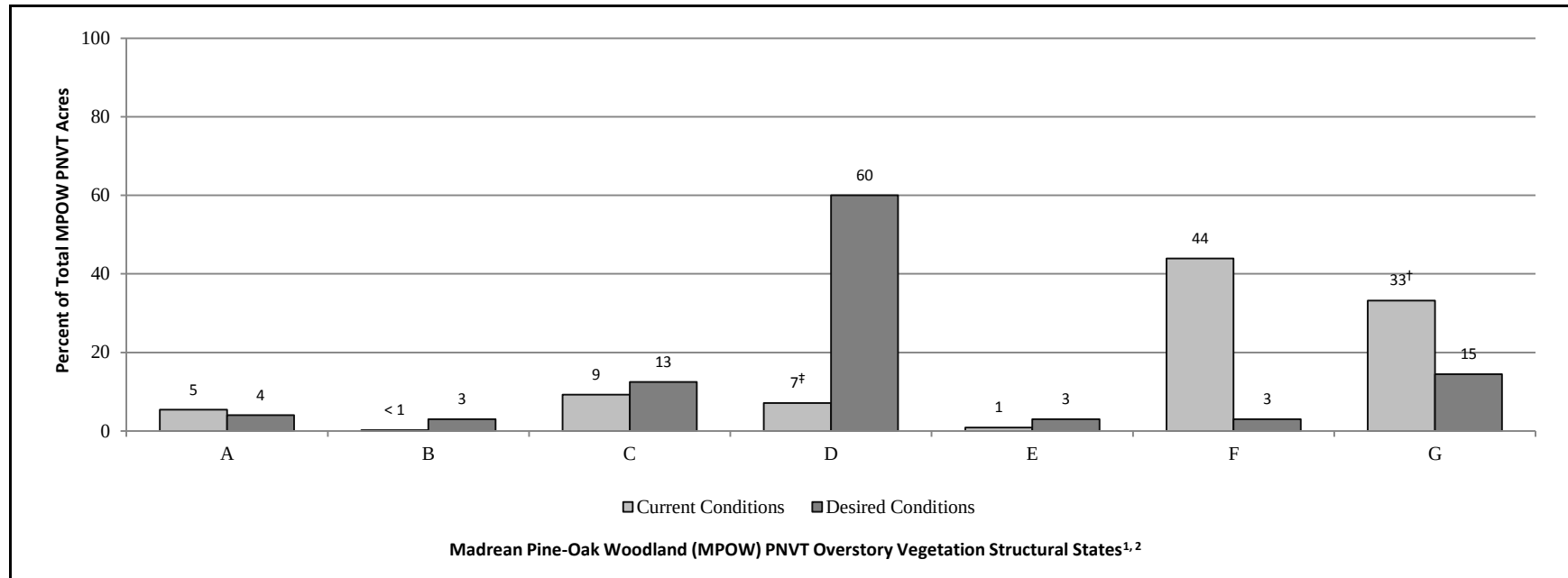
Spruce-Fir Forest PNVT Alternative D Proposed Low Acre Treatment Objectives

Appendix D table 40. Alternative D spruce-fir forest resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period, for the proposed low acre treatment objectives

Model Year Runs	Spruce-Fir Forest Overstory Vegetation Structural State																			Total
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	
Number of acres in each vegetation state																				
Desired Conditions	1,590	2,297	1,767	1,237	3,887	3,887	1,767	1,237	0	0	0	0	0	0	0	0	0	0	0	17,667
Initial Conditions	2,537	5,830	2,664	1,040	88	88	0	592	0	0	2,537	648	1,040	88	0	88	592	0	0	17,667
10 years	27	6,404	1,173	778	143	147	402	638	343	225	67	4,012	883	73	124	669	1,088	287	194	17,667
15-year planning period	10	6,155	1,232	925	194	175	398	608	498	285	40	3,784	919	85	154	436	1,106	400	262	17,667
20 years	14	5,975	1,254	1,012	204	218	402	581	624	315	13	3,401	1,006	94	213	421	1,042	583	295	17,667
30 years	18	5,831	1,211	1,010	227	241	430	544	817	495	18	2,858	1,048	123	265	316	1,017	764	432	17,667
40 years	14	5,417	1,332	1,146	290	322	419	545	982	505	28	2,380	1,020	214	309	304	1,035	859	545	17,667
50-year modeling period	9	5,331	1,210	1,103	339	356	455	613	1,149	626	20	1,983	912	183	342	254	1,095	1,059	632	17,667
Percent of total PNVT contributed by each vegetation state																				
Desired Conditions	9	13	10	7	22	22	10	7	0	0	0	0	0	0	0	0	0	0	0	100
Initial Conditions	14	33	15	6	1	1	0	3	0	0	14	4	6	1	0	1	3	0	0	100
10 years	0	36	7	4	1	1	2	4	2	1	0	23	5	0	1	4	6	2	1	100
15-year planning period	0	35	7	5	1	1	2	3	3	2	0	21	5	0	1	2	6	2	1	100
20 years	0	34	7	6	1	1	2	3	4	2	0	19	6	1	1	2	6	3	2	100
30 years	0	33	7	6	1	1	2	3	5	3	0	16	6	1	1	2	6	4	2	100
40 years	0	31	8	6	2	2	2	3	6	3	0	13	6	1	2	2	6	5	3	100
50-year modeling period	0	30	7	6	2	2	3	3	7	4	0	11	5	1	2	1	6	6	4	100
Percent departure for each vegetation state from desired conditions																				
Desired Conditions	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Initial Conditions	100	100	25	51	98	98	96	2	100	100	100	100	100	100	100	100	100	100	100	100
10 years	100	100	34	37	96	96	77	48	100	100	100	100	100	100	100	100	100	100	100	100
15-year planning period	100	100	30	25	95	95	77	51	100	100	100	100	100	100	100	100	100	100	100	100
20 years	100	100	29	18	95	94	77	53	100	100	100	100	100	100	100	100	100	100	100	100
30 years	100	100	31	18	94	94	76	56	100	100	100	100	100	100	100	100	100	100	100	100
40 years	100	100	25	7	93	92	76	56	100	100	100	100	100	100	100	100	100	100	100	100
50-year modeling period	100	100	32	11	91	91	74	50	100	100	100	100	100	100	100	100	100	100	100	100

Woodland PNVTs

Madrean Pine-Oak Woodland PNVT



Appendix D figure 19. Madrean pine-oak woodland (MPOW) PNVT current and desired overstory vegetation structural states

¹ Madrean Pine-Oak Woodland (MPOW) PNVT Overstory Vegetation Structural States. At 394,928 acres or approximately 20% of the forests this PNVT ranks 2nd in order of size out of the 14 PNVTs on the A-SNFs

STRUCTURAL STATES PART OF THE HISTORIC LANDSCAPE CONDITIONS OR WITHIN HISTORIC RANGE OF VARIABILITY

State A - Recently burned, grass, forb and shrub types with < 10% tree canopy cover; early successional development

State B - Seedling and sapling size (< 5" diameter) trees with open (≥ 10% & ≤ 30%) canopy cover; all tree types; early successional development

State C - Small size (5"-9.9" diameter) trees, with open canopy cover; all tree types; mid successional development

State D - Medium (10"-19.9" diameter) and large to very large size (≥ 20" diameter) trees; multi-storied, with open canopy cover; all tree types; late successional development

[‡]Current state makeup: 5% (20,461 ac) medium size trees; and 2% (7,579 ac) large to very large size trees

State E - Seedling and sapling size trees with closed (> 30%) canopy cover; all tree types; early successional development

State F - Small size trees, with closed canopy cover; all tree types; mid successional development

State G - Medium and large to very large size trees; multi-storied, with closed canopy cover; all tree types; late successional development

[†]Current state makeup: 23% (89,110 ac) medium size trees; and 10% (41,863 ac) large to very large size trees

² MPOW PNVT has a 61% or high departure rating from Desired Conditions (DC) and a 72% or high departure rating from Historical Range of Variability (HRV) making it the 4th most departed PNVT on the A-SNFs for both DC and HRV. Desired Conditions were provided by the Regional Office, and HRV was derived from the Nature Conservancy (Schussman and Gori, 2006)

Madrean Pine-Oak Woodland PNVT Alternative A

Appendix D table 41. Alternative A Madrean pine-oak woodland resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period

Model Year Runs	Madrean Pine-Oak Woodland Overstory Vegetation Structural State							Total
	A	B	C	D	E	F	G	
Number of acres in each vegetation state								
Desired Conditions	15,797	11,848	51,341	236,957	11,848	11,848	59,239	394,928
Initial Conditions	21,376	957	36,392	28,040	3,591	173,599	130,972	394,928
10 years	22,629	4,423	21,168	44,587	3,673	139,765	158,683	394,928
15-year planning period	22,748	4,700	17,416	48,576	4,028	122,151	175,309	394,928
20 years	23,182	5,805	14,968	52,091	4,739	109,079	185,064	394,928
30 years	24,683	6,832	11,453	56,949	4,818	91,860	198,333	394,928
40 years	25,710	6,477	9,439	60,819	6,240	75,036	211,207	394,928
50-year modeling period	26,658	7,188	8,254	66,387	4,779	66,585	215,077	394,928
Percent of total PNVT contributed by each vegetation state								
Desired Conditions	4	3	13	60	3	3	15	100
Initial Conditions	5	0	9	7	1	44	33	100
10 years	6	1	5	11	1	35	40	100
15-year planning period	6	1	4	12	1	31	44	100
20 years	6	1	4	13	1	28	47	100
30 years	6	2	3	14	1	23	50	100
40 years	7	2	2	15	2	19	53	100
50-year modeling period	7	2	2	17	1	17	54	100
Percent departure for each vegetation state from desired conditions								
Desired Conditions	0	0	0	0	0	0	0	
Initial Conditions	100	92	29	88	70	100	100	
10 years	100	63	59	81	69	100	100	
15-year planning period	100	60	66	80	66	100	100	
20 years	100	51	71	78	60	100	100	
30 years	100	42	78	76	59	100	100	
40 years	100	45	82	74	47	100	100	
50-year modeling period	100	39	84	72	60	100	100	

Madrean Pine-Oak Woodland PNVT Alternative B Proposed High Acre Treatment Objectives

Appendix D table 42. Alternative B Madrean pine-oak woodland resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period, for the proposed high acre treatment objectives

Model Year Runs	Madrean Pine-Oak Woodland Overstory Vegetation Structural State							Total
	A	B	C	D	E	F	G	
Number of acres in each vegetation state								
Desired Conditions	15,797	11,848	51,341	236,957	11,848	11,848	59,239	394,928
Initial Conditions	21,376	957	36,392	28,040	3,591	173,599	130,972	394,928
10 years	15,679	4,779	40,204	79,538	3,357	108,684	142,687	394,928
15-year planning period	19,588	6,003	38,268	98,732	4,147	91,623	136,566	394,928
20 years	23,143	7,780	35,070	113,937	3,989	79,973	131,037	394,928
30 years	28,553	10,268	29,106	137,593	5,766	55,566	128,075	394,928
40 years	33,411	11,927	23,261	148,177	6,595	49,445	122,112	394,928
50-year modeling period	36,254	14,928	21,682	152,126	7,188	42,139	120,611	394,928
Percent of total PNVT contributed by each vegetation state								
Desired Conditions	4	3	13	60	3	3	15	100
Initial Conditions	5	0	9	7	1	44	33	100
10 years	4	1	10	20	1	28	36	100
15-year planning period	5	2	10	25	1	23	35	100
20 years	6	2	9	29	1	20	33	100
30 years	7	3	7	35	1	14	32	100
40 years	8	3	6	38	2	13	31	100
50-year modeling period	9	4	5	39	2	11	31	100
Percent departure for each vegetation state from desired conditions								
Desired Conditions	0	0	0	0	0	0	0	
Initial Conditions	100	92	29	88	70	100	100	
10 years	100	60	22	66	72	100	100	
15-year planning period	100	49	25	58	65	100	100	
20 years	100	34	32	52	66	100	100	
30 years	100	13	43	42	51	100	100	
40 years	100	1	55	37	44	100	100	
50-year modeling period	100	26	58	36	39	100	100	

Madrean Pine-Oak Woodland PNVT Alternative B Proposed Average Acre Treatment Objectives

Appendix D table 43. Alternative B Madrean pine-oak woodland resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period, for the proposed average acre treatment objectives

Model Year Runs	Madrean Pine-Oak Woodland Overstory Vegetation Structural State							Total
	A	B	C	D	E	F	G	
Number of acres in each vegetation state								
Desired Conditions	15,797	11,848	51,341	236,957	11,848	11,848	59,239	394,928
Initial Conditions	21,376	957	36,392	28,040	3,591	173,599	130,972	394,928
10 years	13,921	4,147	33,075	66,605	3,772	118,715	154,693	394,928
15-year planning period	17,811	5,450	31,614	79,795	4,048	101,220	154,989	394,928
20 years	20,753	6,556	27,823	93,144	3,989	90,004	152,659	394,928
30 years	25,493	8,767	23,893	111,863	5,233	66,585	153,094	394,928
40 years	29,620	9,972	19,154	121,855	6,240	56,336	151,751	394,928
50-year modeling period	31,515	11,729	17,831	126,061	6,694	48,971	152,126	394,928
Percent of total PNVT contributed by each vegetation state								
Desired Conditions	4	3	13	60	3	3	15	100
Initial Conditions	5	0	9	7	1	44	33	100
10 years	4	1	8	17	1	30	39	100
15-year planning period	5	1	8	20	1	26	39	100
20 years	5	2	7	24	1	23	39	100
30 years	6	2	6	28	1	17	39	100
40 years	8	3	5	31	2	14	38	100
50-year modeling period	8	3	5	32	2	12	39	100
Percent departure for each vegetation state from desired conditions								
Desired Conditions	0	0	0	0	0	0	0	
Initial Conditions	100	92	29	88	70	100	100	
10 years	100	65	36	72	68	100	100	
15-year planning period	100	54	38	66	66	100	100	
20 years	100	45	46	61	66	100	100	
30 years	100	26	53	53	56	100	100	
40 years	100	16	63	49	47	100	100	
50-year modeling period	100	1	65	47	44	100	100	

Madrean Pine-Oak Woodland PNVT Alternative B Proposed Low Acre Treatment Objectives

Appendix D table 44. Alternative B Madrean pine-oak woodland resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period, for the proposed low acre treatment objectives

Model Year Runs	Madrean Pine-Oak Woodland Overstory Vegetation Structural State							Total
	A	B	C	D	E	F	G	
Number of acres in each vegetation state								
Desired Conditions	15,797	11,848	51,341	236,957	11,848	11,848	59,239	394,928
Initial Conditions	21,376	957	36,392	28,040	3,591	173,599	130,972	394,928
10 years	12,164	3,515	25,947	53,671	4,186	128,746	166,699	394,928
15-year planning period	16,034	4,897	24,959	60,858	3,949	110,817	173,413	394,928
20 years	18,364	5,332	20,576	72,351	3,989	100,035	174,282	394,928
30 years	22,432	7,267	18,680	86,134	4,700	77,603	178,112	394,928
40 years	25,828	8,017	15,047	95,533	5,884	63,228	181,390	394,928
50-year modeling period	26,776	8,530	13,980	99,996	6,200	55,803	183,641	394,928
Percent of total PNVT contributed by each vegetation state								
Desired Conditions	4	3	13	60	3	3	15	100
Initial Conditions	5	0	9	7	1	44	33	100
10 years	3	1	7	14	1	33	42	100
15-year planning period	4	1	6	15	1	28	44	100
20 years	5	1	5	18	1	25	44	100
30 years	6	2	5	22	1	20	45	100
40 years	7	2	4	24	1	16	46	100
50-year modeling period	7	2	4	25	2	14	46	100
Percent departure for each vegetation state from desired conditions								
Desired Conditions	0	0	0	0	0	0	0	
Initial Conditions	100	92	29	88	70	100	100	
10 years	100	70	49	77	65	100	100	
15-year planning period	100	59	51	74	67	100	100	
20 years	100	55	60	69	66	100	100	
30 years	100	39	64	64	60	100	100	
40 years	100	32	71	60	50	100	100	
50-year modeling period	100	28	73	58	48	100	100	

Madrean Pine-Oak Woodland PNVT Alternative C Proposed High Acre Treatment Objectives

Appendix D table 45. Alternative C Madrean pine-oak woodland resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period, for the proposed high acre treatment objectives

Model Year Runs	Madrean Pine-Oak Woodland Overstory Vegetation Structural State							Total
	A	B	C	D	E	F	G	
Number of acres in each vegetation state								
Desired Conditions	15,797	11,848	51,341	236,957	11,848	11,848	59,239	394,928
Initial Conditions	21,376	957	36,392	28,040	3,591	173,599	130,972	394,928
10 years	26,421	4,028	30,291	59,002	3,317	123,810	148,058	394,928
15-year planning period	33,529	5,213	27,092	72,509	3,831	108,487	144,267	394,928
20 years	40,441	7,701	24,012	83,369	3,989	96,323	139,094	394,928
30 years	50,472	10,229	20,931	98,416	5,253	71,640	137,988	394,928
40 years	57,422	12,598	18,246	104,103	6,200	61,925	134,433	394,928
50-year modeling period	59,871	12,677	16,705	115,042	8,017	55,290	127,325	394,928
Percent of total PNVT contributed by each vegetation state								
Desired Conditions	4	3	13	60	3	3	15	100
Initial Conditions	5	0	9	7	1	44	33	100
10 years	7	1	8	15	1	31	37	100
15-year planning period	8	1	7	18	1	27	37	100
20 years	10	2	6	21	1	24	35	100
30 years	13	3	5	25	1	18	35	100
40 years	15	3	5	26	2	16	34	100
50-year modeling period	15	3	4	29	2	14	32	100
Percent departure for each vegetation state from desired conditions								
Desired Conditions	0	0	0	0	0	0	0	
Initial Conditions	100	92	29	88	70	100	100	
10 years	100	66	41	75	72	100	100	
15-year planning period	100	56	47	69	68	100	100	
20 years	100	35	53	65	66	100	100	
30 years	100	14	59	58	56	100	100	
40 years	100	6	64	56	48	100	100	
50-year modeling period	100	7	67	51	32	100	100	

Madrean Pine-Oak Woodland PNVT Alternative C Proposed Average Acre Treatment Objectives

Appendix D table 46. Alternative C Madrean pine-oak woodland resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period, for the proposed average acre treatment objectives

Model Year Runs	Madrean Pine-Oak Woodland Overstory Vegetation Structural State							Total
	A	B	C	D	E	F	G	
Number of acres in each vegetation state								
Desired Conditions	15,797	11,848	51,341	236,957	11,848	11,848	59,239	394,928
Initial Conditions	21,376	957	36,392	28,040	3,591	173,599	130,972	394,928
10 years	19,312	4,009	25,295	52,091	3,633	129,556	161,032	394,928
15-year planning period	24,288	4,700	22,669	61,846	3,949	114,687	162,789	394,928
20 years	28,632	6,042	19,983	70,001	4,009	101,358	164,902	394,928
30 years	35,603	8,096	16,468	81,632	4,700	80,111	168,318	394,928
40 years	40,144	9,636	14,810	87,476	5,272	66,585	171,004	394,928
50-year modeling period	42,257	9,834	13,210	95,493	7,030	59,042	168,061	394,928
Percent of total PNVT contributed by each vegetation state								
Desired Conditions	4	3	13	60	3	3	15	100
Initial Conditions	5	0	9	7	1	44	33	100
10 years	5	1	6	13	1	33	41	100
15-year planning period	6	1	6	16	1	29	41	100
20 years	7	2	5	18	1	26	42	100
30 years	9	2	4	21	1	20	43	100
40 years	10	2	4	22	1	17	43	100
50-year modeling period	11	2	3	24	2	15	43	100
Percent departure for each vegetation state from desired conditions								
Desired Conditions	0	0	0	0	0	0	0	
Initial Conditions	100	92	29	88	70	100	100	
10 years	100	66	51	78	69	100	100	
15-year planning period	100	60	56	74	67	100	100	
20 years	100	49	61	70	66	100	100	
30 years	100	32	68	66	60	100	100	
40 years	100	19	71	63	56	100	100	
50-year modeling period	100	17	74	60	41	100	100	

Madrean Pine-Oak Woodland PNVT Alternative C Proposed Low Acre Treatment Objectives

Appendix D table 47. Alternative C Madrean pine-oak woodland resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period, for the proposed low acre treatment objectives

Model Year Runs	Madrean Pine-Oak Woodland Overstory Vegetation Structural State							Total
	A	B	C	D	E	F	G	
Number of acres in each vegetation state								
Desired Conditions	15,797	11,848	51,341	236,957	11,848	11,848	59,239	394,928
Initial Conditions	21,376	957	36,392	28,040	3,591	173,599	130,972	394,928
10 years	12,203	3,989	20,299	45,180	3,949	135,302	174,005	394,928
15-year planning period	15,047	4,186	18,246	51,183	4,068	120,887	181,311	394,928
20 years	16,824	4,384	15,955	56,633	4,028	106,393	190,711	394,928
30 years	20,734	5,963	12,006	64,847	4,147	88,582	198,649	394,928
40 years	22,866	6,674	11,374	70,850	4,344	71,245	207,574	394,928
50-year modeling period	24,643	6,990	9,715	75,945	6,042	62,793	208,798	394,928
Percent of total PNVT contributed by each vegetation state								
Desired Conditions	4	3	13	60	3	3	15	100
Initial Conditions	5	0	9	7	1	44	33	100
10 years	3	1	5	11	1	34	44	100
15-year planning period	4	1	5	13	1	31	46	100
20 years	4	1	4	14	1	27	48	100
30 years	5	2	3	16	1	22	50	100
40 years	6	2	3	18	1	18	53	100
50-year modeling period	6	2	2	19	2	16	53	100
Percent departure for each vegetation state from desired conditions								
Desired Conditions	0	0	0	0	0	0	0	
Initial Conditions	100	92	29	88	70	100	100	
10 years	100	66	60	81	67	100	100	
15-year planning period	100	65	64	78	66	100	100	
20 years	100	63	69	76	66	100	100	
30 years	100	50	77	73	65	100	100	
40 years	100	44	78	70	63	100	100	
50-year modeling period	100	41	81	68	49	100	100	

Madrean Pine-Oak Woodland PNVT Alternative D Proposed High Acre Treatment Objectives

Appendix D table 48. Alternative D Madrean pine-oak woodland resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period, for the proposed high acre treatment objectives

Model Year Runs	Madrean Pine-Oak Woodland Overstory Vegetation Structural State							Total
	A	B	C	D	E	F	G	
Number of acres in each vegetation state								
Desired Conditions	15,797	11,848	51,341	236,957	11,848	11,848	59,239	394,928
Initial Conditions	21,376	957	36,392	28,040	3,591	173,599	130,972	394,928
10 years	17,495	6,714	60,503	108,684	3,475	84,199	113,858	394,928
15-year planning period	22,590	8,609	55,132	134,947	3,791	66,150	103,708	394,928
20 years	27,250	10,347	46,009	154,614	4,423	55,566	96,678	394,928
30 years	35,149	13,112	37,795	175,664	4,897	42,534	85,778	394,928
40 years	42,060	17,258	30,449	183,878	6,911	34,438	79,933	394,928
50-year modeling period	44,153	19,154	28,079	189,012	6,556	30,409	77,564	394,928
Percent of total PNVT contributed by each vegetation state								
Desired Conditions	4	3	13	60	3	3	15	100
Initial Conditions	5	0	9	7	1	44	33	100
10 years	4	2	15	28	1	21	29	100
15-year planning period	6	2	14	34	1	17	26	100
20 years	7	3	12	39	1	14	24	100
30 years	9	3	10	44	1	11	22	100
40 years	11	4	8	47	2	9	20	100
50-year modeling period	11	5	7	48	2	8	20	100
Percent departure for each vegetation state from desired conditions								
Desired Conditions	0	0	0	0	0	0	0	
Initial Conditions	100	92	29	88	70	100	100	
10 years	100	43	18	54	71	100	92	
15-year planning period	100	27	7	43	68	100	75	
20 years	100	13	10	35	63	100	63	
30 years	100	11	26	26	59	100	45	
40 years	100	46	41	22	42	100	35	
50-year modeling period	100	62	45	20	45	100	31	

Madrean Pine-Oak Woodland PNVT Alternative D Proposed Average Acre Treatment Objectives

Appendix D table 49. Alternative D Madrean pine-oak woodland resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period, for the proposed average acre treatment objectives

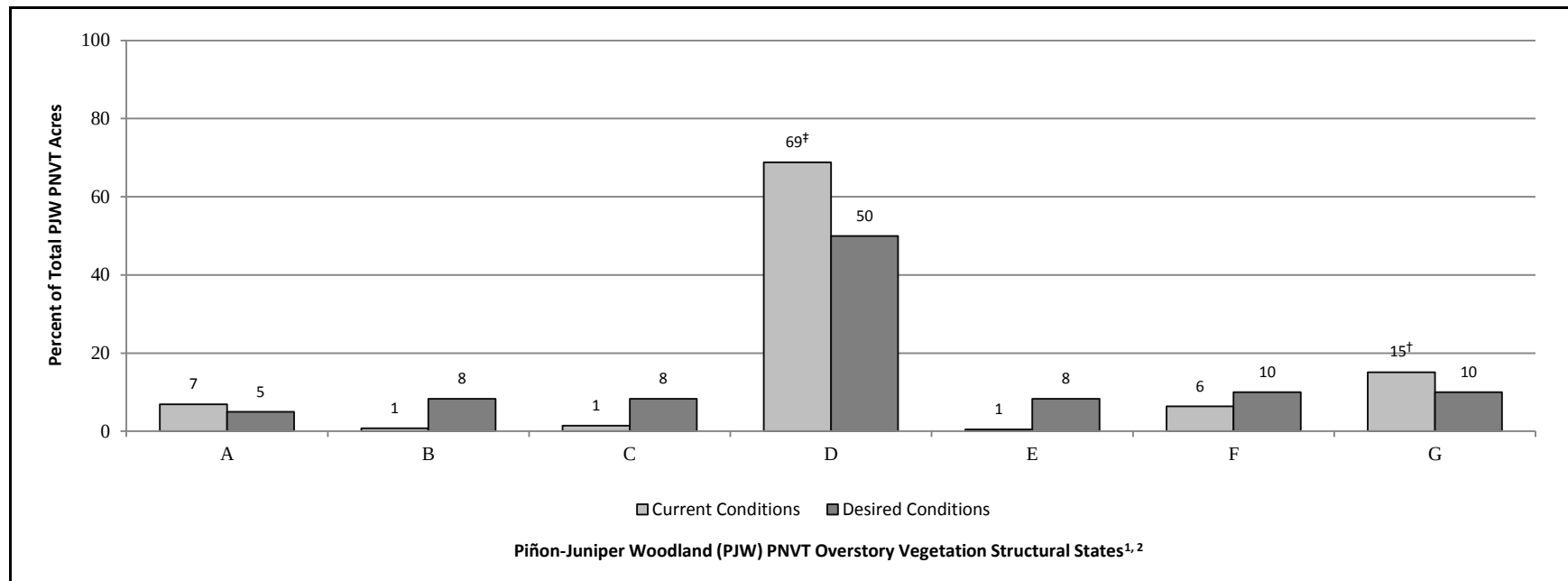
Model Year Runs	Madrean Pine-Oak Woodland Overstory Vegetation Structural State							Total
	A	B	C	D	E	F	G	
Number of acres in each vegetation state								
Desired Conditions	15,797	11,848	51,341	236,957	11,848	11,848	59,239	394,928
Initial Conditions	21,376	957	36,392	28,040	3,591	173,599	130,972	394,928
10 years	14,770	5,253	43,837	80,723	3,633	105,959	140,752	394,928
15-year planning period	19,036	6,437	38,723	100,272	3,594	88,878	137,988	394,928
20 years	23,202	7,800	33,984	113,976	4,226	76,241	135,480	394,928
30 years	29,106	9,893	27,842	131,975	4,364	57,896	133,871	394,928
40 years	33,450	12,322	23,715	139,844	6,121	49,011	130,464	394,928
50-year modeling period	35,761	14,217	20,319	146,005	6,200	42,830	129,595	394,928
Percent of total PNVT contributed by each vegetation state								
Desired Conditions	4	3	13	60	3	3	15	100
Initial Conditions	5	0	9	7	1	44	33	100
10 years	4	1	11	20	1	27	36	100
15-year planning period	5	2	10	25	1	23	35	100
20 years	6	2	9	29	1	19	34	100
30 years	7	3	7	33	1	15	34	100
40 years	8	3	6	35	2	12	33	100
50-year modeling period	9	4	5	37	2	11	33	100
Percent departure for each vegetation state from desired conditions								
Desired Conditions	0	0	0	0	0	0	0	
Initial Conditions	100	92	29	88	70	100	100	
10 years	100	56	15	66	69	100	100	
15-year planning period	100	46	25	58	70	100	100	
20 years	100	34	34	52	64	100	100	
30 years	100	16	46	44	63	100	100	
40 years	100	4	54	41	48	100	100	
50-year modeling period	100	20	60	38	48	100	100	

Madrean Pine-Oak Woodland PNVT Alternative D Proposed Low Acre Treatment Objectives

Appendix D table 50. Alternative D Madrean pine-oak woodland resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period, for the proposed low acre treatment objectives

Model Year Runs	Madrean Pine-Oak Woodland Overstory Vegetation Structural State							Total
	A	B	C	D	E	F	G	
Number of acres in each vegetation state								
Desired Conditions	15,797	11,848	51,341	236,957	11,848	11,848	59,239	394,928
Initial Conditions	21,376	957	36,392	28,040	3,591	173,599	130,972	394,928
10 years	12,045	3,791	27,171	52,762	3,791	127,720	167,647	394,928
15-year planning period	15,481	4,265	22,313	65,597	3,396	111,607	172,267	394,928
20 years	19,154	5,253	21,958	73,338	4,028	96,915	174,282	394,928
30 years	23,064	6,674	17,890	88,266	3,831	73,259	181,943	394,928
40 years	24,841	7,385	16,982	95,809	5,332	63,583	180,995	394,928
50-year modeling period	27,368	9,281	12,559	102,997	5,845	55,250	181,627	394,928
Percent of total PNVT contributed by each vegetation state								
Desired Conditions	4	3	13	60	3	3	15	100
Initial Conditions	5	0	9	7	1	44	33	100
10 years	3	1	7	13	1	32	42	100
15-year planning period	4	1	6	17	1	28	44	100
20 years	5	1	6	19	1	25	44	100
30 years	6	2	5	22	1	19	46	100
40 years	6	2	4	24	1	16	46	100
50-year modeling period	7	2	3	26	1	14	46	100
Percent departure for each vegetation state from desired conditions								
Desired Conditions	0	0	0	0	0	0	0	
Initial Conditions	100	92	29	88	70	100	100	
10 years	100	68	47	78	68	100	100	
15-year planning period	100	64	57	72	71	100	100	
20 years	100	56	57	69	66	100	100	
30 years	100	44	65	63	68	100	100	
40 years	100	38	67	60	55	100	100	
50-year modeling period	100	22	76	57	51	100	100	

Piñon-Juniper Woodland PNVT



Appendix D figure 20. Piñon-juniper woodland (PJW) PNVT current and desired overstory vegetation structural states

¹ Piñon-Juniper Woodland (PJW) PNVT Overstory Vegetation Structural States. At 222,166 acres or approximately 11% of the forests this PNVT ranks 3rd in order of size out of the 14 PNVTs on the A-SNFs

STRUCTURAL STATES PART OF THE HISTORIC LANDSCAPE CONDITIONS OR WITHIN HISTORIC RANGE OF VARIABILITY

State A - Recently burned, grass, forb and shrub types with < 10% tree canopy cover; early successional development

State B - Seedling and sapling size (< 5" diameter) trees with open (≥ 10% & ≤ 30%) canopy cover; all tree types; early successional development

State C - Small size (5"-9.9" diameter) trees, with open canopy cover; all tree types; mid successional development

State D - Medium (10"-19.9" diameter) and large to very large size (≥ 20" diameter) trees; multi-storied, with open canopy cover; all tree types; late successional development

[‡]Current state makeup: 44% (97,416 ac) medium size trees; and 25% (54,547 ac) large to very large size trees

State E - Seedling and sapling size trees with closed (> 30%) canopy cover; all tree types; early successional development

State F - Small size trees, with closed canopy cover; all tree types; mid successional development

State G - Medium and large to very large size trees; multi-storied, with closed canopy cover; all tree types; late successional development

[†]Current state makeup: 8% (17,580 ac) medium size trees; and 7% (16,013 ac) large to very large size trees

² PJW PNVT has a 26% or low departure rating from Desired Conditions (DC) and Historical Range of Variability (HRV) making it the 9th and 11th most departed PNVT on the A-SNFs for DC and HRV, respectively. Desired Conditions were provided by the Regional Office, and HRV was derived from LANDFIRE (2005)

Piñon-Juniper Woodland PNVT Alternative A

Appendix D table 51. Alternative A piñon-juniper woodland resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period

Model Year Runs	Piñon-Juniper Woodland Overstory Vegetation Structural State							Total
	A	B	C	D	E	F	G	
Number of acres in each vegetation state								
Desired Conditions	11,108	17,773	17,773	111,080	17,773	22,216	22,216	222,159
Initial Conditions	15,378	1,756	3,228	152,867	1,138	14,198	33,594	222,159
10 years	14,192	7,923	4,100	120,116	5,512	15,466	54,849	222,159
15-year planning period	13,721	8,883	3,928	106,592	7,029	17,210	64,796	222,159
20 years	13,724	9,606	4,811	95,046	8,202	18,767	72,003	222,159
30 years	12,932	9,101	4,360	78,013	9,716	21,749	86,288	222,159
40 years	12,477	8,695	4,003	64,265	9,153	26,763	96,803	222,159
50-year modeling period	12,570	7,859	4,382	55,361	8,019	27,252	106,716	222,159
Percent of total PNVT contributed by each vegetation state								
Desired Conditions	5	8	8	50	8	10	10	100
Initial Conditions	7	1	1	69	1	6	15	100
10 years	6	4	2	54	2	7	25	100
15-year planning period	6	4	2	48	3	8	29	100
20 years	6	4	2	43	4	8	32	100
30 years	6	4	2	35	4	10	39	100
40 years	6	4	2	29	4	12	44	100
50-year modeling period	6	4	2	25	4	12	48	100
Percent departure for each vegetation state from desired conditions								
Desired Conditions	0	0	0	0	0	0	0	
Initial Conditions	100	90	82	38	94	36	51	
10 years	100	55	77	8	69	30	100	
15-year planning period	100	50	78	4	60	23	100	
20 years	100	46	73	14	54	16	100	
30 years	100	49	75	30	45	2	100	
40 years	100	51	77	42	48	20	100	
50-year modeling period	100	56	75	50	55	23	100	

Piñon-Juniper Woodland PNVT Alternative B Proposed High Acre Treatment Objectives

Appendix D table 52. Alternative B piñon-juniper woodland resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period, for the proposed high acre treatment objectives

Model Year Runs	Piñon-Juniper Woodland Overstory Vegetation Structural State							Total
	A	B	C	D	E	F	G	
Number of acres in each vegetation state								
Desired Conditions	11,108	17,773	17,773	111,080	17,773	22,216	22,216	222,159
Initial Conditions	15,378	1,756	3,228	152,867	1,138	14,198	33,594	222,159
10 years	12,514	7,914	7,665	131,844	5,581	12,533	44,107	222,159
15-year planning period	11,492	10,040	8,580	124,605	8,120	12,851	46,470	222,159
20 years	10,938	10,697	9,363	117,757	9,273	15,475	48,657	222,159
30 years	9,548	11,087	10,864	110,271	11,252	18,393	50,743	222,159
40 years	7,866	10,737	12,057	106,457	10,437	20,673	53,931	222,159
50-year modeling period	7,513	11,368	12,374	102,878	11,622	21,305	55,099	222,159
Percent of total PNVT contributed by each vegetation state								
Desired Conditions	5	8	8	50	8	10	10	100
Initial Conditions	7	1	1	69	1	6	15	100
10 years	6	4	3	59	3	6	20	100
15-year planning period	5	5	4	56	4	6	21	100
20 years	5	5	4	53	4	7	22	100
30 years	4	5	5	50	5	8	23	100
40 years	4	5	5	48	5	9	24	100
50-year modeling period	3	5	6	46	5	10	25	100
Percent departure for each vegetation state from desired conditions								
Desired Conditions	0	0	0	0	0	0	0	
Initial Conditions	100	90	82	38	94	36	51	
10 years	100	55	57	19	69	44	99	
15-year planning period	100	44	52	12	54	42	100	
20 years	100	40	47	6	48	30	100	
30 years	100	38	39	1	37	17	100	
40 years	100	40	32	4	41	7	100	
50-year modeling period	100	36	30	7	35	4	100	

Piñon-Juniper Woodland PNVT Alternative B Proposed Average Acre Treatment Objectives

Appendix D table 53. Alternative B piñon-juniper woodland resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period, for the proposed average acre treatment objectives

Model Year Runs	Piñon-Juniper Woodland Overstory Vegetation Structural State							Total
	A	B	C	D	E	F	G	
Number of acres in each vegetation state								
Desired Conditions	11,108	17,773	17,773	111,080	17,773	22,216	22,216	222,159
Initial Conditions	15,378	1,756	3,228	152,867	1,138	14,198	33,594	222,159
10 years	12,251	8,257	6,396	127,946	5,595	13,359	48,355	222,159
15-year planning period	11,287	9,746	7,035	119,789	7,819	14,172	52,311	222,159
20 years	10,164	10,235	7,809	111,691	8,920	17,005	56,336	222,159
30 years	8,899	10,361	8,709	100,787	11,002	20,049	62,350	222,159
40 years	7,580	9,702	9,790	95,222	10,504	22,300	67,061	222,159
50-year modeling period	7,317	9,972	9,996	90,100	10,940	24,162	69,672	222,159
Percent of total PNVT contributed by each vegetation state								
Desired Conditions	5	8	8	50	8	10	10	100
Initial Conditions	7	1	1	69	1	6	15	100
10 years	6	4	3	58	3	6	22	100
15-year planning period	5	4	3	54	4	6	24	100
20 years	5	5	4	50	4	8	25	100
30 years	4	5	4	45	5	9	28	100
40 years	3	4	4	43	5	10	30	100
50-year modeling period	3	4	4	41	5	11	31	100
Percent departure for each vegetation state from desired conditions								
Desired Conditions	0	0	0	0	0	0	0	
Initial Conditions	100	90	82	38	94	36	51	
10 years	100	54	64	15	69	40	100	
15-year planning period	100	45	60	8	56	36	100	
20 years	100	42	56	1	50	23	100	
30 years	100	42	51	9	38	10	100	
40 years	100	45	45	14	41	0	100	
50-year modeling period	100	44	44	19	38	9	100	

Piñon-Juniper Woodland PNVT Alternative B Proposed Low Acre Treatment Objectives

Appendix D table 54. Alternative B piñon-juniper woodland resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period, for the proposed low acre treatment objectives

Model Year Runs	Piñon-Juniper Woodland Overstory Vegetation Structural State							Total
	A	B	C	D	E	F	G	
Number of acres in each vegetation state								
Desired Conditions	11,108	17,773	17,773	111,080	17,773	22,216	22,216	222,159
Initial Conditions	15,378	1,756	3,228	152,867	1,138	14,198	33,594	222,159
10 years	11,987	8,600	5,126	124,049	5,608	14,185	52,603	222,159
15-year planning period	11,082	9,452	5,489	114,973	7,518	15,492	58,152	222,159
20 years	9,390	9,773	6,254	105,625	8,568	18,534	64,015	222,159
30 years	8,250	9,636	6,553	91,303	10,753	21,705	73,958	222,159
40 years	7,293	8,667	7,522	83,988	10,571	23,927	80,191	222,159
50-year modeling period	7,121	8,576	7,617	77,321	10,258	27,020	84,246	222,159
Percent of total PNVT contributed by each vegetation state								
Desired Conditions	5	8	8	50	8	10	10	100
Initial Conditions	7	1	1	69	1	6	15	100
10 years	5	4	2	56	3	6	24	100
15-year planning period	5	4	2	52	3	7	26	100
20 years	4	4	3	48	4	8	29	100
30 years	4	4	3	41	5	10	33	100
40 years	3	4	3	38	5	11	36	100
50-year modeling period	3	4	3	35	5	12	38	100
Percent departure for each vegetation state from desired conditions								
Desired Conditions	0	0	0	0	0	0	0	
Initial Conditions	100	90	82	38	94	36	51	
10 years	100	90	82	38	94	36	51	
15-year planning period	100	52	71	12	68	36	100	
20 years	100	47	69	4	58	30	100	
30 years	100	45	65	5	52	17	100	
40 years	100	46	63	18	39	2	100	
50-year modeling period	100	51	58	24	41	8	100	

Piñon-Juniper Woodland PNVT Alternative C Proposed High Acre Treatment Objectives

Appendix D table 55. Alternative C piñon-juniper woodland resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period, for the proposed high acre treatment objectives

Model Year Runs	Piñon-Juniper Woodland Overstory Vegetation Structural State							Total
	A	B	C	D	E	F	G	
Number of acres in each vegetation state								
Desired Conditions	11,108	17,773	17,773	111,080	17,773	22,216	22,216	222,159
Initial Conditions	15,378	1,756	3,228	152,867	1,138	14,198	33,594	222,159
10 years	15,803	8,947	8,059	124,899	5,723	13,003	45,724	222,159
15-year planning period	15,241	10,137	8,445	116,311	6,826	14,582	50,616	222,159
20 years	15,034	11,078	10,470	106,726	8,669	16,047	54,134	222,159
30 years	14,864	11,224	11,350	94,815	9,801	21,093	59,011	222,159
40 years	14,474	11,104	10,690	85,467	10,815	24,179	65,429	222,159
50-year modeling period	12,846	9,709	10,518	82,183	10,094	27,017	69,792	222,159
Percent of total PNVT contributed by each vegetation state								
Desired Conditions	5	8	8	50	8	10	10	100
Initial Conditions	7	1	1	69	1	6	15	100
10 years	7	4	4	56	3	6	21	100
15-year planning period	7	5	4	52	3	7	23	100
20 years	7	5	5	48	4	7	24	100
30 years	7	5	5	43	4	9	27	100
40 years	7	5	5	38	5	11	29	100
50-year modeling period	6	4	5	37	5	12	31	100
Percent departure for each vegetation state from desired conditions								
Desired Conditions	0	0	0	0	0	0	0	
Initial Conditions	100	90	82	38	94	36	51	
10 years	100	50	55	12	68	41	100	
15-year planning period	100	43	52	5	62	34	100	
20 years	100	38	41	4	51	28	100	
30 years	100	37	36	15	45	5	100	
40 years	100	38	40	23	39	9	100	
50-year modeling period	100	45	41	26	43	22	100	

Piñon-Juniper Woodland PNVT Alternative C Proposed Average Acre Treatment Objectives

Appendix D table 56. Alternative C piñon-juniper woodland resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period, for the proposed average acre treatment objectives

Model Year Runs	Piñon-Juniper Woodland Overstory Vegetation Structural State							Total
	A	B	C	D	E	F	G	
Number of acres in each vegetation state								
Desired Conditions	11,108	17,773	17,773	111,080	17,773	22,216	22,216	222,159
Initial Conditions	15,378	1,756	3,228	152,867	1,138	14,198	33,594	222,159
10 years	14,045	8,711	6,618	123,433	5,423	13,902	50,027	222,159
15-year planning period	13,161	9,565	6,817	113,030	6,885	15,756	56,946	222,159
20 years	13,156	10,140	7,975	103,122	8,317	17,701	61,748	222,159
30 years	11,918	10,145	8,852	90,454	9,780	22,387	68,623	222,159
40 years	11,613	10,057	8,622	79,706	10,232	25,122	76,806	222,159
50-year modeling period	10,536	8,786	8,413	74,541	9,382	27,748	82,754	222,159
Percent of total PNVT contributed by each vegetation state								
Desired Conditions	5	8	8	50	8	10	10	100
Initial Conditions	7	1	1	69	1	6	15	100
10 years	6	4	3	56	2	6	23	100
15-year planning period	6	4	3	51	3	7	26	100
20 years	6	5	4	46	4	8	28	100
30 years	5	5	4	41	4	10	31	100
40 years	5	5	4	36	5	11	35	100
50-year modeling period	5	4	4	34	4	12	37	100
Percent departure for each vegetation state from desired conditions								
Desired Conditions	0	0	0	0	0	0	0	
Initial Conditions	100	90	82	38	94	36	51	
10 years	100	51	63	11	69	37	100	
15-year planning period	100	46	62	2	61	29	100	
20 years	100	43	55	7	53	20	100	
30 years	100	43	50	19	45	1	100	
40 years	100	43	51	28	42	13	100	
50-year modeling period	100	51	53	33	47	25	100	

Piñon-Juniper Woodland PNVT Alternative C Proposed Low Acre Treatment Objectives

Appendix D table 57. Alternative C piñon-juniper woodland resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period, for the proposed low acre treatment objectives

Model Year Runs	Piñon-Juniper Woodland Overstory Vegetation Structural State							Total
	A	B	C	D	E	F	G	
Number of acres in each vegetation state								
Desired Conditions	11,108	17,773	17,773	111,080	17,773	22,216	22,216	222,159
Initial Conditions	15,378	1,756	3,228	152,867	1,138	14,198	33,594	222,159
10 years	12,286	8,475	5,177	121,966	5,123	14,801	54,331	222,159
15-year planning period	11,080	8,992	5,189	109,748	6,944	16,930	63,276	222,159
20 years	11,278	9,202	5,480	99,518	7,964	19,355	69,362	222,159
30 years	8,971	9,065	6,354	86,094	9,759	23,681	78,235	222,159
40 years	8,753	9,010	6,554	73,945	9,649	26,065	88,184	222,159
50-year modeling period	8,225	7,864	6,307	66,899	8,669	28,479	95,715	222,159
Percent of total PNVT contributed by each vegetation state								
Desired Conditions	5	8	8	50	8	10	10	100
Initial Conditions	7	1	1	69	1	6	15	100
10 years	6	4	2	55	2	7	24	100
15-year planning period	5	4	2	49	3	8	28	100
20 years	5	4	2	45	4	9	31	100
30 years	4	4	3	39	4	11	35	100
40 years	4	4	3	33	4	12	40	100
50-year modeling period	4	4	3	30	4	13	43	100
Percent departure for each vegetation state from desired conditions								
Desired Conditions	0	0	0	0	0	0	0	
Initial Conditions	100	90	82	38	94	36	51	
10 years	100	52	71	10	71	33	100	
15-year planning period	100	49	71	1	61	24	100	
20 years	100	48	69	10	55	13	100	
30 years	100	49	64	22	45	7	100	
40 years	100	49	63	33	46	17	100	
50-year modeling period	100	56	65	40	51	28	100	

Piñon-Juniper Woodland PNVT Alternative D Proposed High Acre Treatment Objectives

Appendix D table 58. Alternative D piñon-juniper woodland resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period, for the proposed high acre treatment objectives

Model Year Runs	Piñon-Juniper Woodland Overstory Vegetation Structural State							Total
	A	B	C	D	E	F	G	
Number of acres in each vegetation state								
Desired Conditions	11,108	17,773	17,773	111,080	17,773	22,216	22,216	222,159
Initial Conditions	15,378	1,756	3,228	152,867	1,138	14,198	33,594	222,159
10 years	17,832	9,124	8,233	139,483	5,313	8,416	33,757	222,159
15-year planning period	19,428	11,246	9,294	133,852	7,827	8,373	32,139	222,159
20 years	20,272	12,069	9,676	131,142	8,809	9,458	30,734	222,159
30 years	21,389	14,328	11,117	123,613	10,071	11,174	30,467	222,159
40 years	21,495	14,504	12,768	119,508	11,748	13,174	28,962	222,159
50-year modeling period	20,552	15,299	14,189	117,369	11,893	14,392	28,465	222,159
Percent of total PNVT contributed by each vegetation state								
Desired Conditions	5	8	8	50	8	10	10	100
Initial Conditions	7	1	1	69	1	6	15	100
10 years	8	4	4	63	2	4	15	100
15-year planning period	9	5	4	60	4	4	14	100
20 years	9	5	4	59	4	4	14	100
30 years	10	6	5	56	5	5	14	100
40 years	10	7	6	54	5	6	13	100
50-year modeling period	9	7	6	53	5	6	13	100
Percent departure for each vegetation state from desired conditions								
Desired Conditions	0	0	0	0	0	0	0	
Initial Conditions	100	90	82	38	94	36	51	
10 years	100	49	54	26	70	62	52	
15-year planning period	100	37	48	21	56	62	45	
20 years	100	32	46	18	50	57	38	
30 years	100	19	37	11	43	50	37	
40 years	100	18	28	8	34	41	30	
50-year modeling period	100	14	20	6	33	35	28	

Piñon-Juniper Woodland PNVT Alternative D Proposed Average Acre Treatment Objectives

Appendix D table 59. Alternative D piñon-juniper woodland resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period, for the proposed average acre treatment objectives

Model Year Runs	Piñon-Juniper Woodland Overstory Vegetation Structural State							Total
	A	B	C	D	E	F	G	
Number of acres in each vegetation state								
Desired Conditions	11,108	17,773	17,773	111,080	17,773	22,216	22,216	222,159
Initial Conditions	15,378	1,756	3,228	152,867	1,138	14,198	33,594	222,159
10 years	16,221	8,823	6,614	131,803	5,679	11,297	41,723	222,159
15-year planning period	16,659	10,443	7,374	123,708	7,097	11,919	44,959	222,159
20 years	17,153	11,241	7,482	117,569	8,402	13,318	46,994	222,159
30 years	17,319	12,348	8,202	107,510	9,846	16,066	50,868	222,159
40 years	16,971	11,816	9,162	101,920	11,070	18,367	52,853	222,159
50-year modeling period	16,213	12,501	10,481	98,239	10,432	19,219	55,074	222,159
Percent of total PNVT contributed by each vegetation state								
Desired Conditions	5	8	8	50	8	10	10	100
Initial Conditions	7	1	1	69	1	6	15	100
10 years	7	4	3	59	3	5	19	100
15-year planning period	7	5	3	56	3	5	20	100
20 years	8	5	3	53	4	6	21	100
30 years	8	6	4	48	4	7	23	100
40 years	8	5	4	46	5	8	24	100
50-year modeling period	7	6	5	44	5	9	25	100
Percent departure for each vegetation state from desired conditions								
Desired Conditions	0	0	0	0	0	0	0	
Initial Conditions	100	90	82	38	94	36	51	
10 years	100	50	63	19	68	49	88	
15-year planning period	100	41	59	11	60	46	100	
20 years	100	37	58	6	53	40	100	
30 years	100	31	54	3	45	28	100	
40 years	100	34	48	8	38	17	100	
50-year modeling period	100	30	41	12	41	13	100	

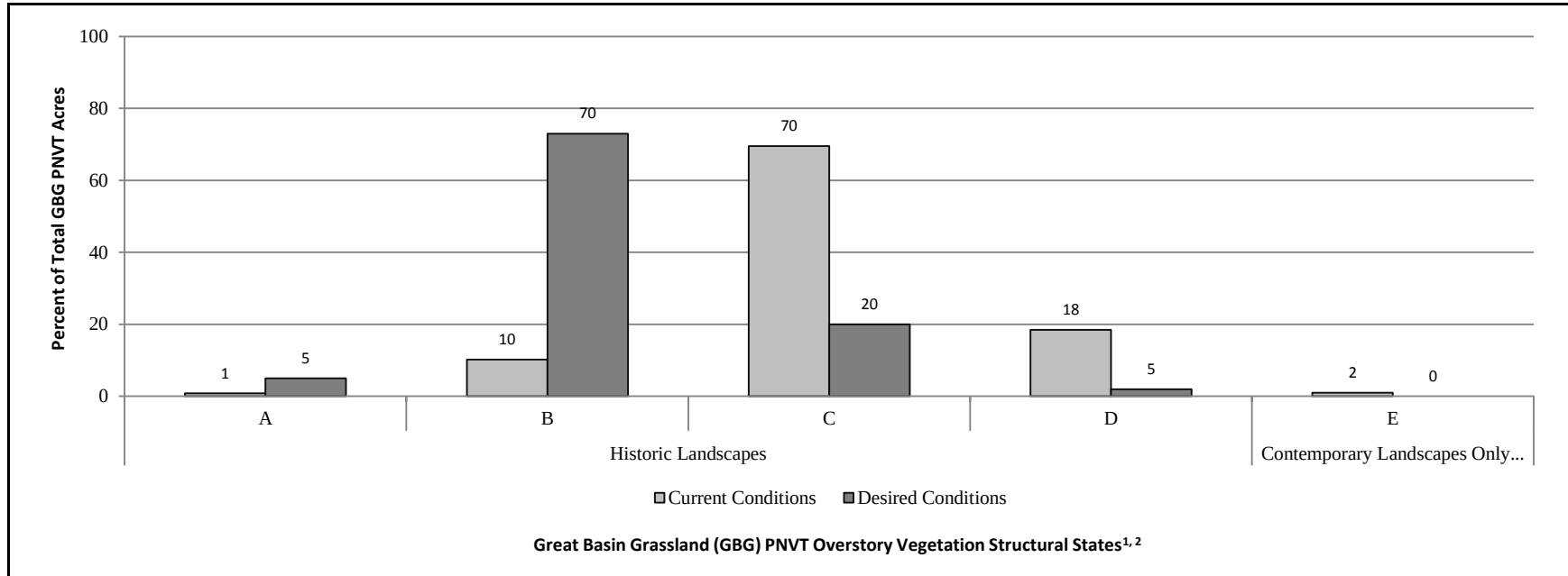
Piñon-Juniper Woodland PNVT Alternative D Proposed Low Acre Treatment Objectives

Appendix D table 60. Alternative D piñon-juniper woodland resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period, for the proposed low acre treatment objectives

Model Year Runs	Piñon-Juniper Woodland Overstory Vegetation Structural State							Total
	A	B	C	D	E	F	G	
Number of acres in each vegetation state								
Desired Conditions	11,108	17,773	17,773	111,080	17,773	22,216	22,216	222,159
Initial Conditions	15,378	1,756	3,228	152,867	1,138	14,198	33,594	222,159
10 years	14,609	8,521	4,994	124,123	6,046	14,178	49,688	222,159
15-year planning period	13,889	9,640	5,453	113,564	6,368	15,465	57,780	222,159
20 years	14,033	10,413	5,288	103,997	7,995	17,178	63,255	222,159
30 years	13,248	10,369	5,287	91,407	9,620	20,958	71,269	222,159
40 years	12,447	9,128	5,555	84,332	10,392	23,560	76,744	222,159
50-year modeling period	11,875	9,703	6,773	79,108	8,972	24,046	81,682	222,159
Percent of total PNVT contributed by each vegetation state								
Desired Conditions	5	8	8	50	8	10	10	100
Initial Conditions	7	1	1	69	1	6	15	100
10 years	7	4	2	56	3	6	22	100
15-year planning period	6	4	2	51	3	7	26	100
20 years	6	5	2	47	4	8	28	100
30 years	6	5	2	41	4	9	32	100
40 years	6	4	3	38	5	11	35	100
50-year modeling period	5	4	3	36	4	11	37	100
Percent departure for each vegetation state from desired conditions								
Desired Conditions	0	0	0	0	0	0	0	
Initial Conditions	100	90	82	38	94	36	51	
10 years	100	52	72	12	66	36	100	
15-year planning period	100	46	69	2	64	30	100	
20 years	100	41	70	6	55	23	100	
30 years	100	42	70	18	46	6	100	
40 years	100	49	69	24	42	6	100	
50-year modeling period	100	45	62	29	50	8	100	

Grassland PNVTs

Great Basin Grassland PNVT



Appendix D figure 21. Great Basin grassland (GBG) PNVT current and desired overstory vegetation structural states

¹ Great Basin Grassland (GBG) PNVT Overstory Vegetation Structural States. At 185,523 acres or approximately 9% of the forests this PNVT ranks 4th in order of size out of the 14 PNVTs on the A-SNFs

STRUCTURAL STATES PART OF THE HISTORIC LANDSCAPE CONDITIONS OR WITHIN HISTORIC RANGE OF VARIABILITY

State A - Herbaceous vegetation regeneration, recently burned, sparsely vegetated; with < 10% tree or shrub canopy cover; early successional development

State B - Open perennial herbaceous vegetation, with < 10% tree or shrub canopy cover; mid successional development

State C - Perennial herbaceous vegetation with shrubs, seedling and sapling size (< 5" diameter), small size (5"-9.9" diameter), and medium size (10"-19.9" diameter) trees with open (≥ 10% & ≤ 30%) canopy cover; late successional development

State D - Shrubs, seedling and sapling, small, medium, and large to very large size (≥ 20" diameter) trees with closed (> 30%) canopy cover, and large to very large size trees with open canopy cover with perennial herbaceous understory vegetation, mid successional development

STRUCTURAL STATE NOT PART OF THE HISTORIC LANDSCAPE CONDITIONS OR WITHIN HISTORIC RANGE OF VARIABILITY, FOUND ON CONTEMPORARY LANDSCAPES ONLY

State E - Various noxious weeds and invasive plants makeup a significant portion of the herbaceous vegetation composition; not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

² GBG PNVT has a 67% or high departure rating from Desired Conditions (DC) and Historical Range of Variability (HRV) making it tied with dry mixed conifer forest for the 3rd most departed PNVT for DC; and 5th most departed PNVT for HRV on the A-SNFs. Desired Conditions were provided by the Regional Office, and HRV was derived from LANDFIRE (2007b)

Great Basin Grassland PNVT Alternative A

Appendix D table 61. Alternative A Great Basin grassland resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period

Model Year Runs	Great Basin Grassland Overstory Vegetation Structural State					Total
	A	B	C	D	E	
Number of acres in each vegetation state						
Desired Conditions	9,276	135,432	37,105	3,710	0	185,523
Initial Conditions	1,494	18,840	127,541	33,939	3,709	185,523
10 years	223	25,695	95,099	60,759	3,748	185,523
15-year planning period	297	27,940	79,756	73,801	3,729	185,523
20 years	334	30,277	65,861	85,285	3,766	185,523
30 years	445	32,318	40,871	108,104	3,785	185,523
40 years	445	35,435	20,983	124,857	3,803	185,523
50-year modeling period	260	29,387	25,806	126,211	3,859	185,523
Percent of total PNVT contributed by each vegetation state						
Desired Conditions	5	70	20	5	0	100
Initial Conditions	1	10	70	18	2	100
10 years	0	14	51	33	2	100
15-year planning period	0	15	43	40	2	100
20 years	0	16	36	46	2	100
30 years	0	17	22	58	2	100
40 years	0	19	11	67	2	100
50-year modeling period	0	16	14	68	2	100
Percent departure for each vegetation state from desired conditions						
Desired Conditions	0	0	0	0	0	
Initial Conditions	100	86	100	100	100	
10 years	100	81	100	100	100	
15-year planning period	100	79	100	100	100	
20 years	100	78	77	100	100	
30 years	100	76	10	100	100	
40 years	100	74	43	100	100	
50-year modeling period	100	78	30	100	100	

Great Basin Grassland PNVT Alternative B Proposed High Acre Treatment Objectives

Appendix D table 62. Alternative B Great Basin grassland resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period, for the proposed high acre treatment objectives

Model Year Runs	Great Basin Grassland Overstory Vegetation Structural State					Total
	A	B	C	D	E	
Number of acres in each vegetation state						
Desired Conditions	9,276	135,432	37,105	3,710	0	185,523
Initial Conditions	1,494	18,840	127,541	33,939	3,709	185,523
10 years	427	118,512	43,246	19,628	3,710	185,523
15-year planning period	427	140,052	28,367	12,968	3,710	185,523
20 years	334	155,098	17,903	8,441	3,748	185,523
30 years	371	168,344	9,332	3,692	3,785	185,523
40 years	297	173,168	6,901	1,373	3,785	185,523
50-year modeling period	334	107,492	73,189	612	3,896	185,523
Percent of total PNVT contributed by each vegetation state						
Desired Conditions	5	70	20	5	0	100
Initial Conditions	1	10	70	18	2	100
10 years	0	64	23	11	2	100
15-year planning period	0	75	15	7	2	100
20 years	0	84	10	5	2	100
30 years	0	91	5	2	2	100
40 years	0	93	4	1	2	100
50-year modeling period	0	58	39	0	2	100
Percent departure for each vegetation state from desired conditions						
Desired Conditions	0	0	0	0	0	
Initial Conditions	100	86	100	100	100	
10 years	100	86	100	100	100	
15-year planning period	100	12	17	100	100	
20 years	100	3	24	100	100	
30 years	100	15	52	100	100	
40 years	100	24	75	0	100	
50-year modeling period	100	28	81	63	100	

Great Basin Grassland PNVT Alternative B Proposed Average Acre Treatment Objectives

Appendix D table 63. Alternative B Great Basin grassland resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period, for the proposed average acre treatment objectives

Model Year Runs	Great Basin Grassland Overstory Vegetation Structural State					Total
	A	B	C	D	E	
Number of acres in each vegetation state						
Desired Conditions	9,276	135,432	37,105	3,710	0	185,523
Initial Conditions	1,494	18,840	127,541	33,939	3,709	185,523
10 years	352	99,988	54,340	27,133	3,710	185,523
15-year planning period	399	120,228	38,320	22,847	3,729	185,523
20 years	297	135,933	27,216	18,348	3,729	185,523
30 years	362	152,528	16,734	12,133	3,766	185,523
40 years	288	160,849	12,616	7,987	3,785	185,523
50-year modeling period	343	108,364	67,929	5,028	3,859	185,523
Percent of total PNVT contributed by each vegetation state						
Desired Conditions	5	70	20	5	0	100
Initial Conditions	1	10	70	18	2	100
10 years	0	54	29	15	2	100
15-year planning period	0	65	21	12	2	100
20 years	0	73	15	10	2	100
30 years	0	82	9	7	2	100
40 years	0	87	7	4	2	100
50-year modeling period	0	58	37	3	2	100
Percent departure for each vegetation state from desired conditions						
Desired Conditions	0	0	0	0	0	
Initial Conditions	100	86	100	100	100	
10 years	100	26	46	100	100	
15-year planning period	100	11	3	100	100	
20 years	100	0	27	100	100	
30 years	100	13	55	100	100	
40 years	100	19	66	100	100	
50-year modeling period	100	20	83	36	100	

Great Basin Grassland PNVT Alternative B Proposed Low Acre Treatment Objectives

Appendix D table 64. Alternative B Great Basin grassland resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period, for the proposed low acre treatment objectives

Model Year Runs	Great Basin Grassland Overstory Vegetation Structural State					Total
	A	B	C	D	E	
Number of acres in each vegetation state						
Desired Conditions	9,276	135,432	37,105	3,710	0	185,523
Initial Conditions	1,494	18,840	127,541	33,939	3,709	185,523
10 years	278	81,463	65,434	34,637	3,710	185,523
15-year planning period	371	100,405	48,273	32,726	3,748	185,523
20 years	260	116,768	36,530	28,255	3,710	185,523
30 years	352	136,712	24,137	20,575	3,748	185,523
40 years	278	148,530	18,330	14,601	3,785	185,523
50-year modeling period	352	109,236	62,670	9,443	3,822	185,523
Percent of total PNVT contributed by each vegetation state						
Desired Conditions	5	70	20	5	0	100
Initial Conditions	1	10	70	18	2	100
10 years	0	44	35	19	2	100
15-year planning period	0	54	26	18	2	100
20 years	0	63	20	15	2	100
30 years	0	74	13	11	2	100
40 years	0	80	10	8	2	100
50-year modeling period	0	59	34	5	2	100
Percent departure for each vegetation state from desired conditions						
Desired Conditions	0	0	0	0	0	
Initial Conditions	100	86	100	100	100	
10 years	100	40	76	100	100	
15-year planning period	100	26	30	100	100	
20 years	100	14	2	100	100	
30 years	100	1	35	100	100	
40 years	100	10	51	100	100	
50-year modeling period	100	19	69	100	100	

Great Basin Grassland PNVT Alternative C

Appendix D table 65. Alternative C Great Basin grassland resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period

Model Year Runs	Great Basin Grassland Overstory Vegetation Structural State					Total
	A	B	C	D	E	
Number of acres in each vegetation state						
Desired Conditions	9,276	135,432	37,105	3,710	0	185,523
Initial Conditions	1,494	18,840	127,541	33,939	3,709	185,523
10 years	223	25,695	95,099	60,759	3,748	185,523
15-year planning period	297	27,940	79,756	73,801	3,729	185,523
20 years	334	30,277	65,861	85,285	3,766	185,523
30 years	445	32,318	40,871	108,104	3,785	185,523
40 years	445	35,435	20,983	124,857	3,803	185,523
50-year modeling period	260	29,387	25,806	126,211	3,859	185,523
Percent of total PNVT contributed by each vegetation state						
Desired Conditions	5	70	20	5	0	100
Initial Conditions	1	10	70	18	2	100
10 years	0	14	51	33	2	100
15-year planning period	0	15	43	40	2	100
20 years	0	16	36	46	2	100
30 years	0	17	22	58	2	100
40 years	0	19	11	67	2	100
50-year modeling period	0	16	14	68	2	100
Percent departure for each vegetation state from desired conditions						
Desired Conditions	0	0	0	0	0	
Initial Conditions	100	86	100	100	100	
10 years	100	81	100	100	100	
15-year planning period	100	79	100	100	100	
20 years	100	78	77	100	100	
30 years	100	76	10	100	100	
40 years	100	74	43	100	100	
50-year modeling period	100	78	30	100	100	

Great Basin Grassland PNVT Alternative D Proposed High Acre Treatment Objectives

Appendix D table 66. Alternative D Great Basin grassland resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period, for the proposed high acre treatment objectives

Model Year Runs	Great Basin Grassland Overstory Vegetation Structural State					Total
	A	B	C	D	E	
Number of acres in each vegetation state						
Desired Conditions	9,276	135,432	37,105	3,710	0	185,523
Initial Conditions	1,494	18,840	127,541	33,939	3,709	185,523
10 years	315	107,448	53,354	20,639	3,766	185,523
15-year planning period	533	130,781	35,565	14,913	3,730	185,523
20 years	461	145,782	24,695	10,819	3,766	185,523
30 years	500	160,994	15,268	4,959	3,803	185,523
40 years	555	170,093	8,906	2,148	3,821	185,523
50-year modeling period	316	117,129	63,328	907	3,842	185,523
Percent of total PNVT contributed by each vegetation state						
Desired Conditions	5	70	20	5	0	100
Initial Conditions	1	10	70	18	2	100
10 years	0	58	29	11	2	100
15-year planning period	0	70	19	8	2	100
20 years	0	79	13	6	2	100
30 years	0	87	8	3	2	100
40 years	0	92	5	1	2	100
50-year modeling period	0	63	34	0	2	100
Percent departure for each vegetation state from desired conditions						
Desired Conditions	0	0	0	0	0	
Initial Conditions	100	86	100	100	100	
10 years	100	21	44	100	100	
15-year planning period	100	3	4	100	100	
20 years	100	8	33	100	100	
30 years	100	19	59	34	100	
40 years	100	26	76	42	100	
50-year modeling period	100	14	71	76	100	

Great Basin Grassland PNVT Alternative D Proposed Average Acre Treatment Objectives

Appendix D table 67. Alternative D Great Basin grassland resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period, for the proposed average acre treatment objectives

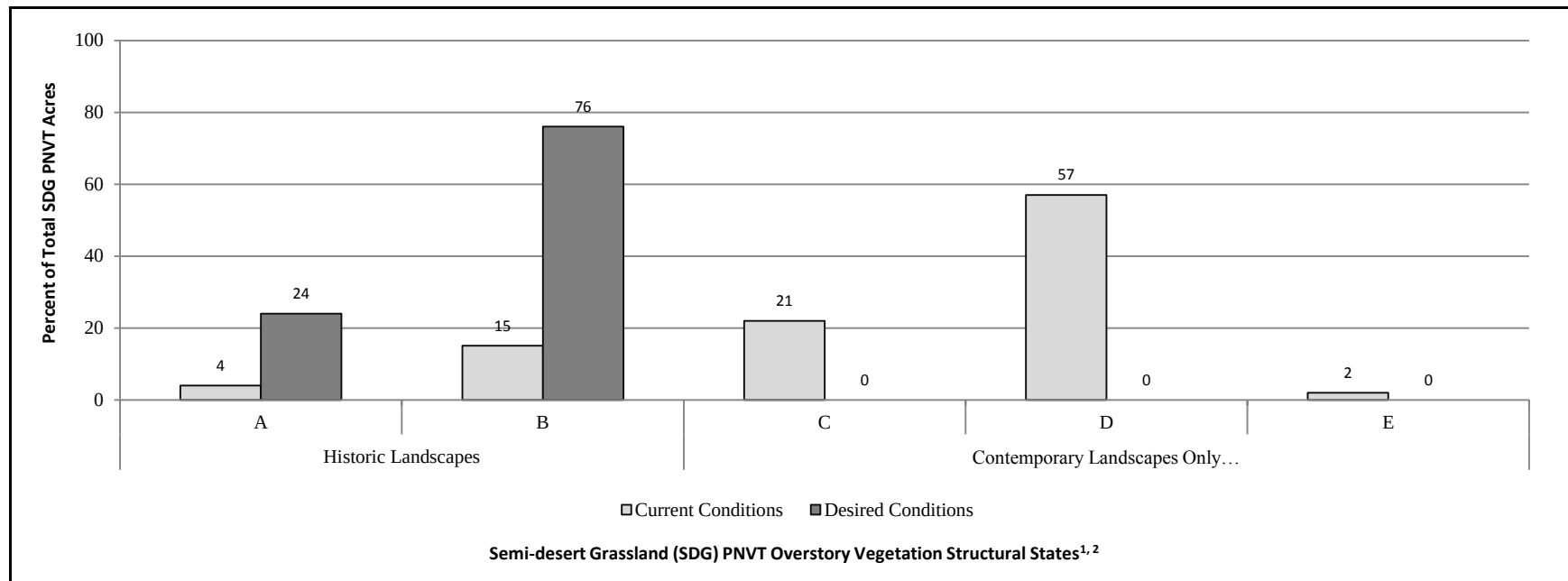
Model Year Runs	Great Basin Grassland Overstory Vegetation Structural State					Total
	A	B	C	D	E	
Number of acres in each vegetation state						
Desired Conditions	9,276	135,432	37,105	3,710	0	185,523
Initial Conditions	1,494	18,840	127,541	33,939	3,709	185,523
10 years	270	90,373	62,734	28,408	3,738	185,523
15-year planning period	451	110,600	46,248	24,484	3,739	185,523
20 years	443	125,401	34,567	21,364	3,748	185,523
30 years	427	143,536	23,455	14,330	3,775	185,523
40 years	491	155,094	16,565	9,570	3,803	185,523
50-year modeling period	362	112,412	63,028	5,925	3,796	185,523
Percent of total PNVT contributed by each vegetation state						
Desired Conditions	5	70	20	5	0	100
Initial Conditions	1	10	70	18	2	100
10 years	0	49	34	15	2	100
15-year planning period	0	60	25	13	2	100
20 years	0	68	19	12	2	100
30 years	0	77	13	8	2	100
40 years	0	84	9	5	2	100
50-year modeling period	0	61	34	3	2	100
Percent departure for each vegetation state from desired conditions						
Desired Conditions	0	0	0	0	0	
Initial Conditions	100	86	100	100	100	
10 years	100	33	69	100	100	
15-year planning period	100	18	25	100	100	
20 years	100	7	7	100	100	
30 years	100	6	37	100	100	
40 years	100	15	55	100	100	
50-year modeling period	100	17	70	60	100	

Great Basin Grassland PNVT Alternative D Proposed Low Acre Treatment Objectives

Appendix D table 68. Alternative D Great Basin grassland resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period, for the proposed low acre treatment objectives

Model Year Runs	Great Basin Grassland Overstory Vegetation Structural State					Total
	A	B	C	D	E	
Number of acres in each vegetation state						
Desired Conditions	9,276	135,432	37,105	3,710	0	185,523
Initial Conditions	1,494	18,840	127,541	33,939	3,709	185,523
10 years	224	73,298	72,114	36,176	3,711	185,523
15-year planning period	369	90,419	56,930	34,055	3,749	185,523
20 years	425	105,020	44,439	31,910	3,729	185,523
30 years	354	126,078	31,642	23,701	3,748	185,523
40 years	427	140,095	24,224	16,992	3,785	185,523
50-year modeling period	407	107,695	62,727	10,943	3,751	185,523
Percent of total PNVT contributed by each vegetation state						
Desired Conditions	5	70	20	5	0	100
Initial Conditions	1	10	70	18	2	100
10 years	0	40	39	19	2	100
15-year planning period	0	49	31	18	2	100
20 years	0	57	24	17	2	100
30 years	0	68	17	13	2	100
40 years	0	76	13	9	2	100
50-year modeling period	0	58	34	6	2	100
Percent departure for each vegetation state from desired conditions						
Desired Conditions	0	0	0	0	0	
Initial Conditions	100	86	100	100	100	
10 years	100	46	94	100	100	
15-year planning period	100	33	53	100	100	
20 years	100	22	20	100	100	
30 years	100	7	15	100	100	
40 years	100	3	35	100	100	
50-year modeling period	100	20	69	100	100	

Semi-desert Grassland PNVT



Appendix D figure 22. Semi-desert grassland (SDG) PNVT current and desired overstory vegetation structural states

¹ Semi-desert Grassland (SDG) PNVT Overstory Vegetation Structural States. At 106,952 acres or approximately 5% of the forests this PNVT ranks 7th in order of size out of the 14 PNVTs on the A-SNFs

STRUCTURAL STATES PART OF THE HISTORIC LANDSCAPE CONDITIONS OR WITHIN HISTORIC RANGE OF VARIABILITY

State A - Herbaceous vegetation regeneration, recently burned, sparsely vegetated; with < 10% tree or shrub canopy cover; early successional development

State B - Perennial herbaceous vegetation, with < 10% tree or shrub canopy cover; mid successional development

STRUCTURAL STATES NOT PART OF THE HISTORIC LANDSCAPE CONDITIONS OR WITHIN HISTORIC RANGE OF VARIABILITY, FOUND ON CONTEMPORARY LANDSCAPES ONLY

State C - Perennial herbaceous vegetation with shrubs, seedling and sapling size (< 5" diameter), small size (5"-9.9" diameter), and medium size (10"-19.9" diameter) trees with open (≥ 10% & ≤ 30%) canopy cover; late successional development

State D - Shrubs, seedling and sapling, small, medium, and large to very large size (≥ 20" diameter) trees with closed (> 30%) canopy cover, and large to very large size trees with open canopy cover with perennial herbaceous understory vegetation, mid successional development; not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

State E - Various noxious weeds and invasive plants makeup a significant portion of the herbaceous vegetation composition; not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

² SDG PNVT has a 79% or high departure rating from Desired Conditions (DC) and Historical Range of Variability (HRV) making it the 1st and 2nd most departed PNVT on the A-SNFs for DC and HRV, respectively. Desired Conditions were provided by the Regional Office, and HRV was derived from the Nature Conservancy (Schussman, 2006a)

Semi-desert Grassland PNVT Alternative A

Appendix D table 69. Alternative A semi-desert grassland resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period

Model Year Runs	Semi-desert Grassland Overstory Vegetation Structural State					Total
	A	B	C	D	E	
Number of acres in each vegetation state						
Desired Conditions	25,668	81,284	0	0	0	106,952
Initial Conditions	1,014	21,216	23,444	59,141	2,137	106,952
10 years	21	18,535	22,877	63,369	2,150	106,952
15-year planning period	21	16,952	22,438	65,380	2,160	106,952
20 years	32	14,909	21,422	68,417	2,171	106,952
30 years	43	11,369	20,567	72,834	2,139	106,952
40 years	53	7,722	20,096	76,930	2,150	106,952
50-year modeling period	43	5,893	18,353	80,492	2,171	106,952
Percent of total PNVT contributed by each vegetation state						
Desired Conditions	24	76	0	0	0	100
Initial Conditions	4	15	21	57	2	100
10 years	0	17	21	59	2	100
15-year planning period	0	16	21	61	2	100
20 years	0	14	20	64	2	100
30 years	0	11	19	68	2	100
40 years	0	7	19	72	2	100
50-year modeling period	0	6	17	75	2	100
Percent departure for each vegetation state from desired conditions						
Desired Conditions	0	0	0	0	0	
Initial Conditions	100	74	100	100	100	
10 years	100	77	100	100	100	
15-year planning period	100	79	100	100	100	
20 years	100	82	100	100	100	
30 years	100	86	100	100	100	
40 years	100	90	100	100	100	
50-year modeling period	100	93	100	100	100	

Semi-desert Grassland PNVT Alternative B Proposed High Acre Treatment Objectives

Appendix D table 70. Alternative B semi-desert grassland resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period, for the proposed high acre treatment objectives

Model Year Runs	Semi-desert Grassland Overstory Vegetation Structural State					Total
	A	B	C	D	E	
Number of acres in each vegetation state						
Desired Conditions	25,668	81,284	0	0	0	106,952
Initial Conditions	1,014	21,216	23,444	59,141	2,137	106,952
10 years	781	32,214	25,508	46,342	2,107	106,952
15-year planning period	578	36,118	26,546	41,615	2,096	106,952
20 years	652	39,925	27,112	37,155	2,107	106,952
30 years	620	48,695	27,797	27,679	2,160	106,952
40 years	449	55,337	27,583	21,444	2,139	106,952
50-year modeling period	556	50,278	34,995	18,920	2,203	106,952
Percent of total PNVT contributed by each vegetation state						
Desired Conditions	24	76	0	0	0	100
Initial Conditions	4	15	21	57	2	100
10 years	1	30	24	43	2	100
15-year planning period	1	34	25	39	2	100
20 years	1	37	25	35	2	100
30 years	1	46	26	26	2	100
40 years	0	52	26	20	2	100
50-year modeling period	1	47	33	18	2	100
Percent departure for each vegetation state from desired conditions						
Desired Conditions	0	0	0	0	0	
Initial Conditions	100	74	100	100	100	
10 years	100	60	100	100	100	
15-year planning period	100	56	100	100	100	
20 years	100	51	100	100	100	
30 years	100	40	100	100	100	
40 years	100	32	100	100	100	
50-year modeling period	100	38	100	100	100	

Semi-desert Grassland PNVT Alternative B Proposed Average Acre Treatment Objectives

Appendix D table 71. Alternative B semi-desert grassland resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period, for the proposed average acre treatment objectives

Model Year Runs	Semi-desert Grassland Overstory Vegetation Structural State					Total
	A	B	C	D	E	
Number of acres in each vegetation state						
Desired Conditions	25,668	81,284	0	0	0	106,952
Initial Conditions	1,014	21,216	23,444	59,141	2,137	106,952
10 years	636	30,128	24,877	49,214	2,096	106,952
15-year planning period	545	33,717	25,813	44,770	2,107	106,952
20 years	561	36,096	27,300	40,888	2,107	106,952
30 years	561	36,096	27,300	40,888	2,107	106,952
40 years	503	43,289	28,114	32,873	2,173	106,952
50-year modeling period	422	44,610	34,701	25,043	2,176	106,952
Percent of total PNVT contributed by each vegetation state						
Desired Conditions	24	76	0	0	0	100
Initial Conditions	4	15	21	57	2	100
10 years	1	28	23	46	2	100
15-year planning period	1	32	24	42	2	100
20 years	1	34	26	38	2	100
30 years	1	34	26	38	2	100
40 years	0	40	26	31	2	100
50-year modeling period	0	42	32	23	2	100
Percent departure for each vegetation state from desired conditions						
Desired Conditions	0	0	0	0	0	
Initial Conditions	100	74	100	100	100	
10 years	100	63	100	100	100	
15-year planning period	100	59	100	100	100	
20 years	100	56	100	100	100	
30 years	100	56	100	100	100	
40 years	100	47	100	100	100	
50-year modeling period	100	45	100	100	100	

Semi-desert Grassland PNVT Alternative B Proposed Low Acre Treatment Objectives

Appendix D table 72. Alternative B semi-desert grassland resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period, for the proposed low acre treatment objectives

Model Year Runs	Semi-desert Grassland Overstory Vegetation Structural State					Total
	A	B	C	D	E	
Number of acres in each vegetation state						
Desired Conditions	9,276	135,432	37,105	3,710	0	106,952
Initial Conditions	1,494	18,840	127,541	33,939	3,709	106,952
10 years	492	28,043	24,246	52,086	2,086	106,952
15-year planning period	513	31,316	25,080	47,925	2,118	106,952
20 years	471	32,267	27,487	44,620	2,107	106,952
30 years	384	37,721	28,318	37,924	2,177	106,952
40 years	460	42,663	28,663	33,037	2,128	106,952
50-year modeling period	289	38,941	34,406	31,166	2,150	106,952
Percent of total PNVT contributed by each vegetation state						
Desired Conditions	24	76	0	0	0	100
Initial Conditions	4	15	21	57	2	100
10 years	0	26	23	49	2	100
15-year planning period	0	29	23	45	2	100
20 years	0	30	26	42	2	100
30 years	0	35	26	35	2	100
40 years	0	40	27	31	2	100
50-year modeling period	0	36	32	29	2	100
Percent departure for each vegetation state from desired conditions						
Desired Conditions	0	0	0	0	0	
Initial Conditions	100	74	100	100	100	
10 years	100	65	100	100	100	
15-year planning period	100	61	100	100	100	
20 years	100	60	100	100	100	
30 years	100	54	100	100	100	
40 years	100	48	100	100	100	
50-year modeling period	100	52	100	100	100	

Semi-desert Grassland PNVT Alternative C

Appendix D table 73. Alternative C semi-desert grassland resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period

Model Year Runs	Semi-desert Grassland Overstory Vegetation Structural State					Total
	A	B	C	D	E	
Number of acres in each vegetation state						
Desired Conditions	9,276	135,432	37,105	3,710	0	106,952
Initial Conditions	1,494	18,840	127,541	33,939	3,709	106,952
10 years	21	18,535	22,877	63,369	2,150	106,952
15-year planning period	21	16,952	22,438	65,380	2,160	106,952
20 years	32	14,909	21,422	68,417	2,171	106,952
30 years	43	11,369	20,567	72,834	2,139	106,952
40 years	53	7,722	20,096	76,930	2,150	106,952
50-year modeling period	43	5,893	18,353	80,492	2,171	106,952
Percent of total PNVT contributed by each vegetation state						
Desired Conditions	24	76	0	0	0	100
Initial Conditions	4	15	21	57	2	100
10 years	0	17	21	59	2	100
15-year planning period	0	16	21	61	2	100
20 years	0	14	20	64	2	100
30 years	0	11	19	68	2	100
40 years	0	7	19	72	2	100
50-year modeling period	0	6	17	75	2	100
Percent departure for each vegetation state from desired conditions						
Desired Conditions	0	0	0	0	0	
Initial Conditions	100	74	100	100	100	
10 years	100	77	100	100	100	
15-year planning period	100	79	100	100	100	
20 years	100	82	100	100	100	
30 years	100	86	100	100	100	
40 years	100	90	100	100	100	
50-year modeling period	100	93	100	100	100	

Semi-desert Grassland PNVT Alternative D Proposed High Acre Treatment Objectives

Appendix D table 74. Alternative D semi-desert grassland resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period, for the proposed high acre treatment objectives

Model Year Runs	Semi-desert Grassland Overstory Vegetation Structural State					Total
	A	B	C	D	E	
Number of acres in each vegetation state						
Desired Conditions	9,276	135,432	37,105	3,710	0	106,952
Initial Conditions	1,494	18,840	127,541	33,939	3,709	106,952
10 years	781	32,214	25,508	46,342	2,107	106,952
15-year planning period	578	36,118	26,545	41,615	2,096	106,952
20 years	652	39,925	27,112	37,155	2,107	106,952
30 years	620	48,695	27,797	27,679	2,160	106,952
40 years	449	55,337	27,583	21,444	2,139	106,952
50-year modeling period	556	50,278	34,995	18,920	2,203	106,952
Percent of total PNVT contributed by each vegetation state						
Desired Conditions	24	76	0	0	0	100
Initial Conditions	4	15	21	57	2	100
10 years	1	30	24	43	2	100
15-year planning period	1	34	25	39	2	100
20 years	1	37	25	35	2	100
30 years	1	46	26	26	2	100
40 years	0	52	26	20	2	100
50-year modeling period	1	47	33	18	2	100
Percent departure for each vegetation state from desired conditions						
Desired Conditions	0	0	0	0	0	
Initial Conditions	100	74	100	100	100	
10 years	100	60	100	100	100	
15-year planning period	100	56	100	100	100	
20 years	100	51	100	100	100	
30 years	100	40	100	100	100	
40 years	100	32	100	100	100	
50-year modeling period	100	38	100	100	100	

Semi-desert Grassland PNVT Alternative D Proposed Average Acre Treatment Objectives

Appendix D table 75. Alternative D semi-desert grassland resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period, for the proposed average acre treatment objectives

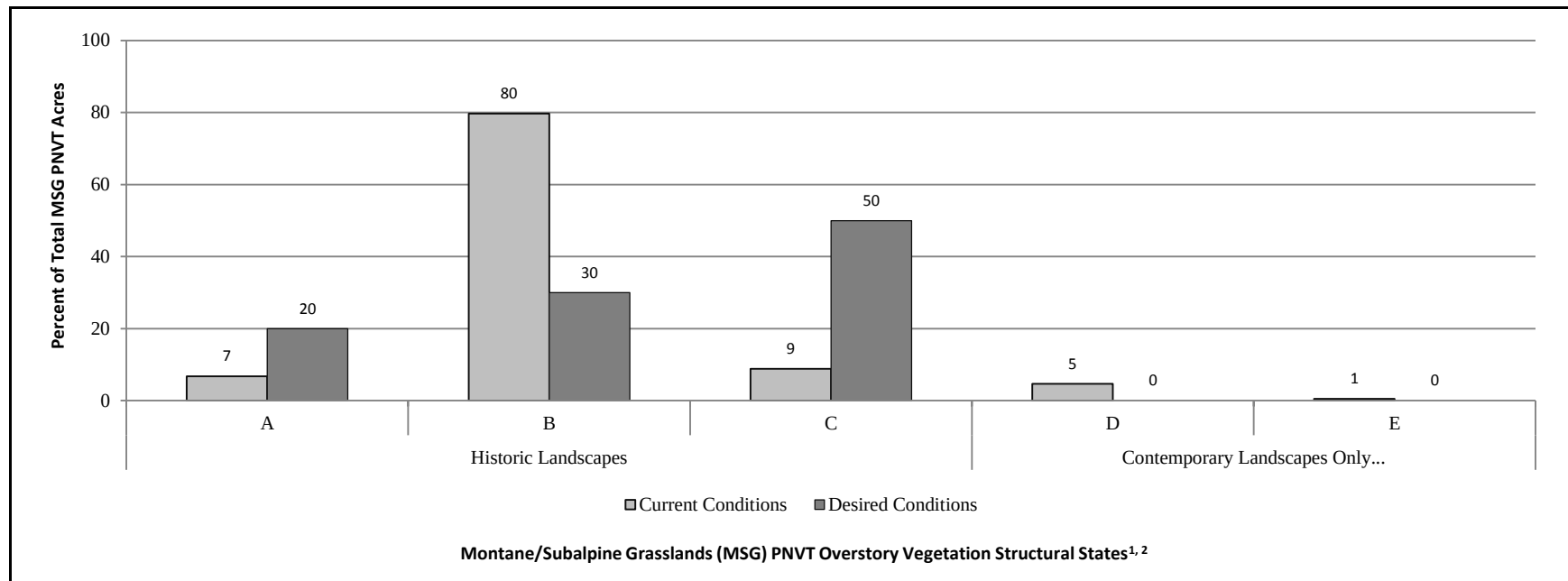
Model Year Runs	Semi-desert Grassland Overstory Vegetation Structural State					Total
	A	B	C	D	E	
Number of acres in each vegetation state						
Desired Conditions	9,276	135,432	37,105	3,710	0	106,952
Initial Conditions	1,494	18,840	127,541	33,939	3,709	106,952
10 years	636	30,128	24,877	49,214	2,096	106,952
15-year planning period	545	33,717	25,813	44,770	2,107	106,952
20 years	519	38,901	27,770	37,615	2,146	106,952
30 years	503	43,284	28,114	32,878	2,173	106,952
40 years	455	49,000	28,123	27,241	2,134	106,952
50-year modeling period	422	44,610	34,700	25,043	2,176	106,952
Percent of total PNVT contributed by each vegetation state						
Desired Conditions	24	76	0	0	0	100
Initial Conditions	4	15	21	57	2	100
10 years	1	28	23	46	2	100
15-year planning period	1	32	24	42	2	100
20 years	0	36	26	35	2	100
30 years	0	40	26	31	2	100
40 years	0	46	26	25	2	100
50-year modeling period	0	42	32	23	2	100
Percent departure for each vegetation state from desired conditions						
Desired Conditions	0	0	0	0	0	
Initial Conditions	100	74	100	100	100	
10 years	100	63	100	100	100	
15-year planning period	100	59	100	100	100	
20 years	100	52	100	100	100	
30 years	100	47	100	100	100	
40 years	100	40	100	100	100	
50-year modeling period	100	45	100	100	100	

Semi-desert Grassland PNVT Alternative D Proposed Low Acre Treatment Objectives

Appendix D table 76. Alternative D semi-desert grassland resulting overstory vegetation structural state acreage by VDDT model year runs over the 50-year modeling period, for the proposed low acre treatment objectives

Model Year Runs	Semi-desert Grassland Overstory Vegetation Structural State					Total
	A	B	C	D	E	
Number of acres in each vegetation state						
Desired Conditions	9,276	135,432	37,105	3,710	0	106,952
Initial Conditions	1,494	18,840	127,541	33,939	3,709	106,952
10 years	492	28,043	24,246	52,085	2,086	106,952
15-year planning period	513	31,315	25,080	47,925	2,118	106,952
20 years	384	37,721	28,318	37,924	2,177	106,952
30 years	386	37,872	28,431	38,076	2,186	106,952
40 years	460	42,663	28,663	33,037	2,128	106,952
50-year modeling period	289	38,941	34,406	31,166	2,150	106,952
Percent of total PNVT contributed by each vegetation state						
Desired Conditions	24	76	0	0	0	100
Initial Conditions	4	15	21	57	2	100
10 years	0	26	23	49	2	100
15-year planning period	0	29	23	45	2	100
20 years	0	35	26	35	2	100
30 years	0	35	27	36	2	100
40 years	0	40	27	31	2	100
50-year modeling period	0	36	32	29	2	100
Percent departure for each vegetation state from desired conditions						
Desired Conditions	0	0	0	0	0	
Initial Conditions	100	74	100	100	100	
10 years	100	65	100	100	100	
15-year planning period	100	61	100	100	100	
20 years	100	54	100	100	100	
30 years	100	53	100	100	100	
40 years	100	48	100	100	100	
50-year modeling period	100	52	100	100	100	

Montane/Subalpine Grasslands PNVT



Appendix D figure 23. Montane/subalpine grasslands (MSG) PNVT current and desired overstory vegetation structural states

¹ Montane/Subalpine Grasslands (MSG) PNVT Overstory Vegetation Structural States. At 51,559 acres or approximately 3% of the forests this PNVT ranks 9th in order of size out of the 14 PNVTs on the A-SNFs

STRUCTURAL STATES PART OF THE HISTORIC LANDSCAPE CONDITIONS OR WITHIN HISTORIC RANGE OF VARIABILITY

State A - Herbaceous vegetation regeneration, recently burned, sparsely vegetated; with < 10% tree or shrub canopy cover; early successional development

State B - Perennial herbaceous vegetation, with < 10% tree or shrub canopy cover; mid successional development

State C - Perennial herbaceous vegetation, with < 10% tree or shrub canopy cover; late successional development

STRUCTURAL STATES NOT PART OF THE HISTORIC LANDSCAPE CONDITIONS OR WITHIN HISTORIC RANGE OF VARIABILITY, FOUND ON CONTEMPORARY LANDSCAPES ONLY

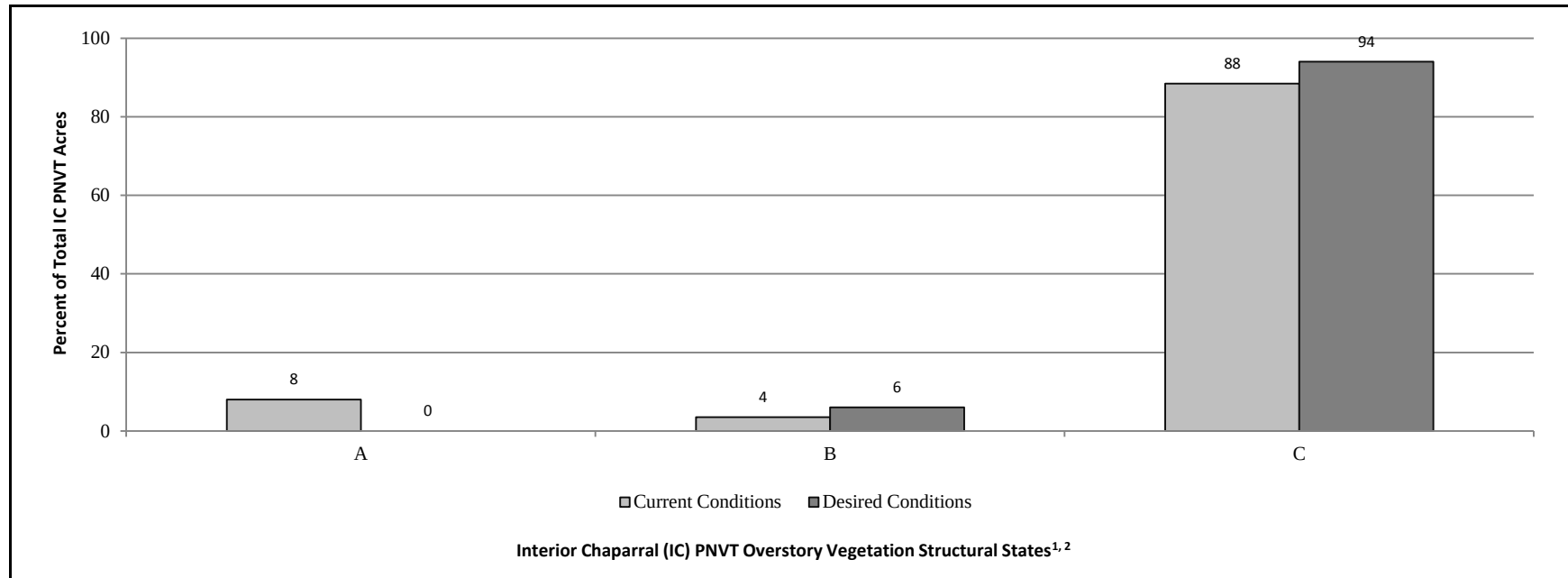
State D - Shrubs, seedling and sapling size (< 5" diameter), small size (5"-9.9" diameter), medium size (10"-19.9" diameter), and large to very large size (≥ 20" diameter) trees with open (≥ 10% & ≤ 30%) or closed (> 30%) canopy cover, with perennial herbaceous understory vegetation; not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

State E - Various noxious weeds and invasive plants makeup a significant portion of the herbaceous vegetation composition; not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

² MSG PNVT has a 54% or moderate departure rating from Desired Conditions (DC) and Historical Range of Variability (HRV) making it tied with wet mixed conifer forest for the 6th most departed PNVT for DC; and 8th most departed PNVT for HRV on the A-SNFs. Desired Conditions were provided by the Regional Office, and HRV was derived from LANDFIRE (2007c)

Chaparral PNVT

Interior Chaparral PNVT



Appendix D figure 24. Interior chaparral (IC) PNVT current and desired overstory vegetation structural states

¹ Interior Chaparral (IC) PNVT Overstory Vegetation Structural States. At 55,981 acres or approximately 3% of the forests this PNVT ranks 8th in order of size out of the 14 PNVTs on the A-SNFs

STRUCTURAL STATES PART OF THE HISTORIC LANDSCAPE CONDITIONS OR WITHIN HISTORIC RANGE OF VARIABILITY

State A - Herbaceous vegetation regeneration, recently burned, sparsely vegetated; with < 10% shrub or tree canopy cover; early successional development

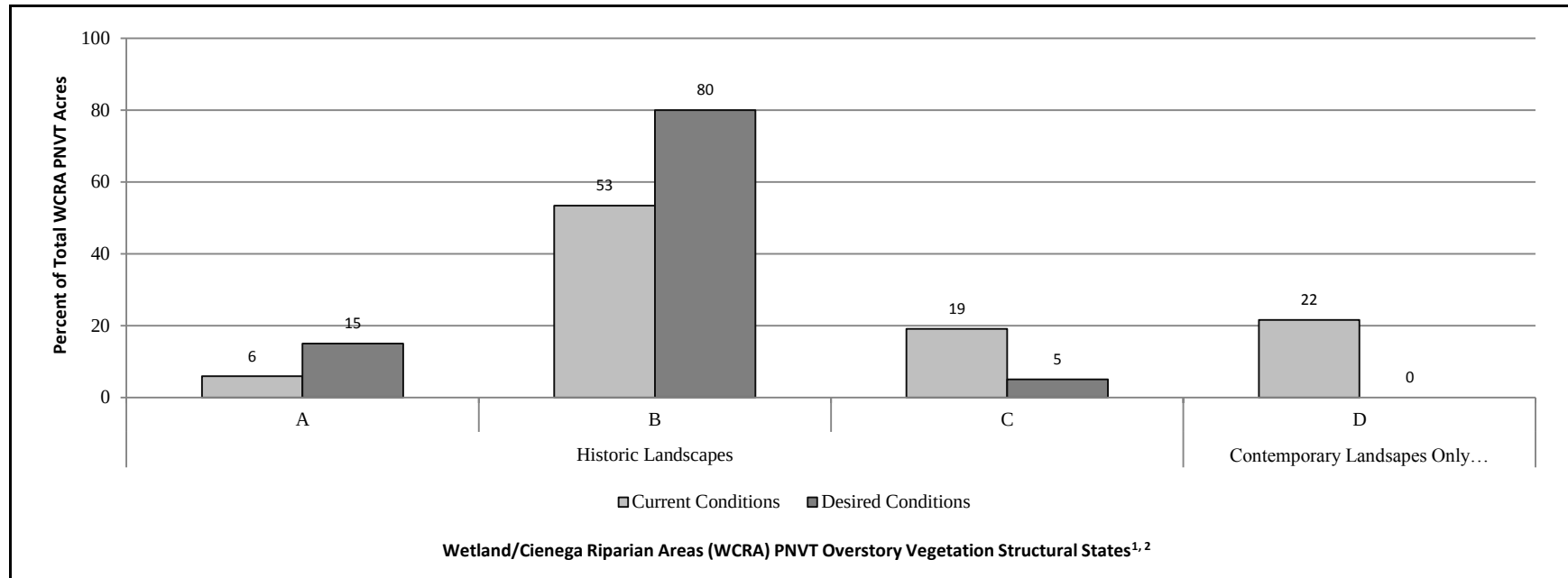
State B - Open perennial herbaceous vegetation, with shrubs, seedling and sapling size (< 5" diameter) and small size (5"-9.9" diameter) trees with open (≥ 10% & ≤ 30%) canopy cover; mid successional development

State C - Shrubs, seedling and sapling, small, medium size (10"-19.9" diameter), and large to very large size (≥ 20" diameter) trees with closed (> 30%) canopy cover, and medium and large to very large size (≥ 20" diameter) trees with open canopy cover and no herbaceous understory vegetation; late successional development

² IC PNVT has a 8% or no departure rating from Desired Conditions (DC) and Historical Range of Variability (HRV) making it the least departed PNVT on the A-SNFs for both DC and HRV. Desired Conditions were provided by the Regional Office, and HRV was derived from the Nature Conservancy (Schussman, 2006b)

Riparian Areas/Riparian Forest PNVTs

Wetland/Cienega Riparian Areas PNVT



Appendix D figure 25. Wetland/cienega riparian areas (WCRA) PNVT current and desired overstory vegetation structural states

¹ Wetland/Cienega Riparian Areas (WCRA) PNVT Overstory Vegetation Structural States. At 17,900 acres or approximately 0.9% of the forests this PNVT ranks 10th in order of size out of the 14 PNVTs on the A-SNFs

STRUCTURAL STATES PART OF THE HISTORIC LANDSCAPE CONDITIONS OR WITHIN HISTORIC RANGE OF VARIABILITY

State A - Herbaceous vegetation regeneration, recently burned, sparsely vegetated; with < 10% tree or shrub canopy cover; early successional development

State B - Perennial herbaceous vegetation, with < 10% tree or shrub canopy cover; mid successional development

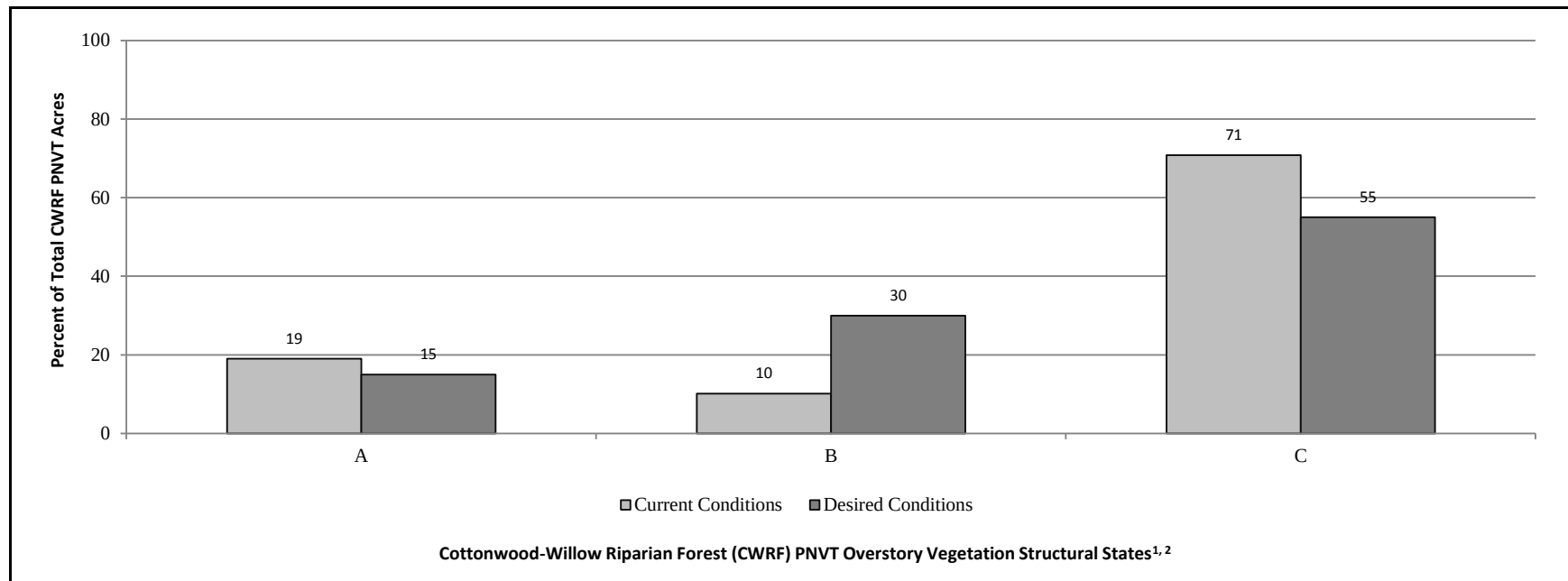
State C - Shrubs, and seedling and sapling size (< 5" diameter) trees with open (≥ 10% & ≤ 30%) or closed (> 30%) canopy cover, with perennial herbaceous understory vegetation; mid successional development

STRUCTURAL STATE NOT PART OF THE HISTORIC LANDSCAPE CONDITIONS OR WITHIN HISTORIC RANGE OF VARIABILITY, FOUND ON CONTEMPORARY LANDSCAPES ONLY

State D - Shrubs, small size (5"-9.9" diameter), medium size (10"-19.9" diameter), and large to very large size (≥ 20" diameter) trees with open or closed canopy cover, with herbaceous understory vegetation; late successional development; not part of the historic conditions or within historic range of variability, found on contemporary landscapes only

² WCRA PNVT has a 36% or low departure rating from Desired Conditions (DC) and Historical Range of Variability (HRV) making it the 7th and 9th most departed PNVT on the A-SNFs for DC and HRV, respectively. Desired Conditions were provided by the Regional Office, and HRV was derived from LANDFIRE (2003)

Cottonwood-Willow Riparian Forest PNVT



Appendix D figure 26. Cottonwood-willow riparian forest (CWRF) PNVT current and desired overstory vegetation structural states

¹ Cottonwood-Willow Riparian Forest (CWRF) PNVT Overstory Vegetation Structural States. At 15,876 acres or approximately 0.8% of the forests this PNVT ranks 12th in order of size out of the 14 PNVTs on the A-SNFs
STRUCTURAL STATES PART OF THE HISTORIC LANDSCAPE CONDITIONS OR WITHIN HISTORIC RANGE OF VARIABILITY

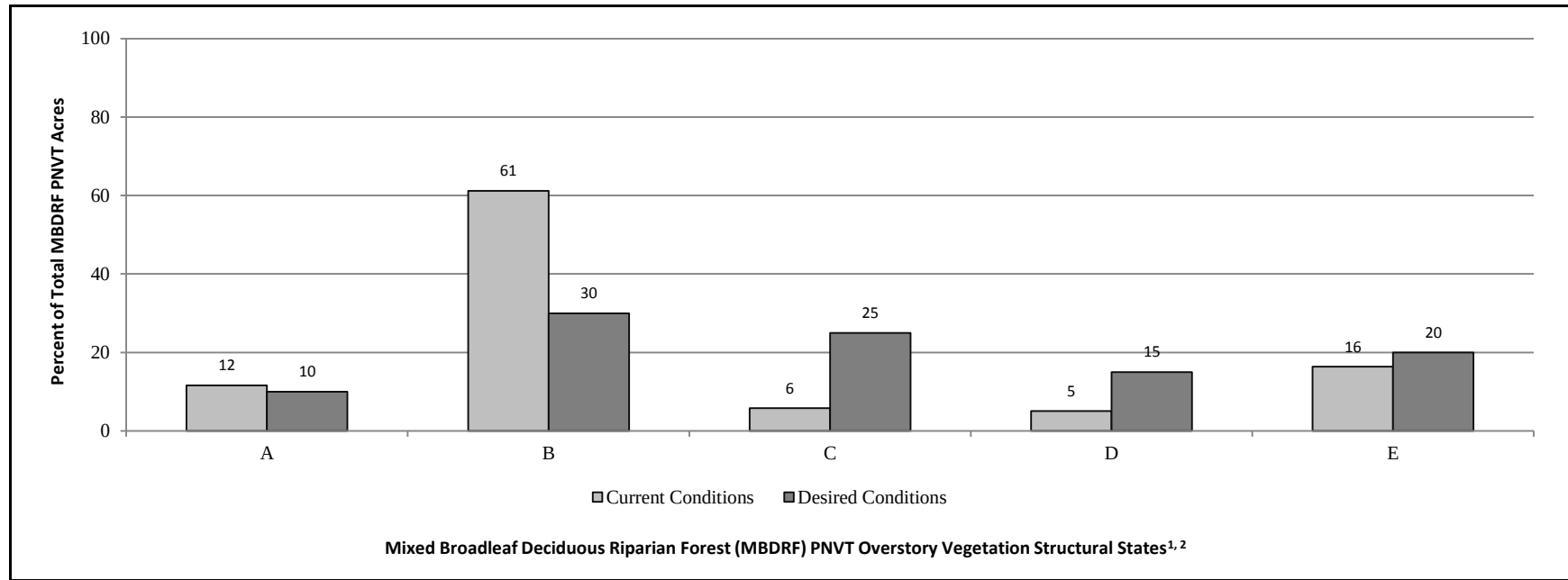
State A - Herbaceous vegetation dominated with shrubs, seedling and sapling size (< 5" diameter) trees with open ($\geq 10\%$ & $\leq 30\%$) or closed ($> 30\%$) canopy cover; early successional development

State B - Tall shrubs and small size (5-9.9" diameter) trees with open or closed canopy cover; mid successional development

State C - Medium size (10-19.9" diameter) and large to very large (≥ 20 " diameter) size trees; multi-storied, with open or closed canopy cover; late successional development

² CWRF PNVT has a 20% or no departure rating from Desired Conditions (DC) and Historical Range of Variability (HRV) making it the 11th and 13th most departed PNVT on the A-SNFs for DC and HRV, respectively. Desired Conditions were provided by the Regional Office, and HRV was derived from LANDFIRE (2007d)

Mixed Broadleaf Deciduous Riparian Forest PNVT



Appendix D figure 27. Mixed broadleaf deciduous riparian forest (MBDRF) PNVT current and desired overstory vegetation structural states

¹ Mixed Broadleaf Deciduous Riparian Forest (MBDRF) PNVT Overstory Vegetation Structural States. At 9,657 acres or approximately 0.5% of the forests this PNVT ranks 13th in order of size out of the 14 PNVTs on the A-SNFs
STRUCTURAL STATES PART OF THE HISTORIC LANDSCAPE CONDITIONS OR WITHIN HISTORIC RANGE OF VARIABILITY

State A - Herbaceous vegetation regeneration, recently burned, sparsely vegetated; with < 10% tree or shrub canopy cover; early successional development

State B - Shrubs, seedling and sapling size (< 5" diameter), small size (5"-9.9" diameter), and medium size (10"-19.9" diameter) trees with closed (> 30%) canopy cover; mid successional development

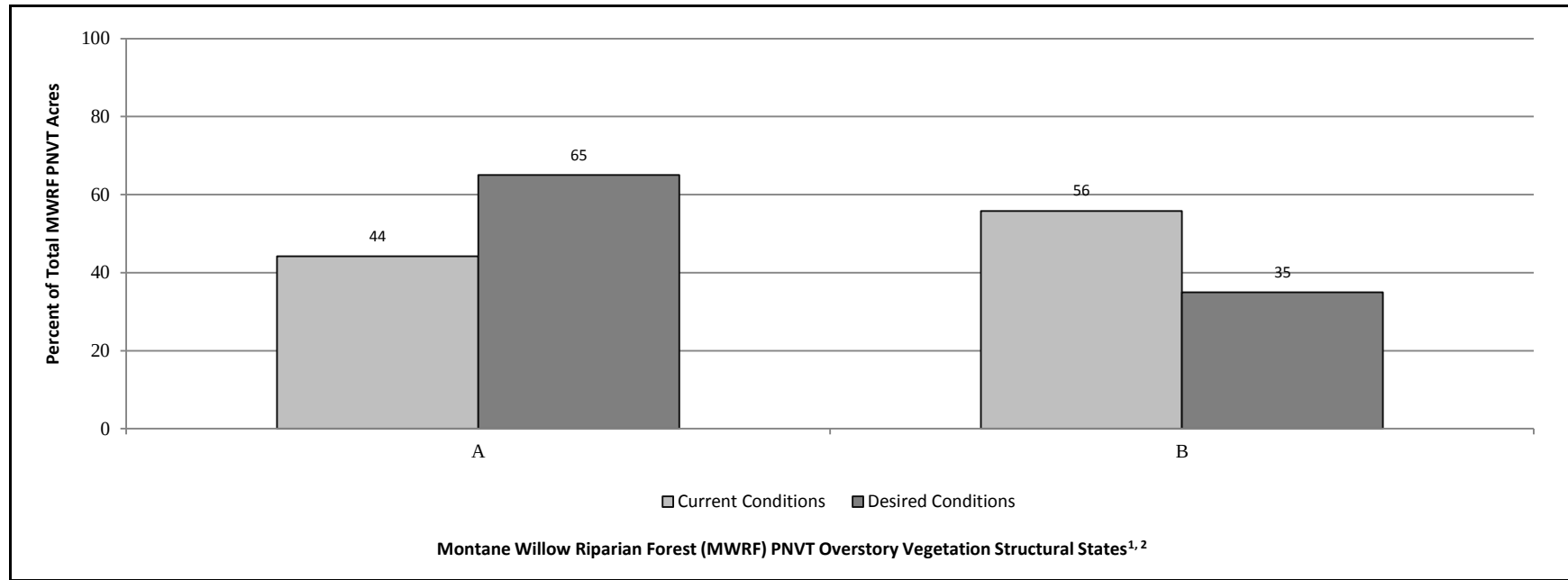
State C - Shrubs, seedling and sapling, and small size trees with open (≥ 10% & ≤ 30%) canopy cover; mid successional development

State D - Shrubs, medium size, and large to very large size (≥ 20" diameter) trees; multi-storied, with open canopy cover; late successional development

State E - Shrubs, medium size, and large to very large size trees; multi-storied, with closed canopy cover; late successional development

² MBDRF PNVT has a 33% or low departure rating from Desired Conditions (DC) and Historical Range of Variability (HRV) making it the 8th and 10th most departed PNVT on the A-SNFs for DC and HRV, respectively. Desired Conditions were provided by the Regional Office, and HRV was derived from LANDFIRE (2008)

Montane Willow Riparian Forest PNVT



Appendix D figure 28. Montane willow riparian forest (MWRF) PNVT current and desired overstory vegetation structural states

¹ Montane Willow Riparian Forest (MWRF) PNVT Overstory Vegetation Structural States. At 4,808 acres or approximately 0.2% of the forests this PNVT is the smallest on the A-SNFs

STRUCTURAL STATES PART OF THE HISTORIC LANDSCAPE CONDITIONS OR WITHIN HISTORIC RANGE OF VARIABILITY

State A - Herbaceous vegetation regeneration, recently burned, and shrubs, and seedling and sapling size (< 5" diameter) trees with open ($\geq 10\%$ & $\leq 30\%$) canopy cover; early successional development

State B - Shrubs, seedling and sapling, small size (5"-9.9" diameter) trees with closed ($> 30\%$) canopy cover, and medium size (10"-19.9" diameter), and large to very large (≥ 20 " diameter) size trees with open or closed canopy cover; mid to late successional development

² MWRF PNVT has a 21% or low departure rating from Desired Conditions (DC) and Historical Range of Variability (HRV) making it the 10th and 12th most departed PNVT on the A-SNFs for DC and HRV, respectively. Desired Conditions were provided by the Regional Office, and HRV was derived from LANDFIRE (2007e)

Appendix D - Addendum - Potential Natural Vegetation Types Current and Desired Herbaceous Understory Vegetation Conditions in Relation to Ecological Status and Range Condition and Departure from Desired Conditions on Capable Grazing Lands

Appendix D - Addendum table 1. A-SNFs’ potential natural vegetation types’ (PNVT) grazing capability and herbaceous understory vegetation ecological status, range condition data on the A-SNFs (USFS, 2008b) and departure from desired conditions

PNVT	No Capability ¹ Grazing Lands (DC departure status unknown)		Herbaceous Understory Vegetation Ecological Status ² and Range Condition ^{3,4} Ratings of Capable ⁵ Grazing Lands												Total PNVT Acres	2011 Wallow Fire Created or Maintained Very-poor Range Condition/Low Ecological Status Ratings ⁶		
			high ecological status				moderately-high ecological status		moderately-low ecological status		low ecological status		no data (DC departure status unknown)				total acres	
			excellent range condition		good range condition		fair range condition		poor range condition		very-poor range condition							
	acres	%	acres	%	acres	%	acres	%	acres	%	acres	%	acres	%	acres	%		
Forests																		
PPF	34,902	5.8	80	0.0	6,776	1.2	76,353	13.5	394,874	69.6	85,409	15.1	3,812	0.7	567,304	602,206	34,543	5.7
WMCF	97,266	54.6	89	0.1	2,827	3.5	17,119	21.2	48,496	60.1	11,533	14.3	665	0.8	80,729	177,995	62,244	35.0
DMCF	43,469	29.4	60	0.1	2,001	1.9	19,838	19.0	47,819	45.8	33,851	32.4	847	0.8	104,416	147,885	31,665	21.4
SFF	15,454	87.5	0	0.0	1,205	54.5	481	21.7	524	23.7	0	0.0	3	0.1	2,213	17,667	6,336	35.9
Subtotal	191,091	20.2	229	0.0	12,809	1.7	113,791	15.1	491,713	65.2	130,793	17.3	5,327	0.7	754,662	945,753	134,788	14.3
Woodlands																		
MPOW	171,651	43.5	0	0.0	24,074	10.8	83,437	37.4	98,703	44.2	4,312	1.9	12,749	5.7	223,275	394,927	6,013	1.5
PJW	7,504	3.4	18	0.0	1,265	0.6	17,363	8.1	164,152	76.5	28,773	13.4	3,091	1.4	214,662	222,166	2,808	1.3
Subtotal	179,155	29.0	18	0.0	25,339	5.8	100,800	23.0	262,855	60.0	33,085	7.6	15,840	3.6	437,937	617,093	8,821	1.4
Grasslands																		
GBG	627	0.3	0	0.0	1,187	0.6	17,767	9.6	128,068	69.3	32,896	17.8	4,979	2.7	184,897	185,523	413	0.2
SDG	21,301	19.9	0	0.0	3,236	3.8	25,533	29.8	42,987	50.2	1,859	2.2	12,035	14.1	85,650	106,592	286	0.3
MSG	307	0.7	1,860	3.6	3,756	7.3	34,607	67.6	8,899	17.4	1,438	2.8	628	1.2	51,188	51,559	1,855	3.6
Subtotal	22,235	6.5	1,860	0.6	8,179	2.5	77,907	24.2	179,954	55.9	36,193	11.2	17,642	5.5	321,735	343,674	2,554	0.7
Chaparral																		
IC	31,403	56.1	0	0.0	299	1.2	11,756	47.8	9,789	39.8	0	0.0	2,734	11.1	24,578	55,981	2,783	5.0
Riparian Areas																		
WCRA	1,013	5.7	52	0.3	816	4.8	7,445	44.1	7,227	42.8	823	4.9	524	3.1	16,887	17,900	1,200	6.7
Riparian Forests																		
CWRF	427	2.7	0	0.0	111	0.7	1,542	10.0	8,839	57.2	4,496	29.1	461	3.0	15,449	15,876	248	1.6
MBDRF	1,476	15.3	0	0.0	1,209	14.8	1,619	19.8	4,172	51.0	348	4.3	833	10.2	8,181	9,657	27	0.3
MWRF	1,368	28.5	0	0.0	101	2.9	428	12.4	1,868	54.3	872	25.3	171	5.0	3,440	4,808	620	12.9
Subtotal	4,284	8.9	52	0.1	2,237	5.1	11,034	25.1	22,106	50.3	6,539	14.9	1,989	4.5	43,957	48,241	2,095	4.3
A-SNFs Total	428,168	21.3	2,159	0.1	48,863	3.1	315,288	19.9	966,417	61.1	206,610	13.1	43,532	2.8	1,582,869	2,010,742	150,755	7.4
Departure from DC	unknown		no departure		low departure		moderate departure		high departure		severe departure		unknown		severe departure			

¹ According to the USFS (2013), no capability areas are those which are inherently inaccessible to livestock or cannot be used by livestock under reasonable management while maintaining or moving toward desired conditions. Often, these areas produce low amounts of forage, are barren, consist of rock outcroppings and/or are otherwise inaccessible to livestock. No capability areas often correlate with areas termed unsuited or inherently unstable in some terrestrial ecosystem survey and terrestrial ecological unit inventory publications. They are typically classified as unsuited or inherently unstable due to the relationship of soils, vegetation and topography with slopes above 60 percent. These areas often erode soil at a faster rate than soil is developed but may still be functioning normally considering the site characteristics. These areas may have high productivity, however due to steepness are not readily utilized by livestock. Low forage producing sites or barren sites may also be classified as no capability regardless of slope. Because areas classified as having no grazing capability are not allocated for livestock grazing they are not usually evaluated for range condition and ecological status, therefore this information is generally not collected from these areas and is unavailable, or incomplete. In addition, other resource program areas do not generally collect this same type of data as well, so again, this type of information is not available outside of capable grazing areas

² Ecological status is the degree of similarity between the existing vegetation (all components and their characteristics) and existing soil conditions compared to the potential natural plant community and the desired soil condition on a site. The present state of a terrestrial ecosystem survey map unit stated in terms of specific values or potentials with respect to species composition, ground cover, and soil characteristics. Ecological status is often evaluated on the basis of similarity indices between current conditions and the potential natural plant community (USFS, 2013). Ecological status ratings are: high, moderately-high, moderate-low, and low (FSH 2209.21. R3). See Appendix D - addendum table 2

³ Range condition is the present state of vegetation of a range site in relation to the climax (potential natural) plant community for that site. It is an expression of the relative degree to which the kinds, proportions, and amounts of plants in a plant community resemble that of the climax plant community for the site (USFS, 2013). The adjective descriptions of range condition are: excellent, good, fair, poor and very-poor (FSH 2209.21. R3). See Appendix D - addendum table 2. According to Dyksterhuis (1948 and 1959), Holechek et al. (1989 and 1998), and Pieper and Beck (1990); range condition is measured in degrees of departure from climax: excellent range condition would represent climax, and very-poor range condition would represent the greatest departure from climax. The relationship between ecological status and range condition are: excellent and good range condition represents high ecological status, signifying no or low departure from desired conditions; fair range condition represents moderately-high ecological status, signifying moderate departure from desired conditions; poor range condition represents moderately-low ecological status, signifying high departure from desired conditions; and very-poor range conditions represent low ecological status, signifying severe departure from desired conditions. See Appendix D - addendum table 2

⁴ Range condition as evaluated and ranked by the Forest Service, is a subjective expression of the status or health of the vegetation and soil relative to the combined potential to produce a sound and stable biotic community. Soundness and stability are evaluated relative to a standard that encompasses the composition, density, and vigor of the vegetation, and physical characteristics of the soil (FSH 2209.21.40 R3, page 3 of 46). Although the *Allotment Analysis Handbook* (FSH 2209.21 R3) was officially removed from the directive system (however, it is still commonly used within Region 3 and the range vegetation scorecards are available at: http://fsweb.r3.fs.fed.us/range/Inventory_Monitoring/documents/rge-vegetation-scorecard-handbook.pdf), this definition is used because the above range condition information was derived (collected, calculated, and evaluated) using the procedures outlined in the FSH 2209.21 R3 over a number of years

⁵ According to the USFS (2013), capable areas are fully capable areas plus limited capability areas plus potentially capable areas. Full capability areas are those which can be used by grazing animals under reasonable and proper management while maintaining or moving toward desired conditions. Areas with satisfactory soil condition are normally assigned full capability. Maintenance of the satisfactory soil condition is the objective for management in these areas. Areas of impaired soil condition may also be included as full capability when management objectives for soil condition attributes are estimated to be achievable within reasonable time periods (e.g. 10-20 years). The relationship between capability and slope is often tied to erosion potential and the likelihood of access by livestock. Although exceptions may occur, slopes of 0-15 percent are commonly considered fully capable as are most slopes of 15-40 percent. Limited capability areas are those areas that have some natural characteristic(s) that limits the capability of these areas for grazing, however, do not totally prevent the area from being utilized by some level of grazing. Common situations of limited capability include slopes usually in excess of 40 percent but in some situations could be less and/or some areas with inherently unstable soils. These areas may or may not be low forage producing areas. Although these areas may have some inherent characteristics that limit the grazing management opportunities they may be functioning normally considering characteristics for the site. The limitations in these areas are naturally occurring; management will not change these limitations. However, with prudent management these areas can provide forage for livestock. Specific management of these areas may include additional impact mitigating infrastructure, shortened grazing times, and monitoring to ensure limiting characteristics are not exacerbated by grazing management. Generally, limited grazing capacity is estimated for these areas, depending upon the degree of limitations present (Holechek, 1989 and 1998). However, in some situations no grazing capacity may be assigned to limited capability areas. Interdisciplinary teams will assess local landscapes, and consistency with local directions such as land management plans to determine the appropriate capacity analysis. Potential capability areas are those which can be used by grazing animals under proper management but where such factors as available water, livestock access, management infrastructure, and sufficient vegetative ground cover and/or forage production are currently lacking. Soil condition may currently be impaired or unsatisfactory, however with proper management satisfactory soil condition could be achieved. These areas may also be in satisfactory soil condition, however are presently not usable by livestock due to limitations such as a lack of water, current accessibility or current poor distribution of livestock. These areas are different than limited capability because management may provide opportunities for change in the grazing capability classification. An example is a forested or woodland area, which once the overstory is reduced, increases in understory vegetation and herbaceous ground cover can be expected. Treated areas may be categorized as potential capability or as full capability rangelands, depending upon the sustainability of the treatment. Infrastructure must support the necessary grazing animal distribution. Potential capability is often assigned to areas of impaired or unsatisfactory soil condition. In these situations, impaired and unsatisfactory soil condition can be improved with proper management. Specific objectives can be developed for areas with impaired or unsatisfactory soil condition, such as an increase in vegetative ground cover to above soil loss tolerance levels per erosion prediction models and terrestrial ecosystem survey/ terrestrial ecological unit inventory information. Management practices are then designed to address those objectives

⁶ Values are a total of acres classified as high and moderate soil burn severity; 1) Low Soil Burn Severity - surface organic layers are not completely consumed and are still recognizable. Structural aggregate stability is not changed from its unburned condition, and roots are generally unchanged because the heat pulse below the soil surface was not great enough to consume or char any underlying organics. The ground surface, including any exposed mineral soil, may appear brown or black (lightly charred), and the canopy and herbaceous understory vegetation will likely appear “green.” 2) Moderate Soil Burn Severity - up to 80 percent of the pre-fire ground cover (litter and ground fuels) may be consumed but generally not all of it. Fine roots (~3/32 inch diameter) may be scorched but are rarely completely consumed over much of the area. The color of the ash on the surface is generally blackened with possible gray patches. There may be potential for recruitment of effective ground cover from scorched needles or leaves remaining in the canopy that will soon fall to the ground. The prevailing color of the site is often “brown” due to canopy needle and other vegetation scorch. Soil structure is generally unchanged. 3) High Soil Burn Severity - all or nearly all of the pre-fire ground cover and surface organic matter (litter, duff, and fine roots) is generally consumed and charring may be visible on larger roots. The prevailing color of the site is often “black” due to extensive charring. Bare soil or ash is exposed and susceptible to erosion, and aggregate structure may be less stable. White or gray ash (up to several centimeters in depth) indicates that considerable ground cover or fuels were consumed. Sometimes very large tree roots (> 3 inch diameter) are entirely burned extending from a charred stump hole. Soil is often gray, orange, or reddish at the ground surface where large fuels were concentrated and consumed

Appendix D - Addendum table 2. Crosswalk relationship between community similarity index, ecological status¹, desired vegetation status, range condition (numerical and adjective), ecological condition, relationship to vegetation climax conditions, similarity to potential natural [vegetation] community, successional status, ecological status (numerical and adjective), and departure from desired understory vegetation conditions (DCs) on the A-SNFs

Region 3 Rangeland Analysis and Management Training Guide (2013 update Pages 2-14 and 2-21) ²			Allotment Analysis Handbook FSH 2209.21 R-3. (FSM 2209.21.40 Page 22 of 46) ³			Relationship to Vegetation Climax Conditions According to Dyksterhuis (1948 and 1959); Holechek et al. (1989 and 1998); and Pieper and Beck (1990) ⁴	Similarity to Potential Natural [Vegetation] Community and Successional Status (Winward 2000) ⁵		Apache-Sitgreaves National Forests’ Ecological Status and Departure from Desired Conditions		
community similarity index (percent)	ecological status (approximate)	desired vegetation status	numerical rating of range condition (percent)	adjective description of range condition	adjective description of ecological condition		numerical rating of similarity to potential natural [vegetation] community	adjective description of successional status	numerical rating of ecological status (percent)	adjective description of ecological status	understory vegetation departure from DCs
67 - 100	high similarity to late seral stage or potential natural [vegetation] community	high similarity to desired plant community	81 - 100	excellent	high	climax; maximum cover and productivity	86 - 100	potential natural [vegetation] community	81 - 100	high	no departure
			67 - 80	good	high		81 - 85	late seral			
			61 - 66	good	high		67 - 80	late seral			
34 - 66	mid similarity to late seral stage or potential natural [vegetation] community	moderate similarity to desired plant community	41 - 60	fair	moderately-high	high seral	61 - 66	late seral	61 - 66	high	low departure
			34 - 40	poor	moderately-low		41 - 60	mid seral			
			21 - 33	poor	moderately-low		34 - 40	early seral			
0 - 33	low similarity to late seral stage or potential natural [vegetation] community	low similarity to desired plant community	0 - 20	very poor	low	low seral	21 - 33	early seral	21 - 33	moderately-low	high departure
							16 - 20	early seral			
							0 - 15	very early seral			

¹ Ecological status is sometimes referred to as “successional status, successional stage, or seral stage” and refers to the relative position of, in this case, a plant community in relationship to climax (Burton, T.A.; Smith, S.J.; and Cowley, E.R. 2011. Riparian area management: multiple indicator monitoring (MIM) of stream channels and streamside vegetation. Technical Reference 1737-23. BLM/OC/ST-10/003+1737+REV. U.S. Department of the Interior, Bureau of Land Management, National Operations Center, Denver, CO. 155 p.)

² USFS. 2013 revision of 1997 and 1999 documents. Region 3 rangeland analysis and management training guide, revised chapter 2 • rangeland inventory (Pp. 2-1 through 2-12A-G). Multiple revisions throughout the original 1997 document. USDA Forest Service, Southwestern Region. Albuquerque, NM. 224 p

³ USFS. 1988. FSH 2209.21 R-3. Allotment analysis handbook, as amended. (Designated range analysis guide in 2001, and removed from the Forest Service Directive System. However, the range vegetation scorecards are still available for use at http://fsweb.r3.fs.fed.us/range/Inventory_Monitoring/documents/rge-vegetation-scorecard-handbook.pdf). USDA Forest Service, Region-3. Albuquerque, NM. 379 p

⁴ Dyksterhuis, E.J. 1949. Condition and management of rangeland based on quantitative ecology. *Journal of Range Management* 2(3): 104-115

Dyksterhuis, E.J. 1958. Ecological principles in range evaluation. *Botanical Review* 24: 253-272

Holechek, J.L.; Pieper, R.D.; and Herbel, C.H. 1989. *Range Management: Principles and Practices*. Prentise-Hall, Inc. Englewood Cliffs, NJ. 501 p

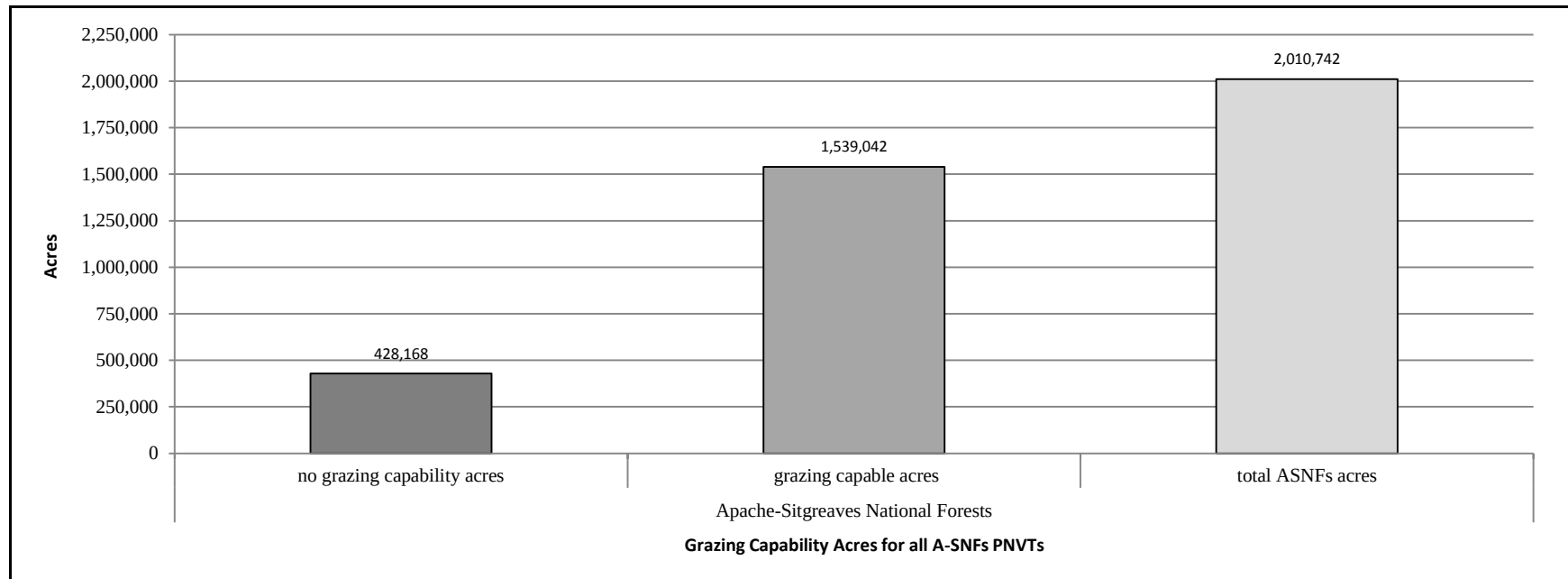
Pieper, R.D.; and Beck, R.F. 1990. Range condition from an ecological perspective: modifications to recognize multiple use objectives. *Journal of Range Management* 43(6): 550-552

Holechek, J.L.; Pieper, R.D.; and Herbel, C.H. 1998. *Range Management: Principles and Practices*, 3rd ed. Prentise-Hall, Inc. Upper Saddle River, NJ. 542 p

⁵ Winward, A.H. 2000. Monitoring the vegetation resources in riparian areas. General Technical Report RMRS-GTR-47. USDA Forest Service, Rocky Mountain Research Station, Ogden, UT. 49 p

All A-SNFs PNTVs

Total Grazing Capability acres of all A-SNFs PNTVs Combined



Appendix D - Addendum figure 1. Comparison of no grazing capability acres to grazing capable acres for all PNTVs combined on the A-SNFs

When combining all of the A-SNFs' PNTVs there are more capable grazing acres than no grazing capability acres. See Appendix D - addendum figure 2 as to the specific herbaceous understory vegetation ecological status³⁴ range condition^{35, 36} and departures from desired conditions of the capable³⁷ grazing lands on the Forests.

³⁴ See footnote 2 in Appendix D - addendum table 1

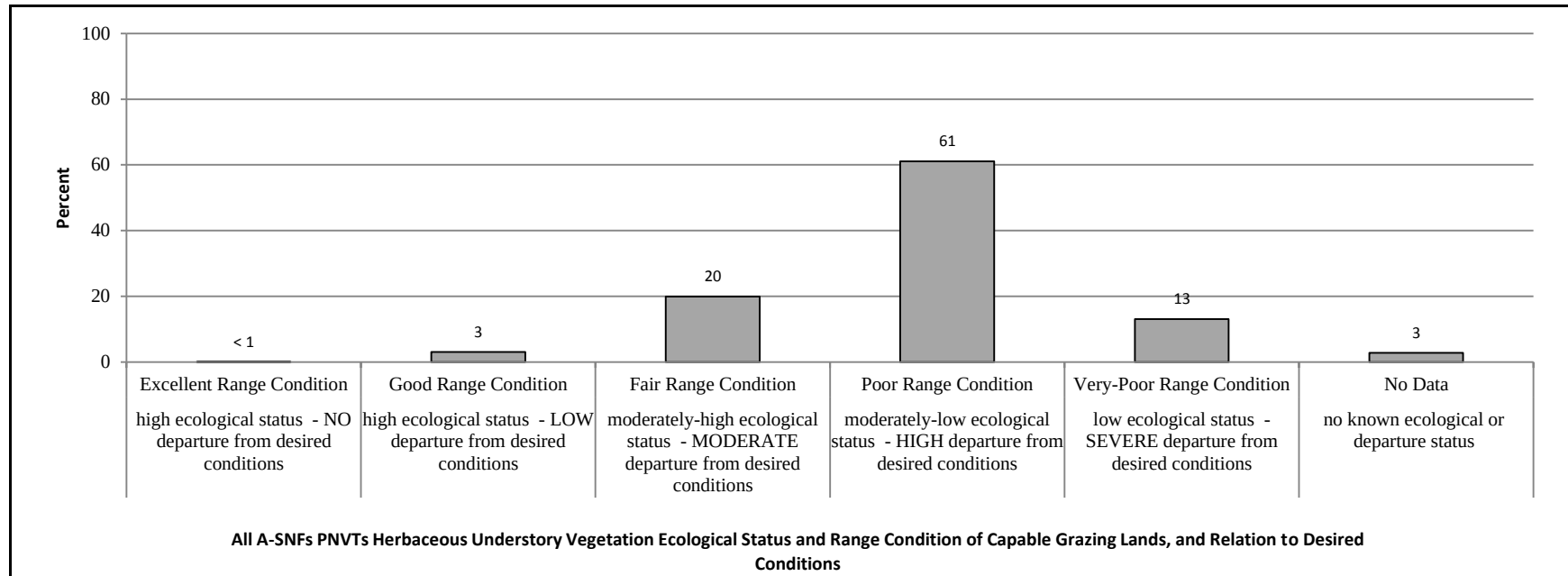
³⁵ See footnote 3 in Appendix D - addendum table 1

³⁶ See footnote 4 in Appendix D - addendum table 1

³⁷ See footnote 5 in Appendix D - addendum table 1

All A-SNFs PNVTs

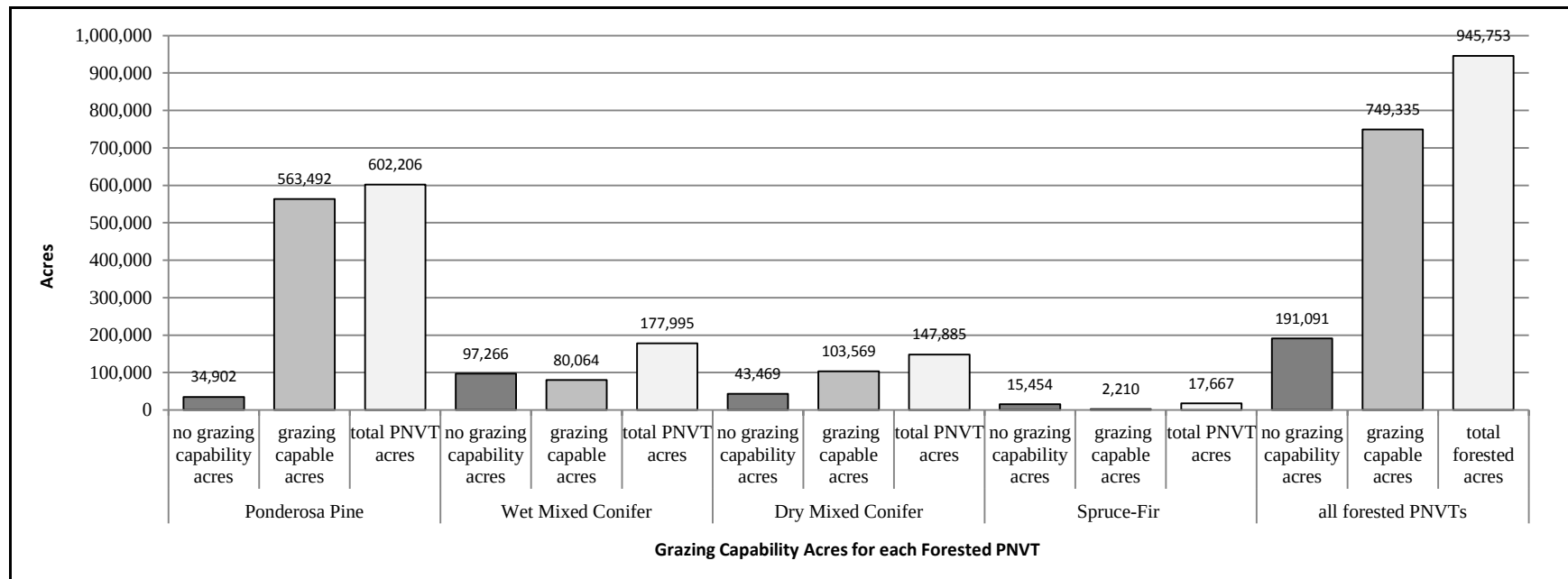
Herbaceous Understory Vegetation Range Condition, Ecological Status and Departure from Desired Condition of all A-SNFs PNVTs Combined



Appendix D - Addendum figure 2. Current herbaceous understory vegetation ecological status and range condition of all the A-SNFs PNV lands capable of supporting livestock grazing, and departure from desired conditions. The amount of capable grazing lands not meeting desired conditions, roughly 74 percent for all A-SNFs PNVs

Forested PNVTs

Total Grazing Capability acres of all Forested PNVTs

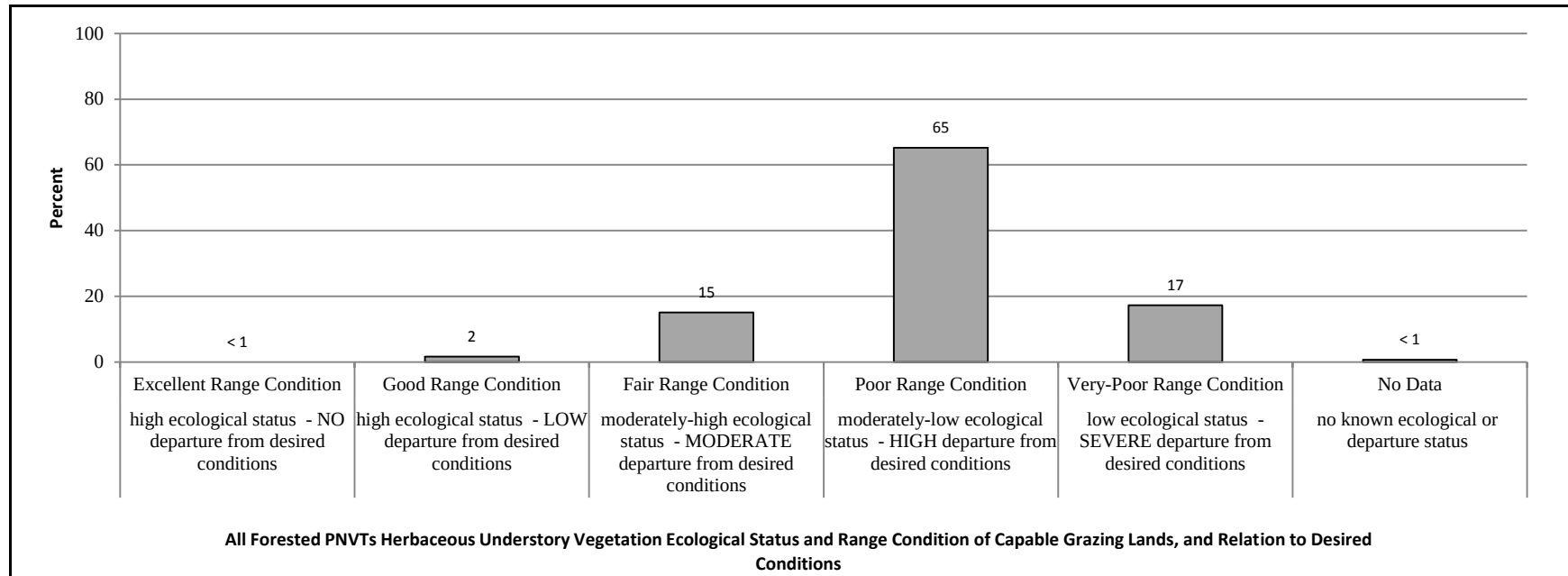


Appendix D - Addendum figure 3. Comparison of no grazing capability acres to grazing capable acres and total acres within the ponderosa pine, wet mixed conifer, dry mixed conifer and spruce-fir forests, and all forested PNVTs combined on the A-SNFs

Within the forested PNVTs, both wet mixed conifer and spruce-fir have more acres within the no grazing capability category than capable grazing acres; 97,266 versus 80,064 acres within the WMCF, and 15,454 acres versus 2,210 acres within the SFF. PPF is the largest PNVT on the A-SNFs at 602,206 acres and ranks 4th out of the 14 PNVTs in the amount of no capability grazing lands at 34,902 acres (nearly 6% of the PNVT). WMCF PNVT is the 5th largest on the A-SNFs at 177,995 acres and ranks 2nd out of the 14 PNVTs in the amount of no capability grazing lands at 97,266 acres (nearly 55% of the PNVT). DMCF PNVT is the 6th largest on the A-SNFs at 147,885 acres and ranks 3rd out of the 14 PNVTs in the amount of no capability grazing lands at 43,468 acres (just over 29% of the PNVT). SFF PNVT is the 11th largest on the A-SNFs at 17,667 acres and ranks 7th out of the 14 PNVTs in the amount of no capability grazing lands at 15,454 acres (nearly 88% of the PNVT). See Appendix D - addendum figures 4 through 8 as to the specific herbaceous understory vegetation ecological status³⁴, range condition^{35, 36}, and departures from desired conditions of the capable³⁷ grazing lands within the ponderosa pine, wet mixed conifer, dry mixed conifer and spruce-fir forest PNVTs.

Forested PNVTs

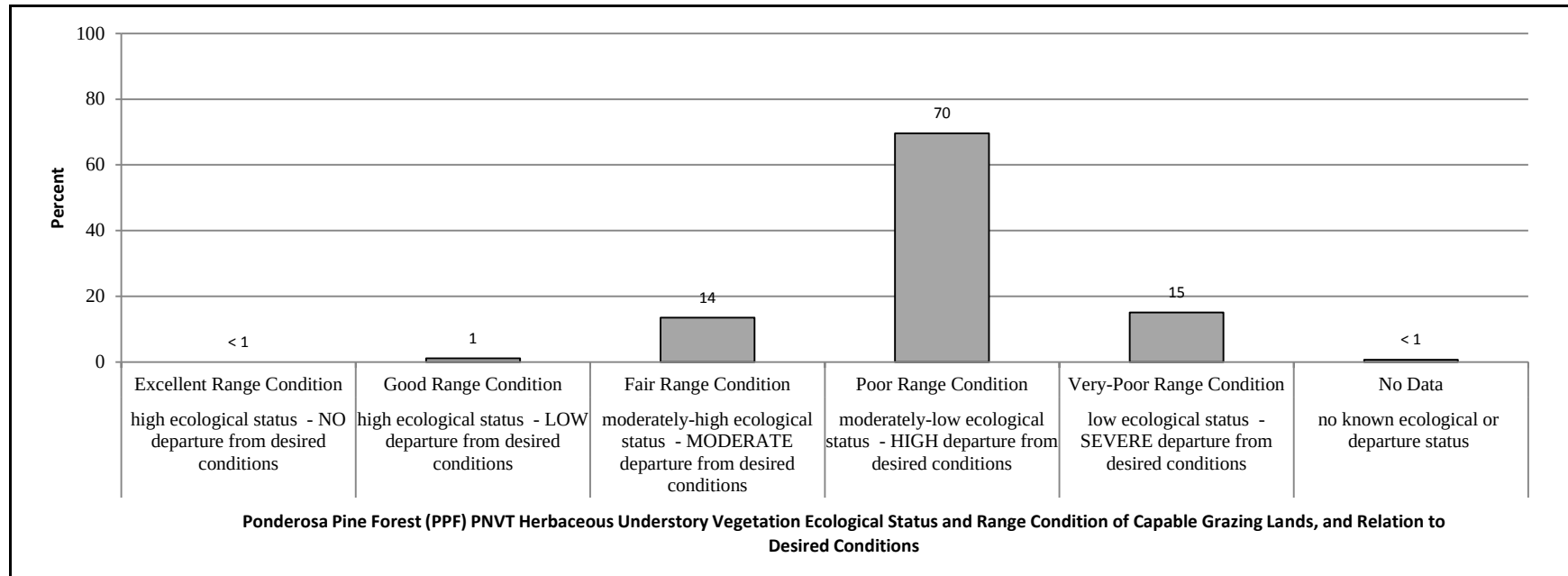
Herbaceous Understory Vegetation Range Condition, Ecological Status and Departure from Desired Condition of all Forested PNVTs Combined



Appendix D - Addendum figure 4. Current herbaceous understory vegetation ecological status³⁴ and range condition^{35, 36} of all the forested PNVTs lands capable³⁷ of supporting livestock grazing, and departure from desired conditions. Overall, of the 5 major vegetation types found on the A-SNFs, forests rank 1st in the amount of capable grazing lands not meeting desired conditions, roughly 83 percent

Ponderosa Pine Forest PNVT

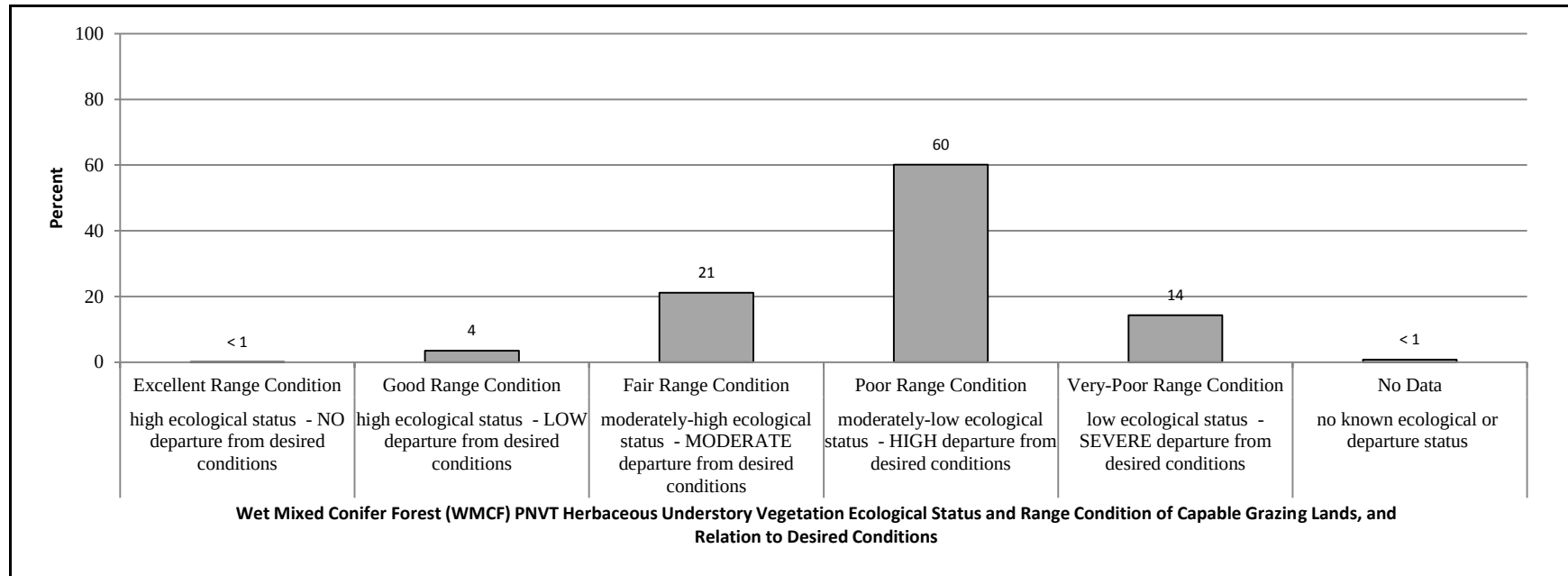
Herbaceous Understory Vegetation Range Condition, Ecological Status and Departure from Desired Condition of the Ponderosa Pine Forest PNVT



Appendix D - Addendum figure 5. Ponderosa Pine Forest (PPF) PNVT current herbaceous understory vegetation ecological status³⁴ and range condition^{35, 36} of the lands capable³⁷ of supporting livestock grazing, and departure from desired conditions. PPF ranks 4th out of the 14 PNVTs in the amount of capable grazing lands not meeting desired conditions, roughly 85 percent

Wet Mixed Conifer Forest PNVT

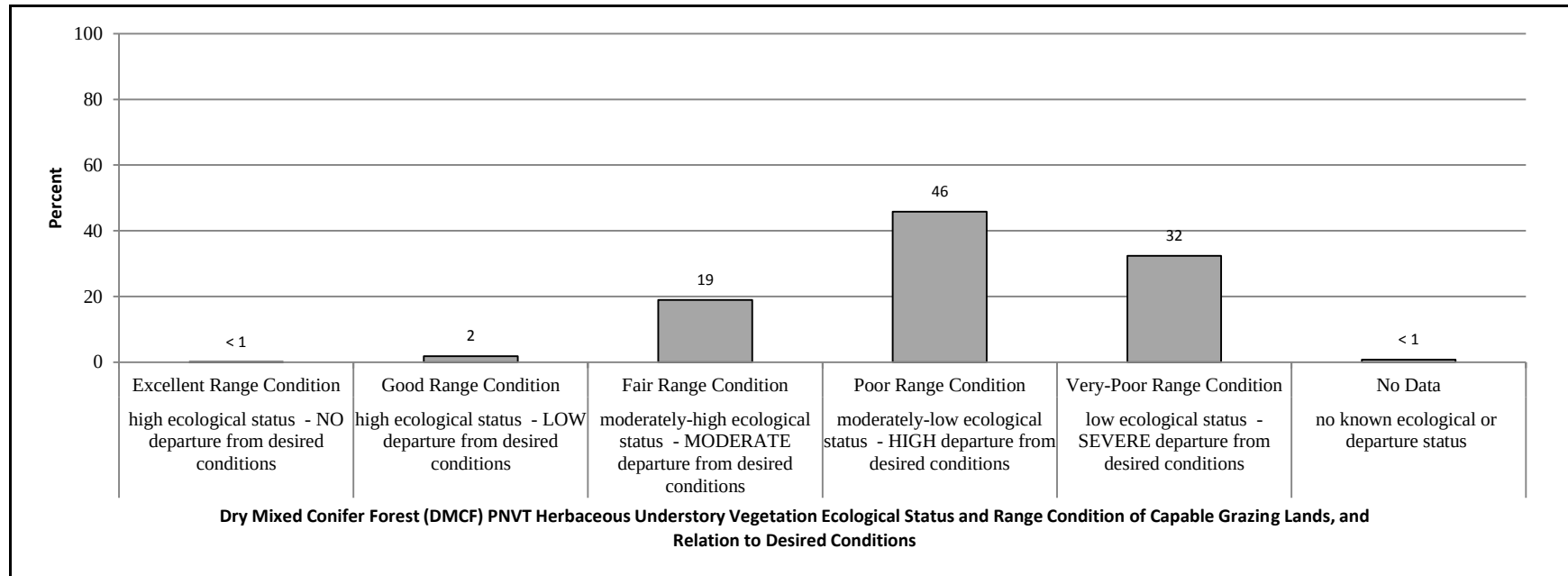
Herbaceous Understory Vegetation Range Condition, Ecological Status and Departure from Desired Condition of the Wet Mixed Conifer Forest PNVT



Appendix D - Addendum figure 6. Wet Mixed Conifer Forest (WMCF) PNVT current herbaceous understory vegetation ecological status³⁴ and range condition^{35, 36} of the lands capable³⁷ of supporting livestock grazing, and departure from desired conditions. WMCF ranks 7th out of the 14 PNVTs in the amount of capable grazing lands not meeting desired conditions, roughly 74 percent

Dry Mixed Conifer Forest PNVT

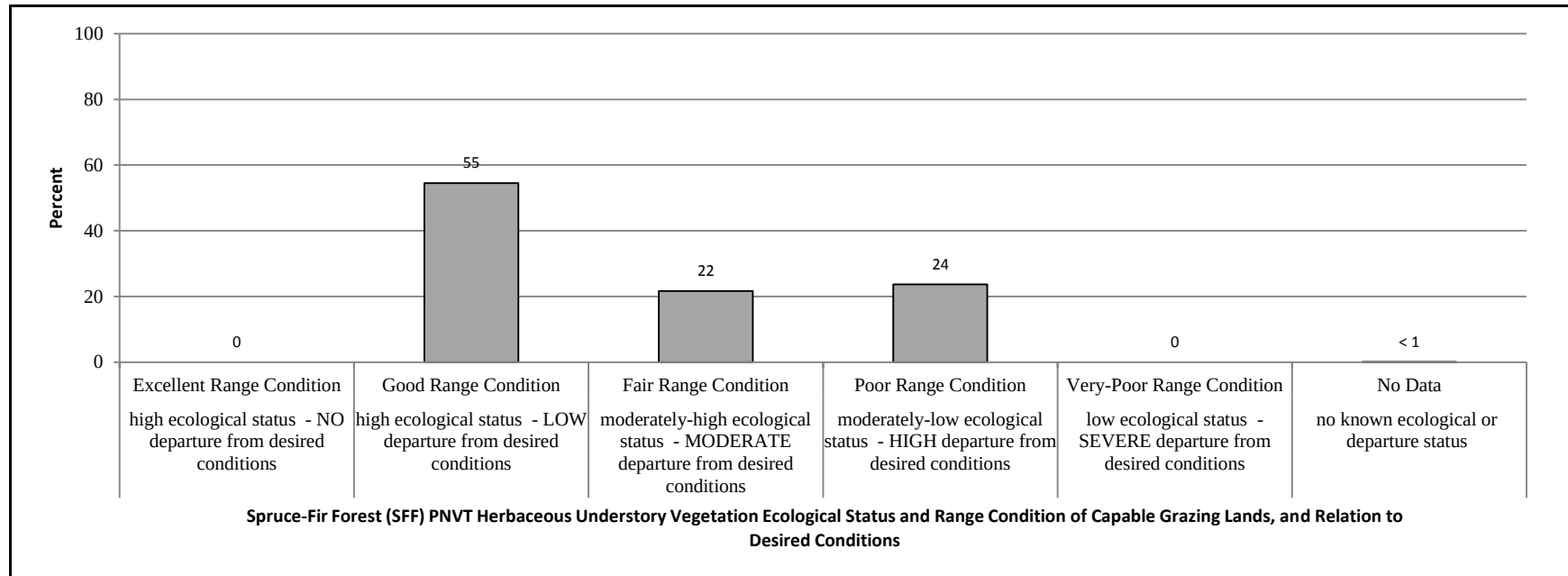
Herbaceous Understory Vegetation Range Condition, Ecological Status and Departure from Desired Condition of the Dry Mixed Conifer Forest PNVT



Appendix D - Addendum figure 7. Dry Mixed Conifer Forest (DMCF) PNVT current herbaceous understory vegetation ecological status³⁴ and range condition^{35, 36} of the lands capable³⁷ of supporting livestock grazing, and departure from desired conditions. DMCF ranks 6th out of the 14 PNVTs in the amount of capable grazing lands not meeting desired conditions, roughly 78 percent

Spruce-Fir Forest PNVT

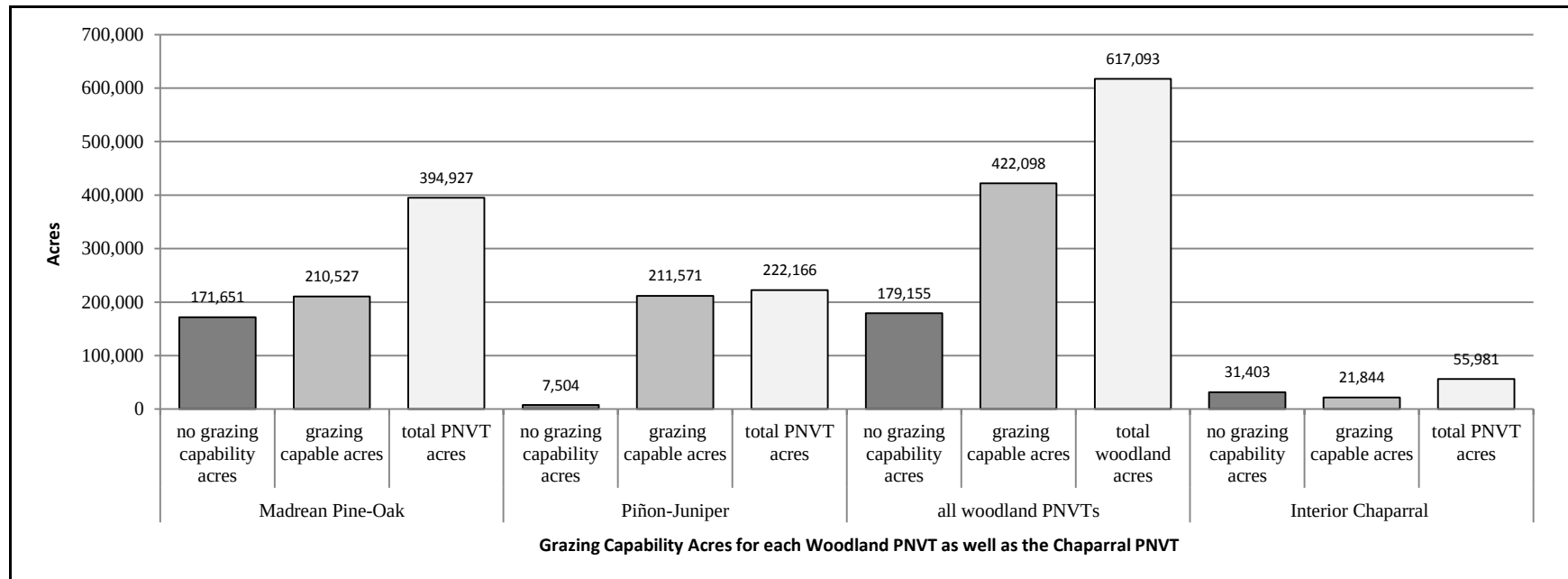
Herbaceous Understory Vegetation Range Condition, Ecological Status and Departure from Desired Condition of the Spruce-Fir Forest PNVT



Appendix D - Addendum figure 8. Spruce-Fir Forest (SFF) PNVT current herbaceous understory vegetation ecological status³⁴ and range condition^{35, 36} of the lands capable³⁷ of supporting livestock grazing, and departure from desired conditions. SFF ranks 13th out of the 14 PNVTs in the amount of capable grazing lands not meeting desired conditions, roughly 24 percent

Woodland PNVTs

Grazing Capability acres of all Woodland PNVTs and Chaparral PNVT

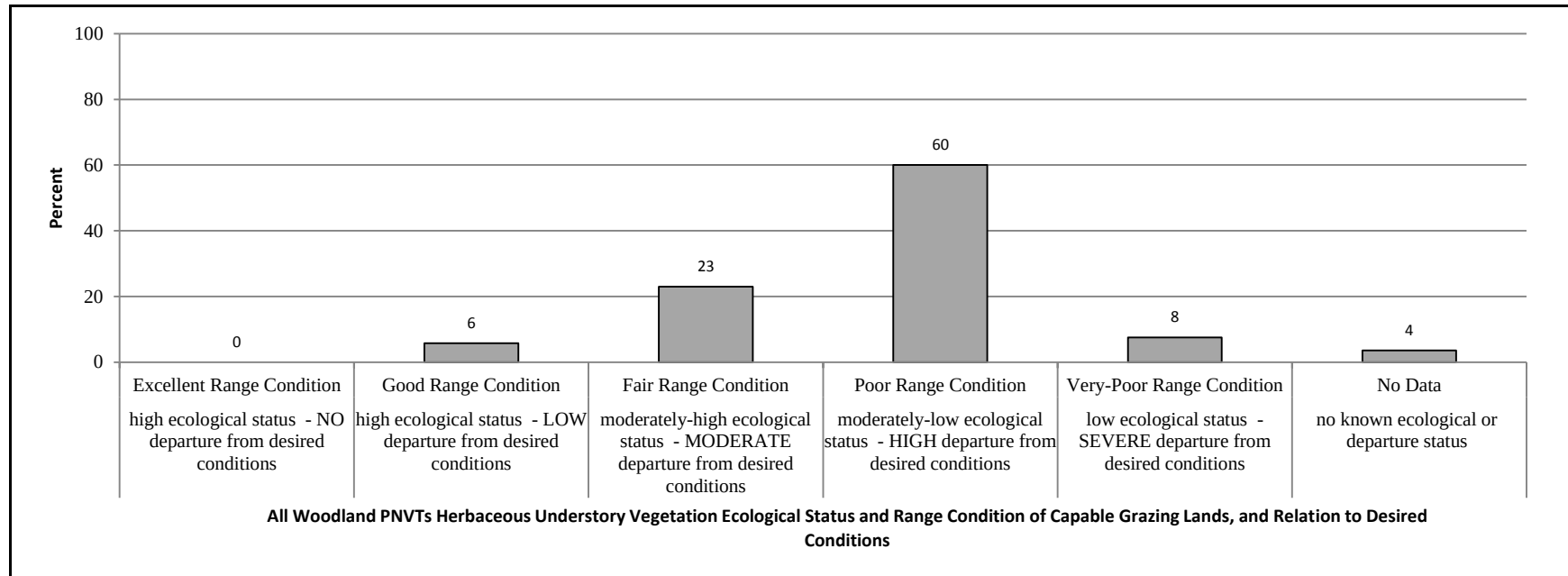


Appendix D - Addendum figure 9. Comparison of no grazing capability acres to grazing capable acres and total acres within Madrean pine-oak and piñon-juniper woodlands, and all woodland PNVTs combined, as well as the interior chaparral PNVT on the A-SNFs

Within the woodland and chaparral PNVTs, only interior chaparral has more acres within the no grazing capability category than capable grazing acres; 31,403 acres versus 21,844 acres. MPOW PNVT is the 2nd largest on the A-SNFs at 394,927 acres and ranks 1st out of the 14 PNVTs in the amount of no capability grazing lands at 171,651 acres (nearly 44% of the PNVT). PJW PNVT is the 3rd largest on the A-SNFs at 222,166 acres and ranks 8th out of the 14 PNVTs in the amount of no capability grazing lands at 7,504 acres (just over 3% of the PNVT). IC PNVT is the 8th largest on the A-SNFs at 55,981 acres and ranks 5th out of the 14 PNVTs in the amount of no capability grazing lands at 31,403 acres (just over 56% of the PNVT). See Appendix D - addendum figures 10 through 13 as to the specific herbaceous understory vegetation ecological status³⁴, range condition^{35, 36}, and departures from desired conditions of the capable³⁷ grazing lands within the Madrean pine-oak and piñon-juniper woodland PNVTs and interior chaparral PNVT.

Woodland PNVTs

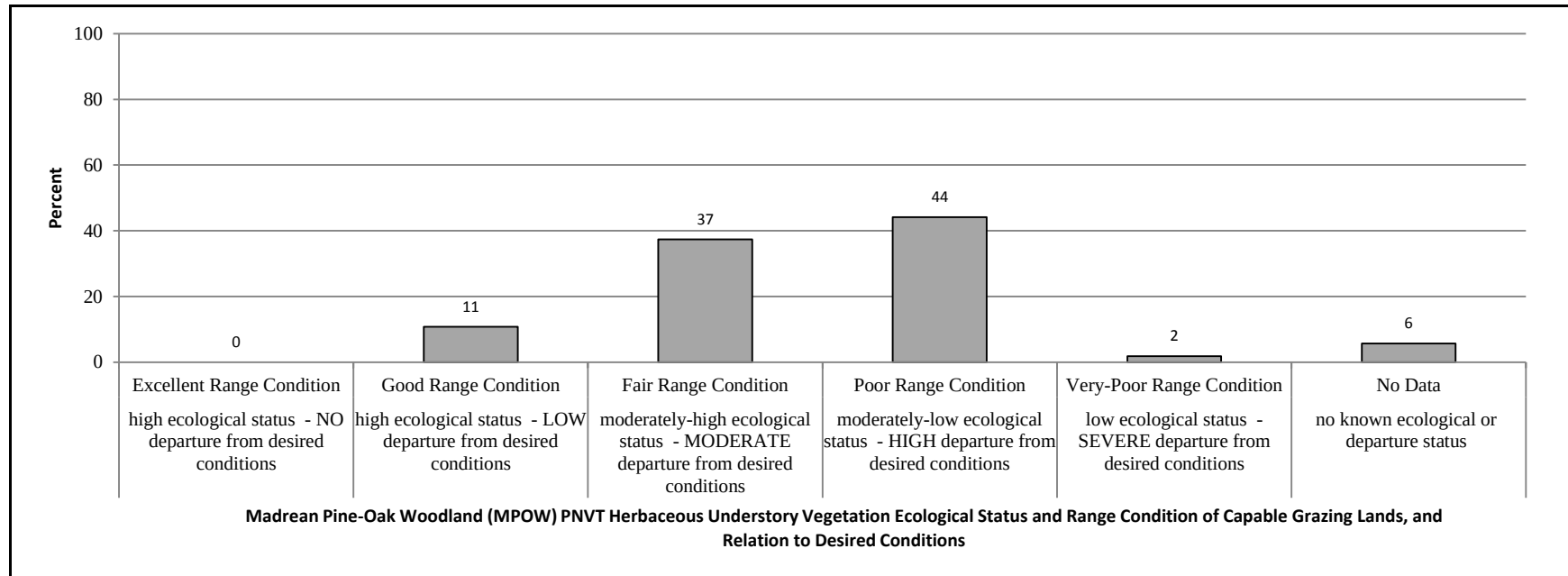
Herbaceous Understory Vegetation Range Condition, Ecological Status and Departure from Desired Condition of the All Woodland PNVTs Combined



Appendix D - Addendum figure 10. Current herbaceous understory vegetation ecological status³⁴ and range condition^{35, 36} of all the woodland PNVTs lands capable³⁷ of supporting livestock grazing, and departure from desired conditions. Overall, of the 5 major vegetation types found on the A-SNFs, woodlands rank 2nd in the amount of capable grazing lands not meeting desired conditions, roughly 68 percent

Madrean Pine-Oak Woodland PNVT

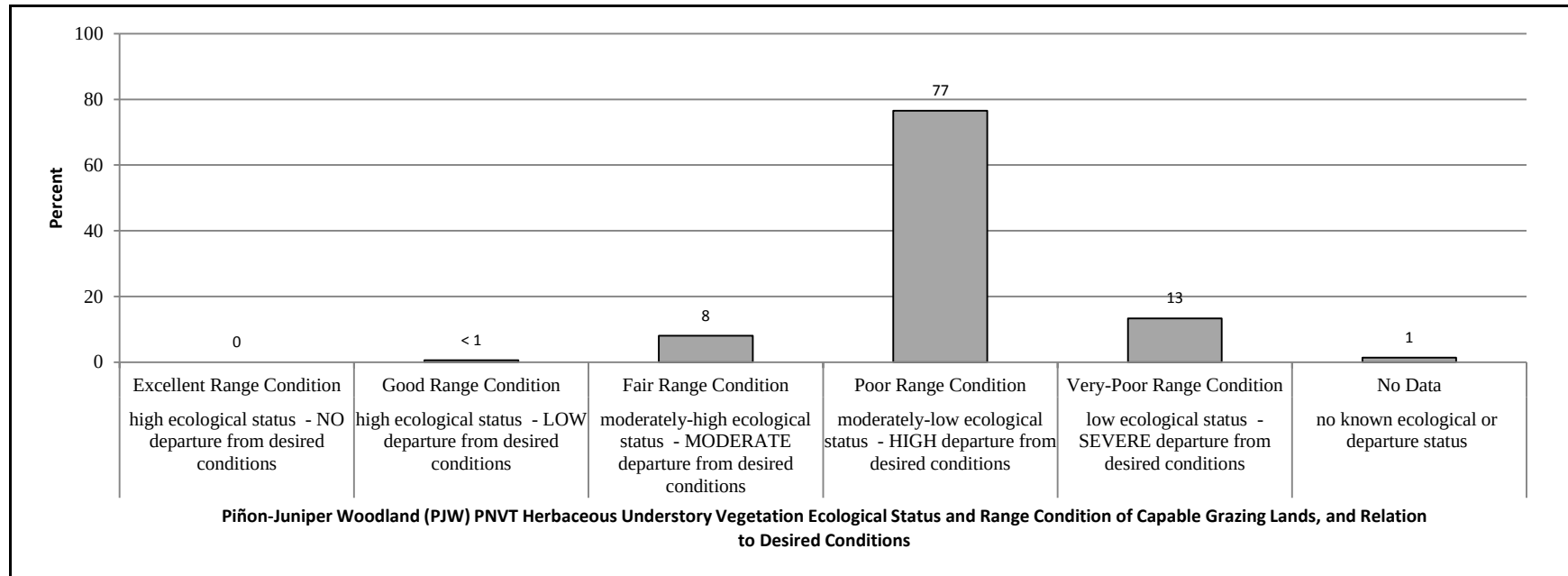
Herbaceous Understory Vegetation Range Condition, Ecological Status and Departure from Desired Condition of the Madrean Pine-Oak Woodland PNVT



Appendix D - Addendum figure 11. Madrean Pine-Oak Woodland (MPOW) PNVT current herbaceous understory vegetation ecological status³⁴ and range condition^{35, 36} of the lands capable³⁷ of supporting livestock grazing, and departure from desired conditions. MPOW ranks 11th out of the 14 PNVTs in the amount of capable grazing lands not meeting desired conditions, roughly 46 percent

Piñon-Juniper Woodland PNVT

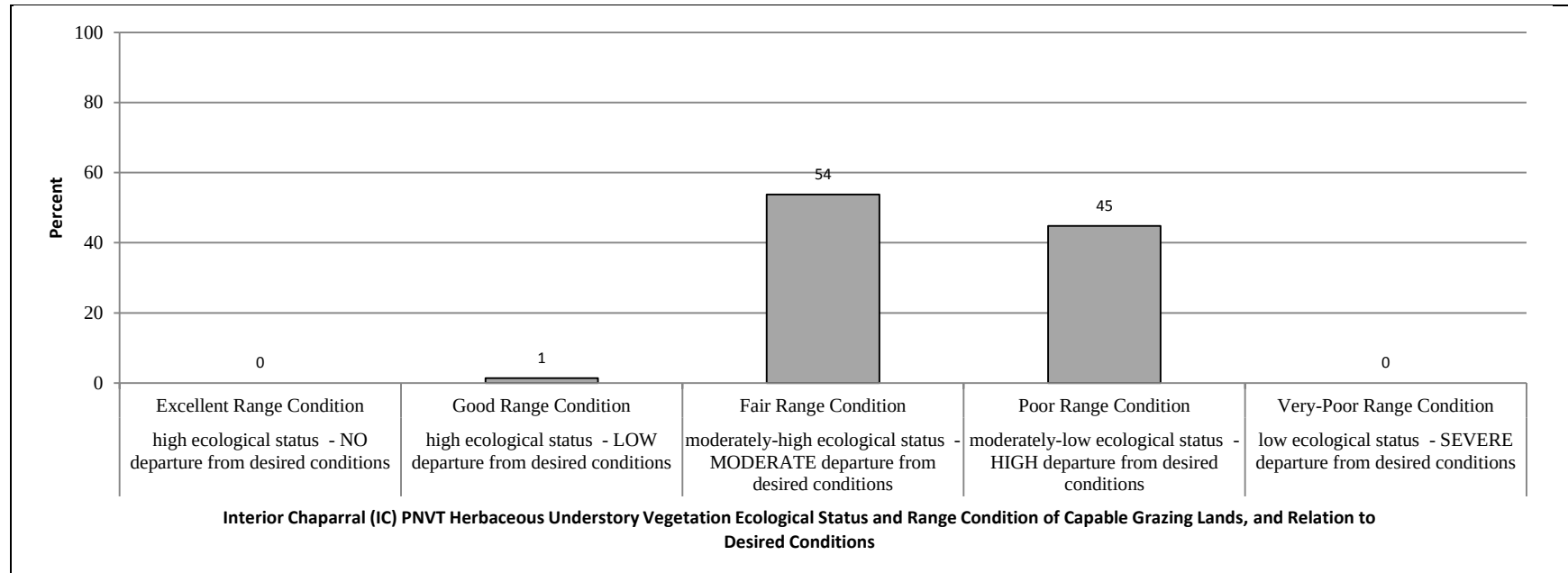
Herbaceous Understory Vegetation Range Condition, Ecological Status and Departure from Desired Condition of the Piñon-Juniper Woodland PNVT



Appendix D - Addendum figure 12. Piñon-Juniper Woodland (PJW) PNVT current herbaceous understory vegetation ecological status³⁴ and range condition^{35, 36} of the lands capable³⁷ of supporting livestock grazing, and departure from desired conditions. PJW ranks 1st out of the 14 PNVTs in the amount of capable grazing lands not meeting desired conditions, roughly 91 percent

Interior Chaparral PNVT

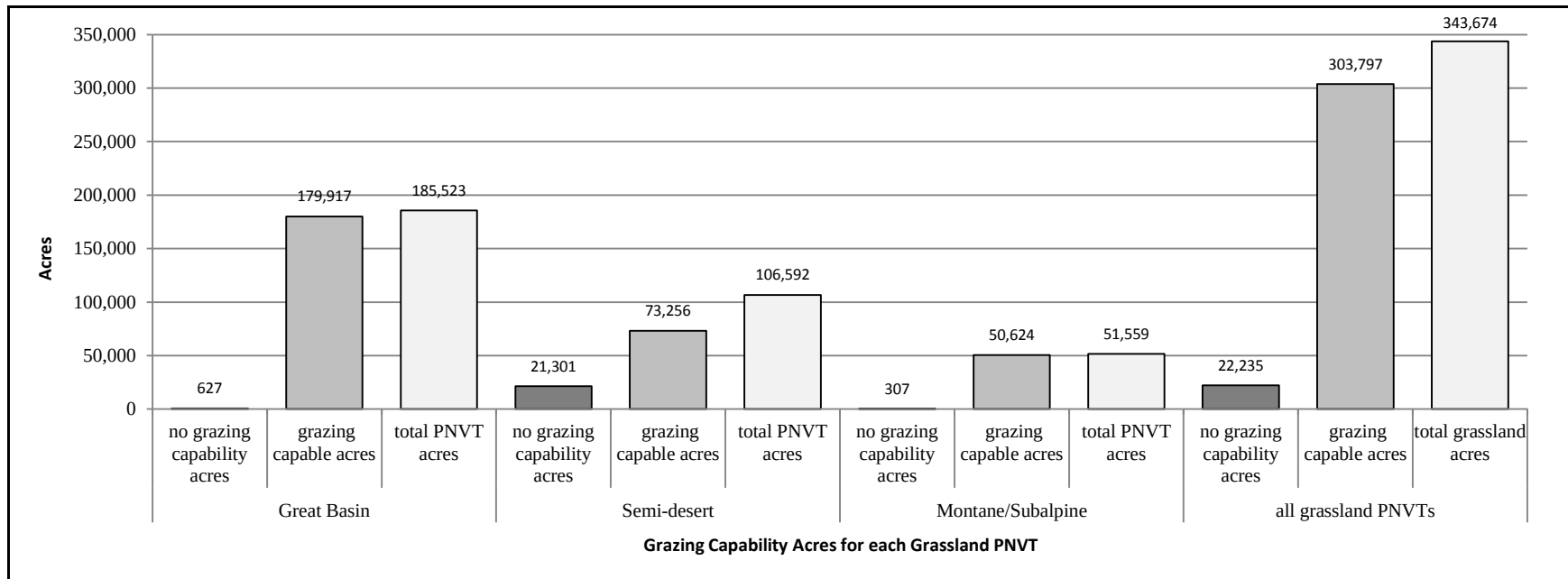
Herbaceous Understory Vegetation Range Condition, Ecological Status and Departure from Desired Condition of the Interior Chaparral PNVT



Appendix D - Addendum figure 13. Interior Chaparral (IC) PNVT current herbaceous understory vegetation ecological status³⁴ and range condition^{35, 36} of the lands capable³⁷ of supporting livestock grazing, and departure from desired conditions. IC ranks 12th out of the 14 PNVTs in the amount of capable grazing lands not meeting desired conditions, roughly 40 percent. Overall, of the 5 major vegetation types found on the A-SNFs, chaparral ranks 5th in the amount of capable grazing lands not meeting desired conditions

Grassland PNVTs

Grazing Capability acres of all Grassland PNVTs

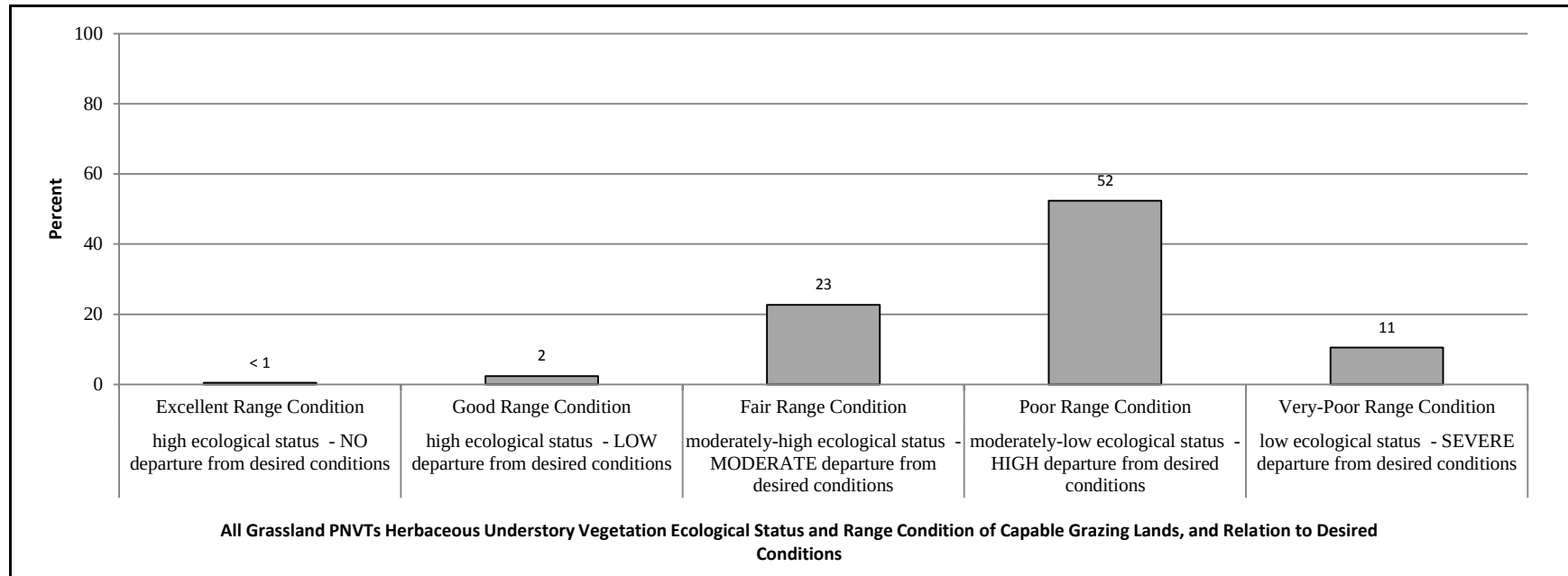


Appendix D - Addendum figure 14. Comparison of no grazing capability acres to grazing capable acres and total acres within the Great Basin, semi-desert and montane/subalpine grasslands, and all grassland PNVTs combined on the A-SNFs

All of the grassland PNVTs contain more capable grazing acres than no grazing capability acres. GBG PNVT is the 4th largest on the A-SNFs at 185,523 acres and ranks 12th out of the 14 PNVTs in the amount of no capability grazing lands at 627 acres (less than 1% of the PNVT). SDG PNVT is the 7th largest on the A-SNFs at 106,592 acres and ranks 6th out of the 14 PNVTs in the amount of no capability grazing lands at 21,301 acres (nearly 20% of the PNVT). MSG PNVT is the 9th largest on the A-SNFs at 51,559 acres and ranks last out of the 14 PNVTs in the amount of no capability grazing lands at 307 acres (nearly 1% of the PNVT). See Appendix D - addendum figures 15 through 18 as to the specific herbaceous understory vegetation ecological status³⁴, range condition^{35, 36}, and departures from desired conditions of the capable³⁷ grazing lands within the Great Basin, semi-desert and montane/subalpine grasslands PNVTs.

Grassland PNVTs

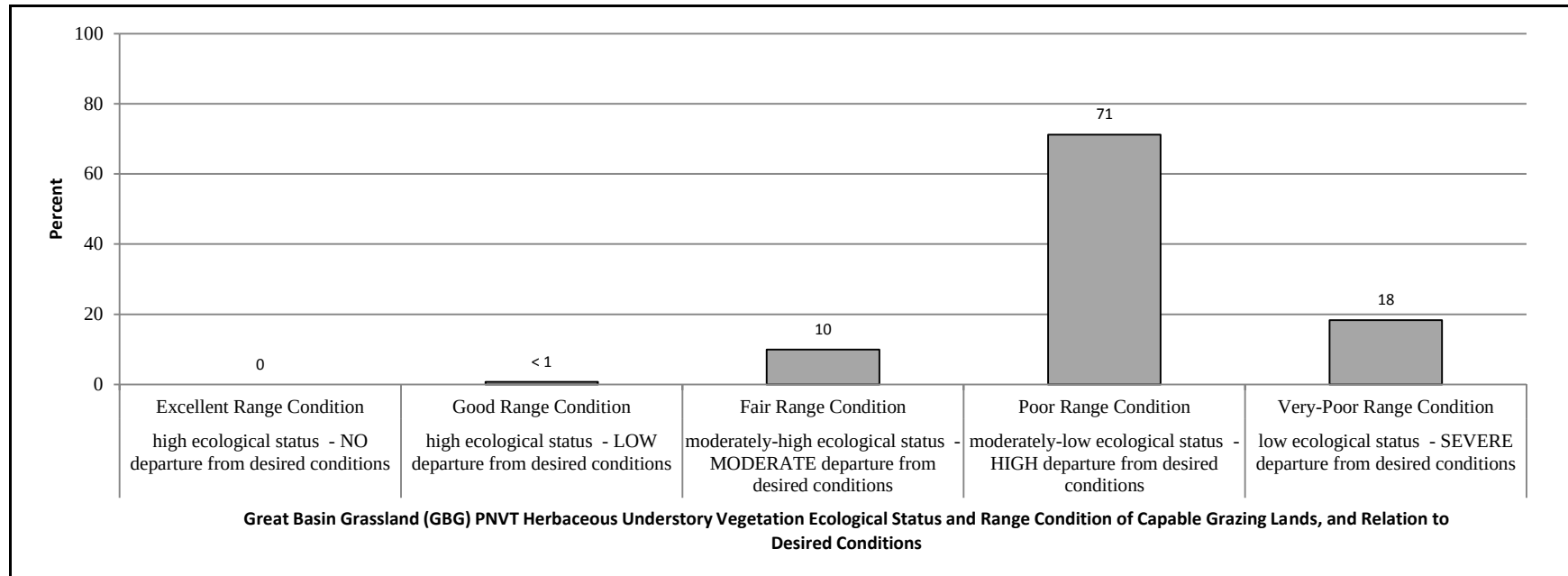
Herbaceous Understory Vegetation Range Condition, Ecological Status and Departure from Desired Condition of the All Grassland PNVTs Combined



Appendix D - Addendum figure 15. Current herbaceous understory vegetation ecological status³⁴ and range condition^{35, 36} of all the grassland PNVTs lands capable³⁷ of supporting livestock grazing, and departure from desired conditions. Overall, of the 5 major vegetation types found on the A-SNFs, grasslands rank 3rd in the amount of capable grazing lands not meeting desired conditions, roughly 67 percent

Great Basin Grassland PNVT

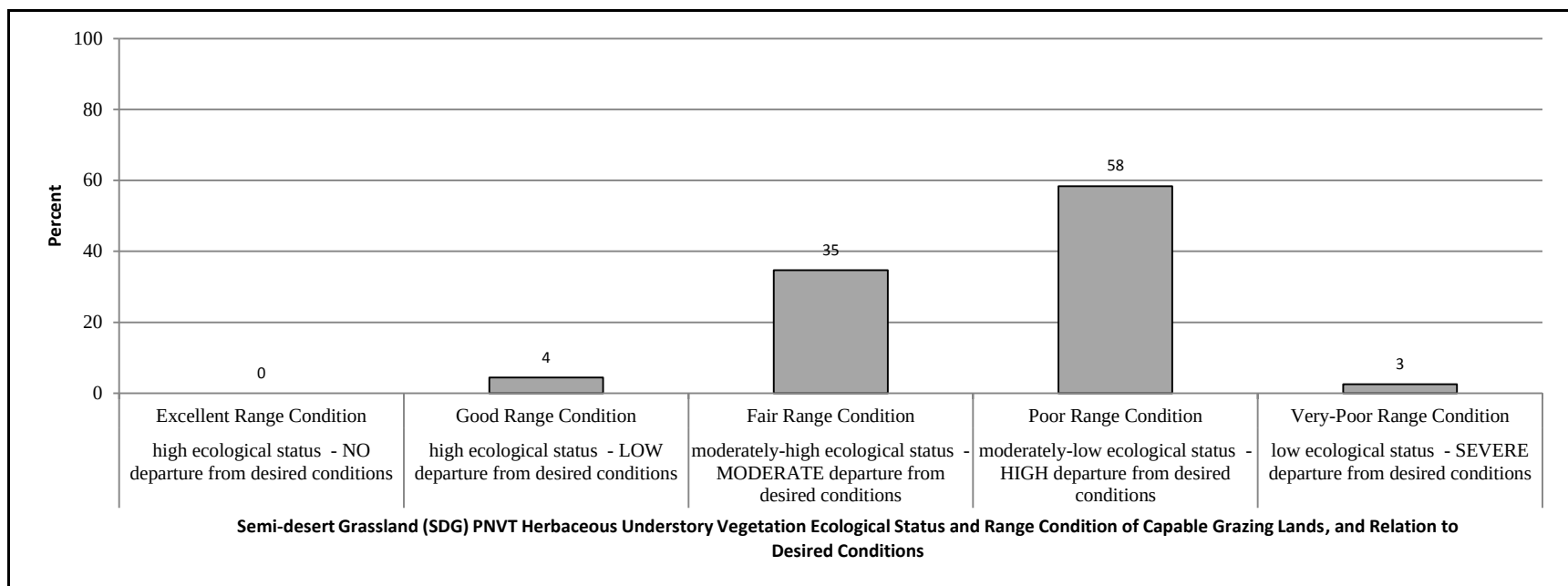
Herbaceous Understory Vegetation Range Condition, Ecological Status and Departure from Desired Condition of the Great Basin Grassland PNVT



Appendix D - Addendum figure 16. Great Basin Grassland (GBG) PNVT current herbaceous understory vegetation ecological status³⁴ and range condition^{35, 36} of the lands capable³⁷ of supporting livestock grazing, and departure from desired conditions. GBG ranks 2nd out of the 14 PNVTs in the amount of capable grazing lands not meeting desired conditions, roughly 87 percent

Semi-desert Grassland PNVT

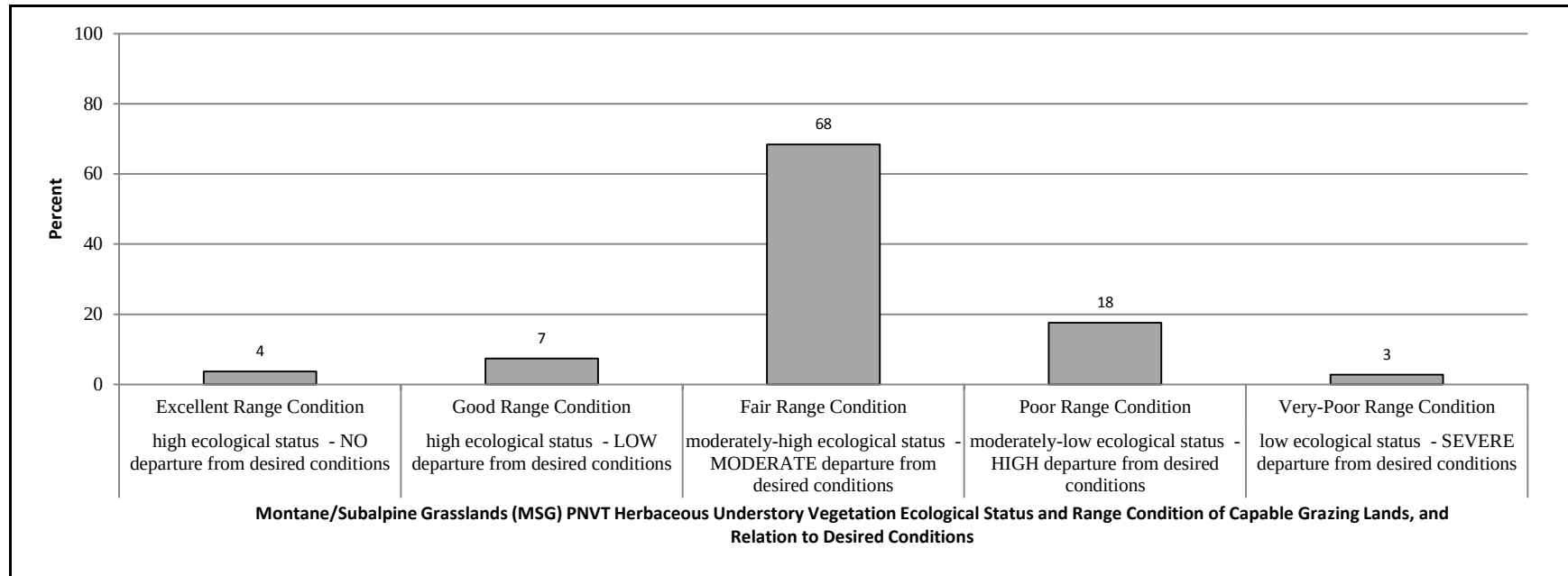
Herbaceous Understory Vegetation Range Condition, Ecological Status and Departure from Desired Condition of the Semi-desert Grassland PNVT



Appendix D - Addendum figure 17. Semi-desert Grassland (SDG) PNVT current herbaceous understory vegetation ecological status³⁴ and range condition^{35, 36} of the lands capable³⁷ of supporting livestock grazing, and departure from desired conditions. SDG ranks 9th out of the 14 PNVTs in the amount of capable grazing lands not meeting desired conditions, roughly 52 percent

Montane/Subalpine Grasslands PNVT

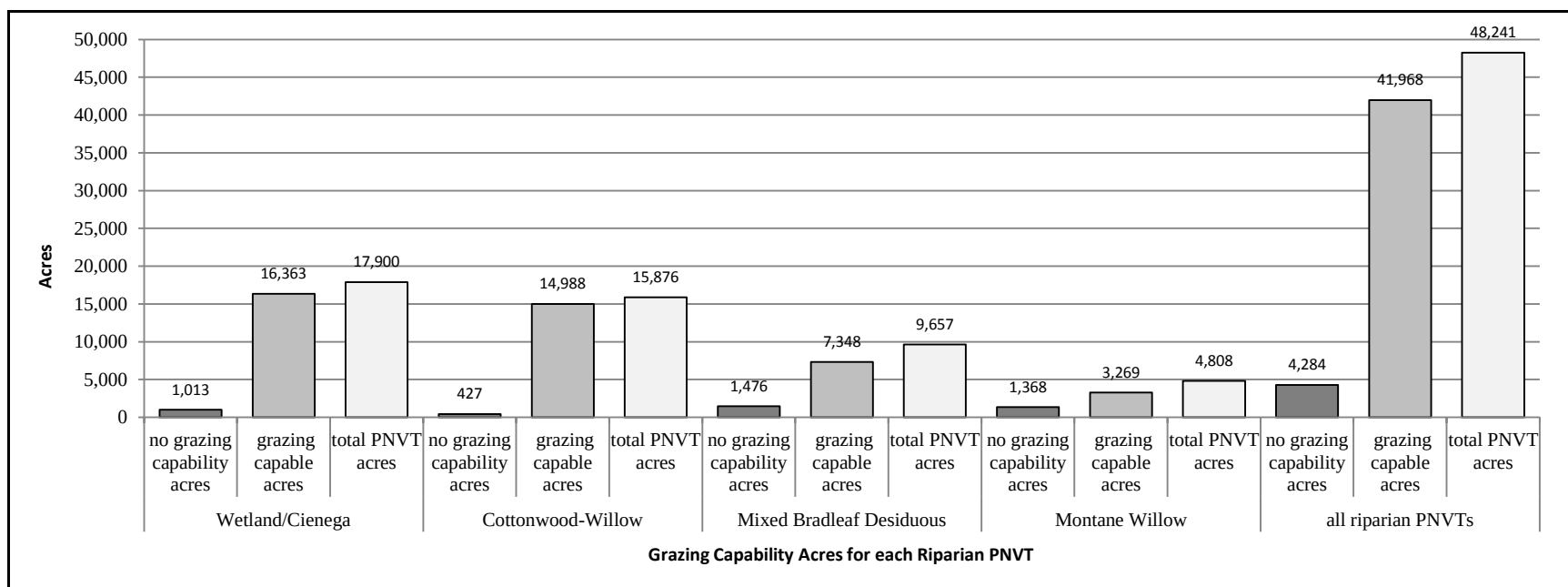
Herbaceous Understory Vegetation Range Condition, Ecological Status and Departure from Desired Condition of the Montane/Subalpine Grasslands PNVT



Appendix D - Addendum figure 18. Montane/Subalpine Grasslands (MSG) PNVT current herbaceous understory vegetation ecological status³⁴ and range condition^{35, 36} of the lands capable³⁷ of supporting livestock grazing, and departure from desired conditions. MSG has the least out of the 14 PNVTs in the amount of capable grazing lands not meeting desired conditions, roughly 20 percent

Riparian Areas/Riparian Forest PNVTs

Grazing Capability acres of A-SNFs Riparian PNVTs



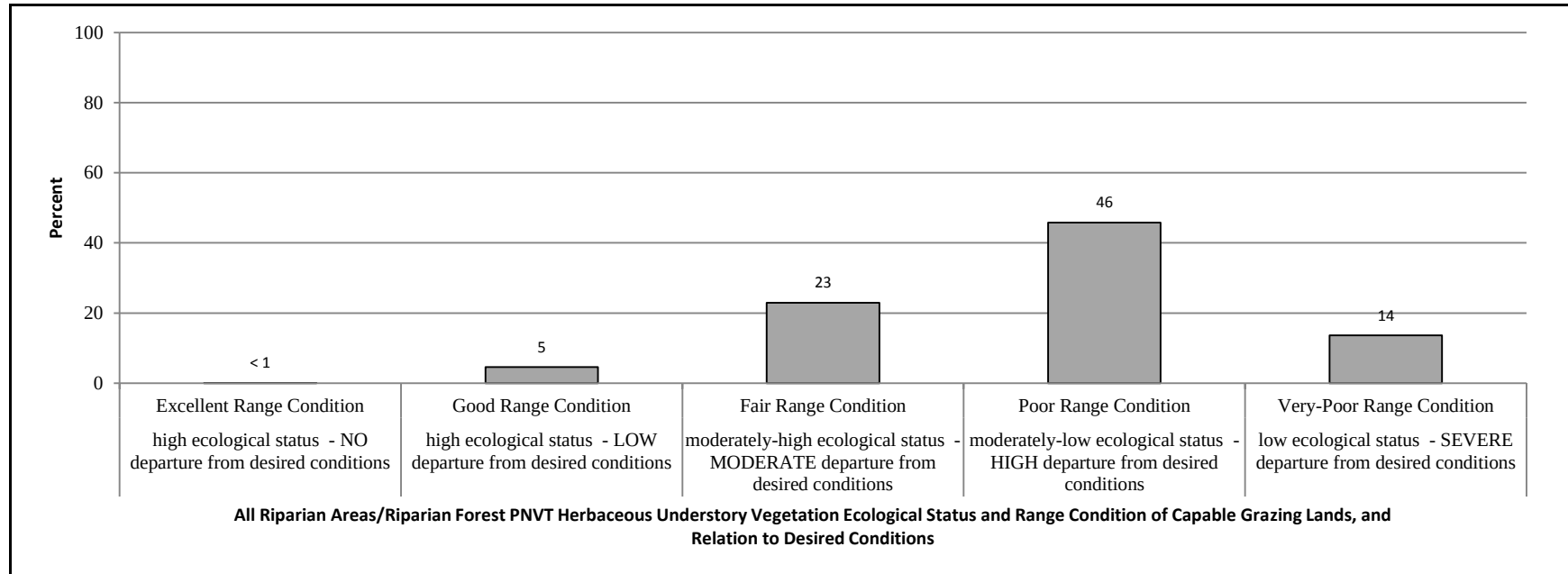
Appendix D - Addendum figure 19. Comparison of no grazing capability acres to grazing capable acres and total acres within the wetland/cienega riparian areas, cottonwood-willow, mixed broadleaf deciduous and montane willow riparian forests, and all riparian PNVTs combined on the A-SNFs

All of the riparian PNVTs contain more capable grazing acres than no grazing capability acres. Wetland/cienega riparian areas (WCRA) PNVT is the 10th largest on the A-SNFs at 17,900 acres and ranks 11th out of the 14 PNVTs in the amount of no capability grazing lands at 1,013 acres (nearly 6% of the PNVT). Cottonwood-willow riparian forest (CWRF) PNVT is the 12th largest on the A-SNFs at 15,876 acres and ranks 13th out of the 14 PNVTs in the amount of no capability grazing lands at 427 acres (nearly 3% of the PNVT). Mixed broadleaf deciduous riparian forest (MBDRF) PNVT is the 13th largest on the A-SNFs at 9,657 acres and ranks 9th out of the 14 PNVTs in the amount of no capability grazing lands at 1,476 acres (just over 15% of the PNVT). Montane willow riparian forest (MWRF) PNVT is the smallest on the A-SNFs at 4,808 acres and ranks 10th out of the 14 PNVTs in the amount of no capability grazing lands at 1,368 acres (nearly 29% of the PNVT). See Appendix D - addendum figures 20 through 24 as to the specific herbaceous understory vegetation ecological status³⁴, range condition^{35, 36}, and departures from desired

conditions of the capable³⁷ grazing lands within the wetland/cienega riparian areas, and cottonwood-willow, mixed broadleaf deciduous and montane willow riparian forest PNVTs.

Riparian Areas/Riparian Forest PNVTs

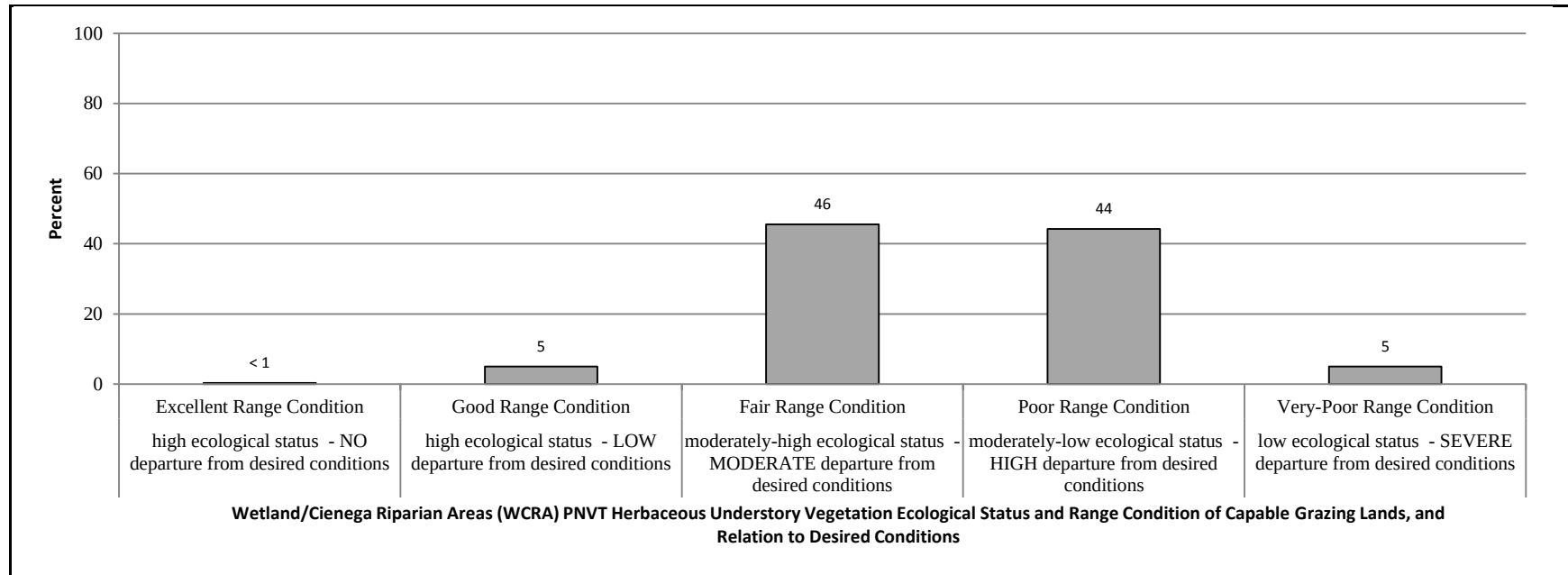
Herbaceous Understory Vegetation Range Condition, Ecological Status and Departure from Desired Condition of the all Riparian Areas/Riparian Forest PNVTs combined



Appendix D - Addendum figure 20. Current herbaceous understory vegetation ecological status³⁴ and range condition^{35, 36} of all the riparian areas/riparian forests PNVTs lands capable³⁷ of supporting livestock grazing, and departure from desired conditions. Overall, of the 5 major vegetation types found on the A-SNFs, riparian areas/riparian forests rank 4th in the amount of capable grazing lands not meeting desired conditions, roughly 65 percent

Wetland/Cienega Riparian Areas PNVT

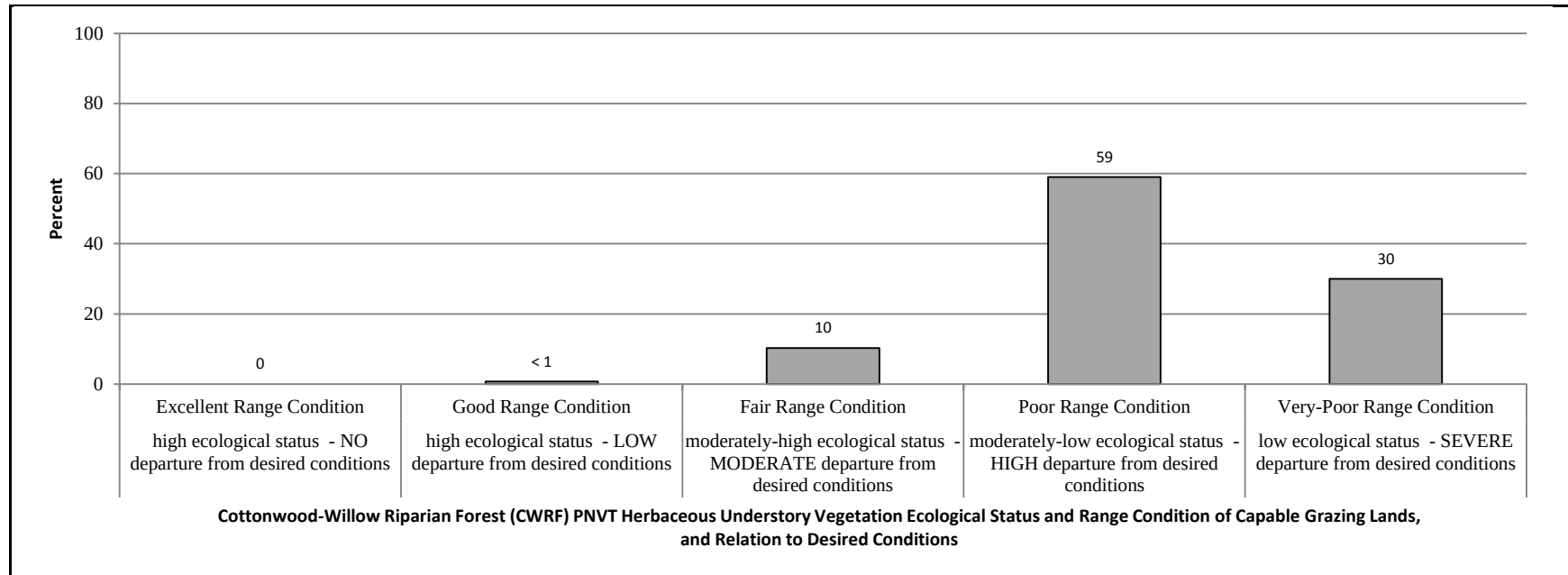
Herbaceous Understory Vegetation Range Condition, Ecological Status and Departure from Desired Condition of the Wetland/Cienega Riparian Areas PNVT



Appendix D - Addendum figure 21. Wetland/Cienega Riparian Areas (WCRA) PNVT current herbaceous understory vegetation ecological status³⁴ and range condition^{35, 36} of the lands capable³⁷ of supporting livestock grazing, and departure from desired conditions. WCRA ranks 10th out of the 14 PNVTs in the amount of capable grazing lands not meeting desired conditions, roughly 48 percent

Cottonwood-Willow Riparian Forest PNVT

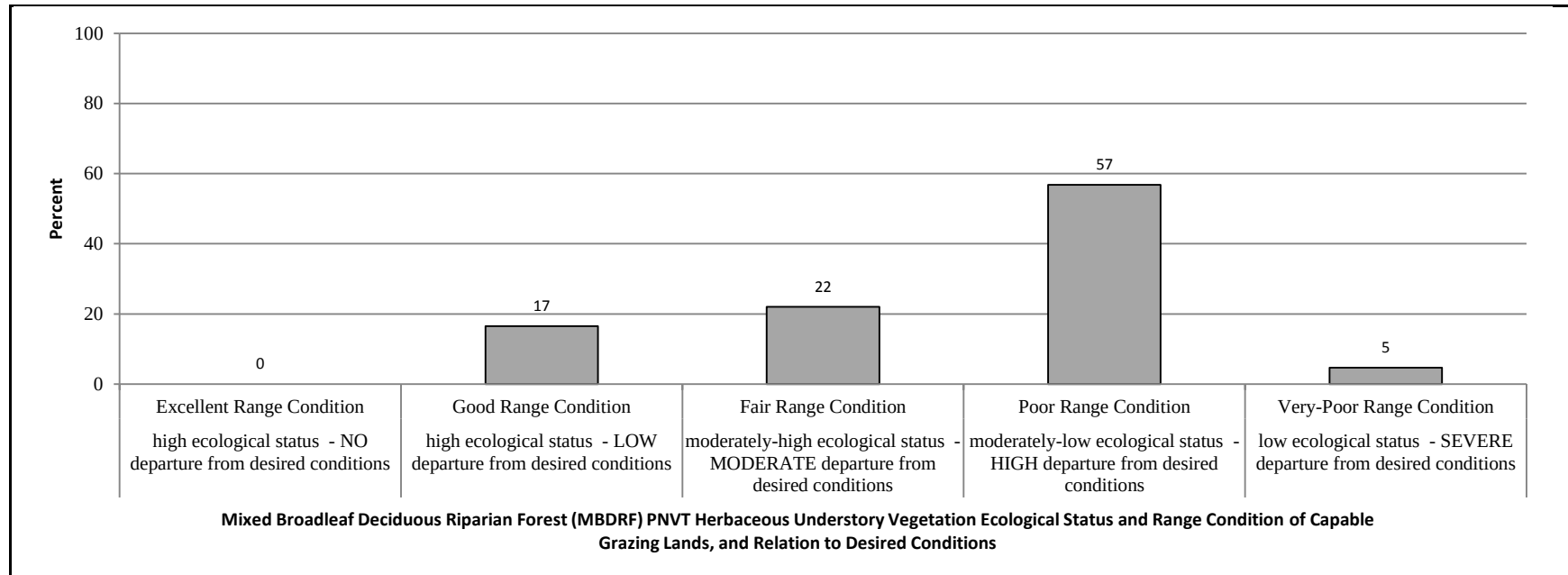
Herbaceous Understory Vegetation Range Condition, Ecological Status and Departure from Desired Condition of the Cottonwood-Willow Riparian Forest PNVT



Appendix D - Addendum figure 22. Cottonwood-Willow Riparian Forest (CWRF) PNVT current herbaceous understory vegetation ecological status³⁴ and range condition^{35, 36} of the lands capable³⁷ of supporting livestock grazing, and departure from desired conditions. CWRF ranks 3rd out of the 14 PNVTs in the amount of capable grazing lands not meeting desired conditions, roughly 86 percent

Mixed Broadleaf Deciduous Riparian Forest PNVT

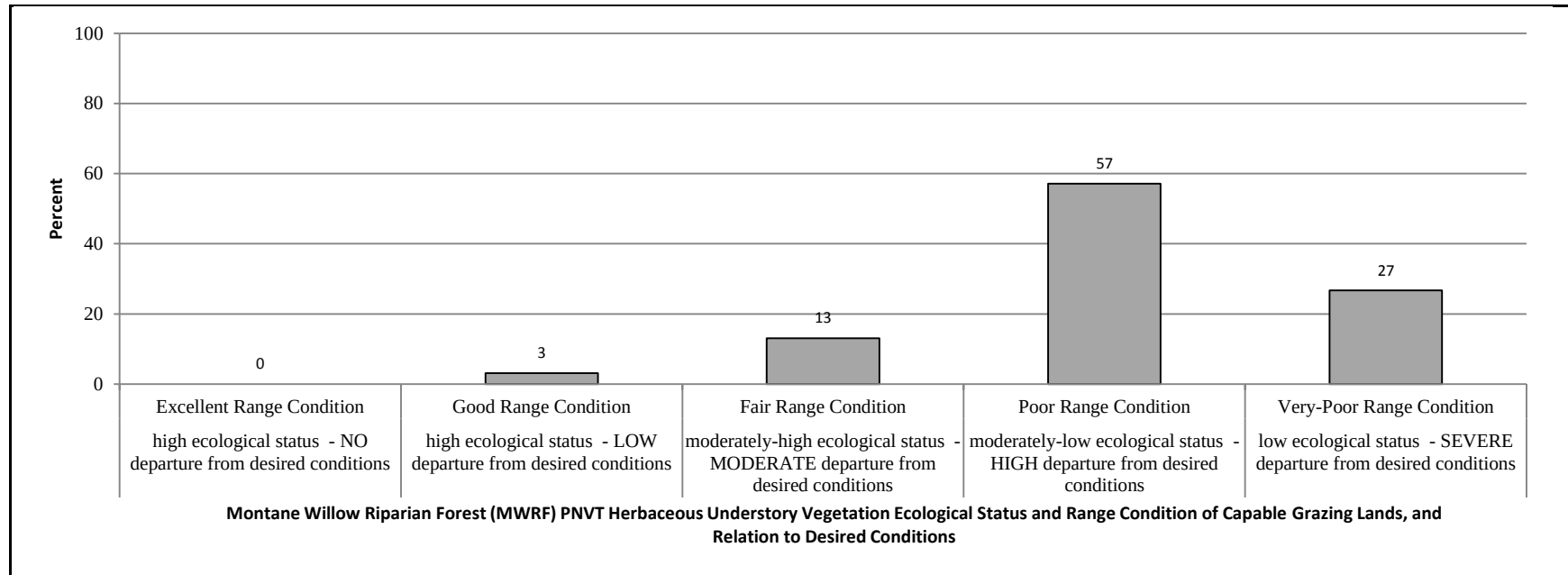
Herbaceous Understory Vegetation Range Condition, Ecological Status and Departure from Desired Condition of the Mixed Broadleaf Deciduous Riparian Forest PNVT



Appendix D - Addendum figure 23. Mixed Broadleaf Deciduous Riparian Forest (MBDRF) PNVT current herbaceous understory vegetation ecological status³⁴ and range condition^{35, 36} of the lands capable³⁷ of supporting livestock grazing, and departure from desired conditions. MBDRF ranks 8th out of the 14 PNVTs in the amount of capable grazing lands not meeting desired conditions, roughly 54 percent

Montane Willow Riparian Forest PNVT

Herbaceous Understory Vegetation Range Condition, Ecological Status and Departure from Desired Condition of the Montane Willow Riparian Forest PNVT



Appendix D - Addendum figure 24. Montane Willow Riparian Forest (MWRF) PNVT current herbaceous understory vegetation ecological status³⁴ and range condition^{35, 36} of the lands capable³⁷ of supporting livestock grazing, and departure from desired conditions. MWRF ranks 5th out of the 14 PNVTs in the amount of capable grazing lands not meeting desired conditions, roughly 80 percent

Appendix E - Threat/Risk Assessment for all Apache-Sitgreaves National Forests' PNVTs

Threats and Risks to All A-SNFs' PNVTs

Threats and risks are factors that may directly or indirectly degrade or impair ecosystem composition, ecosystem structure, ecological processes and/or ecological services in a manner that may impair its ecological integrity, such as an invasive species, loss of connectivity, climate change, or the disruption of a natural disturbance regime. Threats and risks can be anthropogenic or environmental in origin. Threats and risks can also be identified as within the Forest Service's authority to manage or prevent or if they are outside of the agency's authority.

Threat/Risk Assessment to All Forested PNVTs

Ponderosa Pine Forest PNVT

When assessing threats and risks to ponderosa pine forest it is necessary to evaluate the relationship between current departure from HRV and trend in relation to HRV (Appendix E table 1). In this case, assess legacy of past management or deviation from ongoing management activities, evaluate threats/risks and system reversibility. In relation to HRV, departure is severe; however, the current trend is toward HRV; risks are addressed. Continue current management; however, restoration opportunities should be identified for this PNVT.

Appendix E table 1. Recommended actions in evaluating threats/risks for the ponderosa pine forest PNVT in relation to its severe woody overstory vegetation departure from HRV and current trend toward HRV

Current Departure from HRV ¹ is 94 Percent	Ponderosa Pine Forest PNVT Trend in Relation to HRV		
	static (neither towards nor away)	towards HRV ²	away from HRV (or unknown)
Significant (low, moderate, high or SEVERE departure)	Legacy of past management or deviation from ongoing activities; evaluate threats/risks and system reversibility	Risk addressed; continue current management and identify restoration opportunities	Potential for high risk; evaluate threats and system reversibility
Non-significant (within HRV)	No risk; continue current management	No risk; continue current management	Potential risk; evaluate magnitude of future deviations, threats and system reversibility

¹Departure is separated into 5 categories: 1. Within HRV (departure index of 0-20%); 2. low (departure index of 21-40%); 3. moderate (departure index of 41-60%); 4. high (departure index of 61-80%); and 5. severe (departure index of 81-100%)

²See figure 3; under current management (Alternative A), within the 15-year planning period, movement is towards HRV

In regards to the current herbaceous understory vegetation ecological status³⁴ and range condition^{35, 36} of the lands capable³⁷ of supporting livestock grazing, ponderosa pine forest ranks 4th out of the 14 PNVTs in the amount of capable grazing lands not meeting desired conditions, roughly 85 percent (Appendix D - addendum figure 5).

Threats: Most ponderosa pine was historically maintained by low intensity, high-frequency fire as open-canopied forests of diverse age structure. However, many of these forests today have been transformed into dense, even-aged thickets of young trees that are prone to high-intensity fire. The most important threats, based on high likelihood of occurrence and high threat severity, under Forest Service management authority to ponderosa pine forest include (Appendix E table 2) fire suppression, forest management practices (vegetation treatments), human-caused fires and roads, highways and corridors (some areas also have a high density road network established for the removal of timber). These threats types include modification of natural processes, consumptive biological use and habitat conversion which have negative consequences to ecological composition, structure, function and processes. Other anthropogenic threats

with high likelihood of occurrence moderate to high threat severity include feral equine-ungulate and livestock grazing/browsing, and off highway vehicles (OHV). Invasive plants are an additional threat. The most important threat, based on high likelihood of occurrence and high threat severity outside of agency authority is climate change, and this is likely to intensify (Beschta et al., 2013) and be compounding all other identified threats. Other threats outside Forest Service management authority include urban development and insect, disease, parasites and/or pathogens outbreaks (epidemic), and wild ungulate grazing/browsing. These threats types include habitat conversion and invasive species which have negative consequences to ecological composition, structure, function and processes. Uncharacteristic wildfire is an additional threat.

Quite possibly, the most important and far reaching threats under agency authority (Appendix E table 2) for ponderosa pine forests include managing the legacy of past and current livestock grazing/browsing, which, and wild ungulate, and feral equine use; which has removed fine fuels necessary for supporting frequent, low intensity surface fires; forest management practices (vegetation harvest treatments), which have changed forest age class distribution, composition, density, and cover values; and the cessation of frequent fire regimes (fire suppression), which prior to about 1900 ranged in frequency between 2 and 17 years. The contemporary ponderosa pine forest has an estimated fire frequency for all fires of 1 in 75 years and has gone from an FRCC of I to III.

Anthropogenic disturbance has led to major changes in ponderosa pine forest structure and function. With the introduction of grazing animals at various times during the 19th century, low intensity and frequent surface fires have been replaced with high intensity and infrequent crown fires. Although the effects of these large, stand-replacing fires are variable, several fires have led to long-term changes from forested systems to grasslands, woodlands, and areas of dense pine regeneration (Savage and Mast, 2005; Dahms and Geils, 1997). Areas that have not burned yet have higher density of trees, especially of the smaller size class and younger age class, changing the quality of habitat for wildlife and humans (Covington and Moore, 1994; Dahms and Geils, 1997; Allen et al., 2002). Many of the areas that now support trees currently (post-settlement), are on Mollisol soils which develop on grass dominated area while historic forested sites (pre-settlement) are supported by Alfisol soils (Abella et al., 2013). Sabo et al. (2008), found that to maintain more fire-resistant and hence sustainable ponderosa pine ecosystems, tree densities need to be substantially reduced from contemporary levels. There are also interactions between human-caused disturbance and climate change, which may intensify or confound their effects. Climate-related changes can not only affect public-land ecosystems directly, but may exacerbate the aggregate effects of non-climatic stressors, such as habitat modification and pollution caused by logging, mining, grazing, roads, water diversions, and recreation (Root et al., 2003; CEQ, 2010; Barnosky et al., 2012; Beschta et al., 2013).

Risks: The above threats pose the following risks, many of these risks when functioning together are additive and have compounding affects with negative consequences to ecological composition, structure, function and processes. Specifically by affecting vegetation health (atypical composition, structure and function), soil compaction, erosion, sedimentation and loss of soil fertility, altered watershed and hydrologic functions, reduced water quality and quantity, riparian, aquatic and terrestrial locales loss, degradation and fragmentation of these habitats within this PNVN, altered fire regime, introduction and spread of invasive plants, modification of natural processes, change in ecological potentials, species extinction or reduction in population(s) and/or habitat(s), uncharacteristic wildfire, and inability to re-establish natural wildfire processes.

Appendix E table 2. A-SNFs' risks to the ponderosa pine forest PNVT based on identified threats. Threats are categorized as either under agency management authority or outside agency management authority as well as threat type and estimated risk of high (H), moderate (M) or low (L)

Threat	Threat Type	Estimated Risk ¹		Risk Consequence to Ecological Characteristics ²			
		likelihood of occurrence	severity	composition (C)	structure (S)	function (F)	services (Sv)
Under Agency Management Authority							
Feral equine-ungulate grazing/browsing	Consumptive biological use/modification of natural processes/habitat conversion	H	M-H ³	✓	✓	✓	✓
Fire suppression policy	Modification of natural processes	H	H	✓	✓	✓	✓
Forest management practices (vegetation treatments)	Consumptive biological use/modification of natural processes/habitat conversion	H	M	✓	✓	✓	-
Human-caused fire	Habitat conversion	H	H	✓	✓	✓	✓
Invasive plant species	Modification of natural processes/habitat conversion	H	M	✓	✓	✓	✓
Livestock grazing/browsing	Consumptive biological use/modification of natural processes/habitat conversion	H	M-H ³	✓	✓	✓	✓
Off-highway vehicles (OHVs)	Non-consumptive biological use	M	H	✓		✓	✓
Roads, highways and utility corridors	Transportation/habitat conversion	H	H	✓	✓		✓
Outside Agency Management Authority							
Climate change	Modification of natural processes/habitat conversion	H	H	✓	✓	✓	✓
Drought	Habitat conversion	M	M	✓	✓	✓	✓
Insect, disease, parasites and/or pathogens outbreaks (epidemic)	Invasive species/habitat conversion	H	H	✓	✓	✓	✓
Uncharacteristic wildfire	Habitat conversion	H	H	✓	✓	✓	✓
Urban development	Habitat conversion	H	H	✓	✓	✓	✓
Wild ungulate grazing/browsing	Consumptive biological use/modification of natural processes/habitat conversion	H	M-H ³	✓	✓	✓	✓
Wind events (blowdown)	Habitat conversion	L	L	✓	✓		✓
Total (under/outside agency management authority)				8/7	7/7	7/6	7/6

¹ Estimated Risk is divided into Likelihood of Occurrence (defined as the probability of a significant departure from reference conditions) and Severity (defined as the magnitude of the departure from reference conditions)

² Risks are assessed as affecting changes in one or more of the following ecosystem characteristics: vegetation composition (C), vegetation structure (S); vegetation function (F) and/or ecological services (Sv). Composition (C) is the biological elements within the different levels of biological organizations, from genes and species to communities and ecosystems. Structure (S) is the organization and physical arrangement of biological elements such as snags and down woody debris, vertical and horizontal distribution of vegetation, stream habitat complexity, landscape pattern, and connectivity. Function (F) is the ecological processes, such as energy flow; nutrient cycling and retention; soil development and retention; predation and herbivory; and natural disturbances such as wind, fire, and floods. Services (Sv) are the provisioning services - such as clean air and fresh water, as well as energy, fuel, forage, fiber, and minerals; regulating services - such as longterm storage of carbon, climate regulation, water filtration, purification and storage, soil stabilization, flood control, and disease regulation; and supporting services - such as pollination, seed dispersal, soil formation, and nutrient cycling. Not all aspects of structure, composition, function and/or services may be affected because of the occurrence of a threat or threat type

³ Given the extensive amount of herbaceous understory vegetation acres classified as being in low to moderately-low ecological status not meeting desired conditions, and the extent of moderate and high burn severity acres within this PNVT

Reversibility: Some threats/risks are not reversible under Forest Service authority such as: urban development. Even though these threats/risks are not within agency authority, the forests have a responsibility to assess, address, develop and implement appropriate management responses that mitigate undesirable consequences to National Forest System Lands. On the other hand, some threats/risks are reversible such as, epidemic insect, disease and parasites and/or pathogens outbreaks may be partially reversible depending on spatial scale. With uncharacteristic fires – there may be irreversible conditions – soil loss, uncharacteristic succession, habitat modification, loss and/or fragmentation (reduces species' population and/or viability). Some effects of infestations by invasive plants and areas of infestation are reversible depending on species and spatial scale. Risks from fire suppression, human-caused fires, and roads, highways and corridors, and OHVs can be minimized and in many cases be reversed. Some effects of livestock grazing/browsing are also reversible depending on severity of change and spatial scale. According to Loeser et al. (2007), changes in climate affecting precipitation, may cause some ecological alterations to be persistent.

Opportunities: Vegetation treatments and silvicultural opportunities that restore and promote forest vegetative structure and composition that approximates HRV to promote stands of larger trees in more open canopy configuration and reduction in the small sized trees with closed canopies.; manage fire as an integral component of ecosystem sustainability; restoration of natural processes and existing conditions that have been compromised by the legacy of livestock management, vegetation treatments and fire suppression. Evaluate the ecological costs and appropriateness of livestock grazing within this forested PNVT given the extensive amount of herbaceous understory vegetation acres classified as being in low to moderately-low ecological status (roughly 85 percent) not meeting desired conditions, and the extent of moderate and high burn severity acres (Stade and Salvo, 2009). Continuing livestock grazing use should be assessed to determine if it is consistent with ecological recovery, particularly as the climate shifts (Karr and Rossano, 2001; Karr, 2004; LaPaix et al., 2009; Beschta et al., 2013) to reduce or eliminate cascading effects (Kondolf, 1994; Rhodes et al., 1994; Beschta et al., 2013), and to be compatible with maintaining or recovering key ecological functions and native species and habitats (Beschta et al., 2013). Direct effects of herbivory tends to have a very selective influence on plant communities. Heavy grazing results in physiological damage to palatable species, causing them to lose competitive status and decline within the plant community (Hall et al., 1995). According to Archer and Smeins (1991), indirect effects associated with grazing activities further influence plant growth and community composition. These include:

- Alteration of energy flow through the detrital pathway
- Redistribution and transformation of nutrients
- Modification of microclimate
- Alteration of edaphic physical and hydrologic properties
- Destabilization of plant competitive interactions

In addition, implement the recommended guidelines for restocking burned areas (USFS, 2008c) as the consequence of fire. Furthermore, the above discussion concerning the recommendations and effects of grazing is applicable to all of the forested, woodland, grassland, chaparral and especially the more sensitive riparian PNVTs as well.

Improved travel management, and road maintenance and design; and implementation of applicable Best Management Practices (BMPs). Implement aggressive invasive plant management; because, according to Jordan et al. (2008), recent evidence suggests that positive feedbacks between invasive plants and soils could contribute significantly to plant invasions (Corbin and D'Antonio, 2004; Ehrenfeld, 2004; Scott et al., 2001; Wolfe and Klironomos, 2005; Reinhart and Callaway, 2006; Eppstein and Molofsky, 2007; among others), perhaps exemplifying 'ecological engineering' by biological invaders (Cuddington and Hastings, 2004). Invasive species modify soils that they occupy (Ramakrishnan and Vitousek, 1989) in

ways that increase their own fitness relative to that of native species (Vivrette and Muller, 1977; Jordan et al., 2008), and therefore, are more competitive in site occupation.

Ecological Need for Change in Management Activities

Emerging and related concerns are the homogenization of the flora of this PNV. The diversity of native plants contributes to the maintenance and enhancement of above- and belowground biological interactions that keep ecological interactions intact (Printz et al., 2014). Disruptions in plant diversity by loss of species that are potentially important to the site and the threat to native species posed by exotic species that spread in response to human activities create a host of issues related to ecosystem health. There is a need for ecological change within this PNV so that it is more resistant (withstand and maintain normal function) and resilient (recover from) to disturbances within its HRV. Resiliency requires forest characteristics such as fuel loading, species composition and stand structures be compatible with restoration of frequent surface fire functional processes. Desired changes include management activities that also influence understory herbaceous species cover and species richness that is more closely associated with HRV by:

- Stabilizing soils and re-establish dominance of the native plant communities on moderate to high severity burn areas
- Reducing overstory density to restore open forest conditions
- Restoring understory herbaceous vegetation to moderately-high to high ecological condition
- Restoring dominance of seral fire-adapted species
- Promoting regeneration of shade intolerant seral species
- Reducing grazing pressure
- Reducing understory and overstory dominance of shade tolerant species
- Reducing fuel loading to levels commensurate with re-introduction of frequent surface fire (reduction of FRCC from III to I)
- Restoring frequent surface fire as a functional ecological process
- Preventing, controlling and eradicating invasive plants

There is a need to maintain or improve ecosystem conditions to be resistant to and resilient in response to climate change.

According to Tausch (2008), a warming climate will often lead to an upward elevational migration of plant species. Because of the rapidity of expected changes in climate, individuals of a native plant species may be lost from their lower-elevation limits faster than they will be able to migrate upward and establish into newly created habitat. This will result in stressed communities with fewer plant species distributed over large areas of the landscape. As ecosystems become simplified, their trophic levels are truncated and their trophic interactions reduced (Tausch, 2008).

Such ecosystems potentially have an increase in the quantity of unused resources. These stressed communities thus become more open and their resources more available for the invasion and establishment of non-native plant species. These invaders may also be better adapted than native species to the new environmental conditions resulting from climate change. An exception might be native species of plants that can migrate from adjacent areas or regions into locations where they previously were excluded by climate as the new locations become more suitable. The greater the change, the more likely this facilitation of invasive species will be. In addition to climate change are the species of invaders involved, the effects of the interactions of their species composition on the ecosystems, and the disturbance patterns those ecosystems are experiencing. On landscape scales, this ecosystem spatial and temporal variability have major effects on ecosystem susceptibility to invasive species. Climate change

and associated vegetation change interacting with invasive species are also increasingly leading to uncharacteristic wildfires that can further facilitate the establishment of additional invasive plant species (Tausch 2008).

Wet Mixed Conifer Forest PNVT

When assessing threats and risks to wet mixed conifer forest it is necessary to evaluate the relationship between current departure from HRV and trend in relation to HRV (Appendix E table 3). In this case, assess the legacy of past management or deviation from ongoing management activities, evaluate threats/risks and system reversibility (shaded area). In relation to HRV, departure is high; however, the current trend is toward HRV; risks are addressed. Continue current management; however, restoration opportunities should be identified for this PNVT.

Appendix E table 3. Recommended actions in evaluating threats/risks for the wet mixed conifer forest PNVT in relation to its high woody overstory vegetation departure from HRV and current trend toward HRV

Current Departure from HRV ¹ is 61 Percent	Wet mixed conifer forest PNVT Trend in Relation to HRV		
	static (neither towards nor away)	towards HRV ²	away from HRV (or unknown)
Significant (low, moderate, HIGH or severe departure)	Legacy of past management or deviation from ongoing activities; evaluate threats/risks and system reversibility	Risk addressed; continue current management and identify restoration opportunities	Potential for high risk; evaluate threats and system reversibility
Non-significant (within HRV)	No risk; continue current management	No risk; continue current management	Potential risk; evaluate magnitude of future deviations, threats and system reversibility

¹ Departure is separated into 5 categories: 1. Within HRV (departure index of 0-20%); 2. low (departure index of 21-40%); 3. moderate (departure index of 41-60%); 4. high (departure index of 61-80%); and 5. severe (departure index of 81-100%)

² See figure 5; under current management (Alternative A), within the 15-year planning period, movement is towards HRV

In regards to the current herbaceous understory vegetation ecological status³⁴ and range condition^{35, 36} of the lands capable³⁷ of supporting livestock grazing, wet mixed conifer forest PNVT ranks 7th out of the 14 PNVTs in the amount of capable grazing lands not meeting desired conditions, roughly 74 percent (Appendix D - addendum figure 6).

Threats: The most important threat, based on high likelihood of occurrence and high threat severity, under Forest Service management authority to wet mixed conifer forests is (Appendix E table 4) the potential for human-caused fires. This threat type presents the possibility for habitat conversion which have negative consequences to ecological composition, structure, function and processes. Other anthropogenic threats include feral equine, wild ungulate, and livestock grazing/browsing, and off highway vehicles (OHV); invasive plants are an additional threat. The most important threat, based on high likelihood of occurrence and high threat severity outside of agency authority is climate change, and this is likely to intensify (Beschta et al., 2013) and be compounding all other identified threats. Other threats outside Forest Service management authority include insect, disease, parasites and/or pathogens outbreaks (epidemic), and wild ungulate grazing/browsing. These threats types include habitat conversion and invasive species which have negative consequences to ecological composition, structure, function and processes. Uncharacteristic wildfire is an additional threat. Climate-related changes can not only affect public-land ecosystems directly, but may exacerbate the aggregate effects of non-climatic stressors, such as habitat modification and pollution caused by logging, mining, grazing, roads, water diversions, and recreation (Root et al., 2003; CEQ, 2010; Barnosky et al., 2012; Beschta et al., 2013).

Risks: Under current management, risks are addressed.

Opportunities: Vegetation treatments and silvicultural opportunities that restore and promote forest vegetative structure and composition that approximates HRV; manage fire as an integral component of ecosystem sustainability; aggressive invasive plant management and implementation of applicable BMPs. Evaluate the ecological costs and appropriateness of livestock grazing within this forested PNVNT given the extensive amount of herbaceous understory vegetation acres classified as being in low to moderately-low ecological status (roughly 74 percent) not meeting desired conditions, and the extent of moderate and high burn severity acres. Continuing livestock grazing use should be assessed to determine if it is consistent with ecological recovery, particularly as the climate shifts (Karr and Rossano, 2001; Karr, 2004; LaPaix et al., 2009; Beschta et al., 2013) to reduce or eliminate cascading effects (Kondolf, 1994; Rhodes et al., 1994; Beschta et al., 2013), and to be compatible with maintaining or recovering key ecological functions and native species and habitats (Beschta et al., 2013). In addition, implement the recommended guidelines for restocking burned area (USFS, 2008c) as the consequence of fire.

Improved travel management, and road maintenance and design; and implementation of applicable BMPs. Implement aggressive invasive plant management; because, according to Jordan et al. (2008), recent evidence suggests that positive feedbacks between invasive plants and soils could contribute significantly to plant invasions (Corbin and D'Antonio, 2004; Ehrenfeld, 2004; Scott et al., 2001; Wolfe and Klironomos, 2005; Reinhart and Callaway, 2006; Eppstein and Molofsky, 2007), perhaps exemplifying 'ecological engineering' by biological invaders (Cuddington and Hastings, 2004). Invasive species modify soils that they occupy (Ramakrishnan and Vitousek, 1989) in ways that increase their own fitness relative to that of native species (Vivrette and Muller, 1977; Jordan et al., 2008), and therefore, are more competitive in site occupation.

Ecological Need for Change in Management Activities

Emerging and related concerns are the homogenization of the flora of this PNVNT. The diversity of native plants contributes to the maintenance and enhancement of above- and belowground biological interactions that keep ecological interactions intact (Printz et al., 2014). Disruptions in plant diversity by loss of species that are potentially important to the site and the threat to native species posed by exotic species that spread in response to human activities create a host of issues related to ecosystem health. There is a need for ecological change within this PNVNT so that it is more resistant (withstand and maintain normal function) and resilient (recover from) to disturbances within its HRV. Desired changes include management activities that also influence understory herbaceous species cover and species richness that is more closely associated with HRV by:

- Stabilizing soils and re-establish dominance of the native plant communities on moderate to high severity burn areas
- Reducing grazing pressure
- Restoring understory herbaceous vegetation to moderately-high to high ecological condition
- Preventing human-caused fires
- Preventing, controlling and eradicating invasive plants

There is a need to maintain ecosystem conditions to be resistant to and resilient in response to climate change.

Appendix E table 4. A-SNFs' risks to the wet mixed conifer forest PNVT based on identified threats. Threats are categorized as either under agency management authority or outside agency management authority as well as threat type and estimated risk of high (H), moderate (M) or low (L)

Threat	Threat Type	Estimated Risk ¹		Risk Consequence to Ecological Characteristics ²			
		likelihood of occurrence	severity	composition (C)	structure (S)	function (F)	services (Sv)
Under Agency Management Authority							
Feral equine-ungulate grazing/browsing	Consumptive biological use/modification of natural processes/habitat conversion	H	M-H ³	✓	✓	✓	✓
Forest management practices (vegetation treatments)	Consumptive biological use/modification of natural processes/habitat conversion	H	M	✓	✓	✓	-
Human-caused fire	Habitat conversion	H	H	✓	✓	✓	✓
Invasive plant species	Modification of natural processes/habitat conversion	H	M	✓	✓	✓	✓
Livestock grazing/browsing	Consumptive biological use/modification of natural processes/habitat conversion	H	M-H ³	✓	✓	✓	✓
Outside Agency Management Authority							
Climate change	Modification of natural processes/habitat conversion	H	H	✓	✓	✓	✓
Drought	Habitat conversion	M	M	✓	✓	✓	✓
Insect, disease, parasites and/or pathogens outbreaks (epidemic)	Invasive species/habitat conversion	H	H	✓	✓	✓	✓
Uncharacteristic wildfire	Habitat conversion	M	H	✓	✓	✓	✓
Wild ungulate grazing/browsing	Consumptive biological use/modification of natural processes/habitat conversion	H	M-H ³	✓	✓	✓	✓
Wind events (blowdown)	Habitat conversion	L	L	✓	✓	-	✓
Total (under/outside agency management authority)				5/6	5/6	5/5	4/6

¹ Estimated Risk is divided into Likelihood of Occurrence (defined as the probability of a significant departure from reference conditions) and Severity (defined as the magnitude of the departure from reference conditions)

² Risks are assessed as affecting changes in one or more of the following ecosystem characteristics: vegetation composition (C), vegetation structure (S); vegetation function (F) and/or ecological services (Sv). Composition (C) is the biological elements within the different levels of biological organizations, from genes and species to communities and ecosystems. Structure (S) is the organization and physical arrangement of biological elements such as snags and down woody debris, vertical and horizontal distribution of vegetation, stream habitat complexity, landscape pattern, and connectivity. Function (F) is the ecological processes, such as energy flow; nutrient cycling and retention; soil development and retention; predation and herbivory; and natural disturbances such as wind, fire, and floods. Services (Sv) are the provisioning services - such as clean air and fresh water, as well as energy, fuel, forage, fiber, and minerals; regulating services - such as longterm storage of carbon, climate regulation, water filtration, purification and storage, soil stabilization, flood control, and disease regulation; and supporting services - such as pollination, seed dispersal, soil formation, and nutrient cycling. Not all aspects of structure, composition, function and/or services may be affected because of the occurrence of a threat or threat type

³ Given the extensive amount of herbaceous understory vegetation acres classified as being in low to moderately-low ecological status not meeting desired conditions, and the extent of moderate and high burn severity acres within this PNVT

Dry Mixed Conifer Forest PNVT

When assessing threats and risks to dry mixed conifer forest it is necessary to evaluate the relationship between current departure from HRV and trend in relation to HRV (Appendix E table 5). In this case, assess the legacy of past management or deviation from ongoing management activities, evaluate threats/risks and system reversibility. In relation to HRV, departure is high, however, the current trend is toward HRV; risks are addressed. Continue current management; however, restoration opportunities should be identified for this PNVT.

Appendix E table 5. Recommended actions in evaluating threats/risks for the dry mixed conifer forest PNVT in relation to its high woody overstory vegetation departure from HRV and current trend toward HRV

Current Departure from HRV ¹ is 77 Percent	Dry Mixed Conifer Forest PNVT Trend in Relation to HRV		
	static (neither towards nor away)	towards HRV ¹	away from HRV (or unknown)
Significant (low, moderate, HIGH or severe departure)	Legacy of past management or deviation from ongoing activities; evaluate threats/risks and system reversibility	Risk addressed; continue current management and identify restoration opportunities	Potential for high risk; evaluate threats and system reversibility
Non-significant (within HRV)	No risk; continue current management	No risk; continue current management	Potential risk; evaluate magnitude of future deviations, threats and system reversibility

¹ Departure is separated into 5 categories: 1. Within HRV (departure index of 0-20%); 2. low (departure index of 21-40%); 3. moderate (departure index of 41-60%); 4. high (departure index of 61-80%); and 5. severe (departure index of 81-100%)

² See figure 5; under current management (Alternative A), within the 15-year planning period, movement is towards HRV

In regards to the current herbaceous understory vegetation ecological status³⁴ and range condition^{35, 36} of the lands capable³⁷ of supporting livestock grazing, dry mixed conifer forest PNVT ranks 6th out of the 14 PNVTs in the amount of capable grazing lands not meeting desired conditions, roughly 78 percent (Appendix D - addendum figure 7).

Threats: The most important threats, based on high likelihood of occurrence and high threat severity, under Forest Service management authority to dry mixed conifer forest include (Appendix E table 6) fire suppression, human-caused fires and roads, highways and corridors (some areas also have a high density road network established for the removal of timber). These threats types include modification of natural processes, consumptive biological use and habitat conversion which have negative consequences to ecological composition, structure, function and processes. Other anthropogenic threats include feral equine, wild ungulate and livestock grazing/browsing, and off highway vehicles (OHV); invasive plants are an additional threat. The most important threat, based on high likelihood of occurrence and high threat severity outside of agency authority is climate change, and this is likely to intensify (Beschta et al., 2013) and be compounding all other identified threats. Other threats outside Forest Service management authority include insect, disease, parasites and/or pathogens outbreaks (epidemic), and wild ungulate grazing/browsing. These threats types include habitat conversion and invasive species which have negative consequences to ecological composition, structure, function and processes. Uncharacteristic wildfire is an additional threat.

Quite possibly, the most important and far reaching threats under agency authority (Appendix E table 6) for dry mixed conifer forest include managing the legacy of past and current livestock grazing/browsing, which removed fine fuels needed for carrying frequent, low intensity surface fires; forest management practices (vegetation treatments), which have changed forest age class distribution, composition, density, and cover values; and the cessation of frequent fire regimes (fire suppression), which prior to about 1900 ranged in frequency between 10 and 22 years. The contemporary dry mixed conifer forest has and estimated fire frequency for all fires of 1 in 70 years and has gone from an FRCC of I to III.

Unfortunately, little has been quantified on the effects of anthropogenic disturbance on mixed conifer forests. However, a combination of anthropogenic factors, namely grazing management, fire management, and silvicultural practices have had several profound effects on general trends in dry mixed conifer forest form and function. The historical mixed severity fire regime of small patches of infrequent, high severity fire within a broader matrix of low severity, frequent fires has been replaced with a more uniform and large scale, low frequency and high severity fire regime. This change in disturbance, combined with selective logging techniques that preferentially removed the larger, older Rocky Mountain Douglas-fir trees has resulted in more homogenous mixed conifer forests, with greater numbers of smaller, fire susceptible trees. There are also interactions between human-caused disturbance and climate change, which may intensify or confound their effects. Climate-related changes can not only affect public-land ecosystems directly, but may exacerbate the aggregate effects of non-climatic stressors, such as habitat modification and pollution caused by logging, mining, grazing, roads, water diversions, and recreation (Root et al., 2003; CEQ, 2010; Barnosky et al., 2012; Beschta et al., 2013).

Risks: The above threats pose the following risks, many of these risks when functioning together are additive and have compounding affects with negative consequences to ecological composition, structure, function and processes. Specifically by affecting vegetation health (atypical composition, structure and function), soil compaction, erosion, sedimentation and loss of soil fertility, altered watershed and hydrologic functions, reduced water quality and quantity, riparian, aquatic and terrestrial locales loss, degradation and fragmentation of these habitats within this PNVN, altered fire regime, introduction and spread of invasive plants, modification of natural processes, change in ecological potentials, species extinction or reduction in population(s) and/or habitat(s), uncharacteristic wildfire, and inability to re-establish natural wildfire processes.

Reversibility: Some threats/risks are not reversible under Forest Service authority such as: urban development. Even though these threats/risks are not within agency authority, the forests have a responsibility to assess, address, develop and implement appropriate management responses that mitigate undesirable consequences to National Forest System Lands. On the other hand, some threats/risks are reversible such as, epidemic insect, disease and parasites and/or pathogens outbreaks may be partially reversible depending on spatial scale. With uncharacteristic fires – there may be irreversible conditions – soil loss, uncharacteristic succession, habitat modification, loss and/or fragmentation (reduces species' population and/or viability). Some effects of infestations by invasive plants and areas of infestation are reversible depending on species and spatial scale. Risks from fire suppression, human-caused fires, and roads, highways and corridors, and OHVs can be minimized and in many cases be reversed. Some effects of livestock grazing/browsing are also reversible depending on severity of change and spatial scale. According to Loeser et al. (2007), changes in climate affecting precipitation, may cause some ecological alterations to be persistent.

Opportunities: Vegetation treatments and silvicultural opportunities that restore and promote forest vegetative structure and composition that approximates HRV to promote stands of larger trees in more open canopy configuration and reduction in the small sized trees with closed canopies; manage fire as an integral component of ecosystem sustainability; restoration of natural processes and existing conditions that have been compromised by the legacy of livestock management, vegetation treatments and fire suppression. Evaluate the ecological costs and appropriateness of livestock grazing within this forested PNVN given the extensive amount of herbaceous understory vegetation acres classified as being in low to moderately-low ecological status (roughly 78 percent) not meeting desired conditions, and the extent of moderate and high burn severity acres. Continuing livestock grazing use should be assessed to determine if it is consistent with ecological recovery, particularly as the climate shifts (Karr and Rossano, 2001; Karr, 2004; LaPaix et al., 2009; Beschta et al., 2013) to reduce or eliminate cascading effects (Kondolf, 1994; Rhodes et al., 1994; Beschta et al., 2013), and to be compatible with maintaining or recovering key ecological functions and native species and habitats (Beschta et al., 2013). In addition, implement the

recommended guidelines for restocking burned area (USFS, 2008c) as the consequence of fire.

Improved travel management, and road maintenance and design; and implementation of applicable BMPs. Implement aggressive invasive plant management; because, according to Jordan et al. (2008), recent evidence suggests that positive feedbacks between invasive plants and soils could contribute significantly to plant invasions (Corbin and D'Antonio, 2004; Ehrenfeld, 2004; Scott et al., 2001; Wolfe and Klironomos, 2005; Reinhart and Callaway, 2006; Eppstein and Molofsky, 2007), perhaps exemplifying 'ecological engineering' by biological invaders (Cuddington and Hastings, 2004). Invasive species modify soils that they occupy (Ramakrishnan and Vitousek, 1989) in ways that increase their own fitness relative to that of native species (Vivrette and Muller, 1977; Jordan et al., 2008), and therefore, are more competitive in site occupation.

Ecological Need for Change in Management Activities

Emerging and related concerns are the homogenization of the flora of this PNV. The diversity of native plants contributes to the maintenance and enhancement of above- and belowground biological interactions that keep ecological interactions intact (Printz et al., 2014). Disruptions in plant diversity by loss of species that are potentially important to the site and the threat to native species posed by exotic species that spread in response to human activities create a host of issues related to ecosystem health. There is a need for ecological change within this PNV so that it is more resistant (withstand and maintain normal function) and resilient (recover from) to disturbances within its HRV. Resiliency requires forest characteristics such as fuel loading, species composition and stand structures be compatible with restoration of frequent surface fire functional processes. Desired changes include management activities that also influence understory herbaceous species cover and species richness that is more closely associated with HRV by:

- Stabilizing soils and re-establish dominance of the native plant communities on moderate to high severity burn areas
- Reducing overstory density to restore open forest conditions
- Reducing grazing pressure
- Restoring understory herbaceous vegetation to moderately-high to high ecological condition
- Restoring dominance of seral fire-adapted species
- Promoting regeneration of shade intolerant seral species
- Reducing understory and overstory dominance of shade tolerant species
- Reducing fuel loading to levels commensurate with re-introduction of frequent surface fire (reduction of FRCC from III to I)
- Restoring frequent surface fire as a functional ecological process
- Preventing, controlling and eradicating invasive plants

There is a need to maintain or improve ecosystem conditions to be resistant to and resilient in response to climate change.

Appendix E table 6. A-SNFS' risks to the dry mixed conifer forest PNVT based on identified threats. Threats are categorized as either under agency management authority or outside agency management authority as well as threat type and estimated risk of high (H), moderate (M) or low (L)

Threat	Threat Type	Estimated Risk ¹		Risk Consequence to Ecological Characteristics ²			
		likelihood of occurrence	severity	composition (C)	structure (S)	function (F)	services (Sv)
Under Agency Management Authority							
Feral equine-ungulate grazing/browsing	Consumptive biological use/modification of natural processes/habitat conversion	H	M-H ³	✓	✓	✓	✓
Fire suppression policy	Modification of natural processes	H	H	✓	✓	✓	✓
Forest management practices (vegetation treatments)	Consumptive biological use/modification of natural processes/habitat conversion	H	M	✓	✓	✓	
Human-caused fire	Habitat conversion	H	H	✓	✓	✓	✓
Invasive plant species	Modification of natural processes/habitat conversion	H	M	✓	✓	✓	✓
Livestock grazing/browsing	Consumptive biological use/modification of natural processes/habitat conversion	H	M-H ³	✓	✓	✓	✓
Off-highway vehicles (OHVs)	Non-consumptive biological use	M	H	✓		✓	✓
Roads, highways and utility corridors	Transportation/habitat conversion	H	H	✓	✓		✓
Outside Agency Management Authority							
Climate change	Modification of natural processes/habitat conversion	H	H	✓	✓	✓	✓
Drought	Habitat conversion	M	M	✓	✓	✓	✓
Insect, disease, parasites and/or pathogens outbreaks (epidemic)	Invasive species/habitat conversion	H	H	✓	✓	✓	✓
Uncharacteristic wildfire	Habitat conversion	M	H	✓	✓	✓	✓
Wild ungulate grazing/browsing	Consumptive biological use/modification of natural processes/habitat conversion	H	M-H ³	✓	✓	✓	✓
Wind events (blowdown)	Habitat conversion	L	L	✓	✓		✓
Total (under/outside agency management authority)				8/6	7/6	7/6	7/6

¹ Estimated Risk is divided into Likelihood of Occurrence (defined as the probability of a significant departure from reference conditions) and Severity (defined as the magnitude of the departure from reference conditions)

² Risks are assessed as affecting changes in one or more of the following ecosystem characteristics: vegetation composition (C), vegetation structure (S); vegetation function (F) and/or ecological services (Sv). Composition (C) is the biological elements within the different levels of biological organizations, from genes and species to communities and ecosystems. Structure (S) is the organization and physical arrangement of biological elements such as snags and down woody debris, vertical and horizontal distribution of vegetation, stream habitat complexity, landscape pattern, and connectivity. Function (F) is the ecological processes, such as energy flow; nutrient cycling and retention; soil development and retention; predation and herbivory; and natural disturbances such as wind, fire, and floods. Services (Sv) are the provisioning services - such as clean air and fresh water, as well as energy, fuel, forage, fiber, and minerals; regulating services - such as longterm storage of carbon, climate regulation, water filtration, purification and storage, soil stabilization, flood control, and disease regulation; and supporting services - such as pollination, seed dispersal, soil formation, and nutrient cycling. Not all aspects of structure, composition, function and/or services may be affected because of the occurrence of a threat or threat type

³ Given the extensive amount of herbaceous understory vegetation acres classified as being in low to moderately-low ecological status not meeting desired conditions, and the extent of moderate and high burn severity acres within this PNVT

Spruce-Fir Forest PNVT

When assessing threats and risks to spruce-fir forest it is necessary to evaluate the relationship between current departure from HRV and trend in relation to HRV (Appendix E table 7). In this case, assess the legacy of past management or deviation from ongoing management activities, evaluate threats/risks and system reversibility. In relation to HRV, departure is high, however, the current trend is toward HRV; risks are addressed. Continue current management; however, restoration opportunities should be identified for this PNVT.

Appendix E table 7. Recommended actions in evaluating threats/risks for the spruce-fir forest PNVT in relation to its high woody overstory vegetation departure from HRV and current trend toward HRV

Current Departure from HRV ¹ is 62 Percent	Spruce-Fir Forest PNVT Trend in Relation to HRV		
	static (neither towards nor away)	towards HRV ²	away from HRV (or unknown)
Significant (low, moderate, HIGH or severe departure)	Legacy of past management or deviation from ongoing activities; evaluate threats/risks and system reversibility	Risk addressed; continue current management and identify restoration opportunities	Potential for high risk; evaluate threats and system reversibility
Non-significant (no departure; within HRV)	No risk; continue current management	No risk; continue current management	Potential risk; evaluate magnitude of future deviations, threats and system reversibility

¹ Departure is separated into 5 categories: 1. Within HRV (departure index of 0-20%); 2. low (departure index of 21-40%); 3. moderate (departure index of 41-60%); 4. high (departure index of 61-80%); and 5. severe (departure index of 81-100%)

² See figure 9; under current management (Alternative A), within the 15-year planning period, movement is towards HRV

In regards to the current herbaceous understory vegetation ecological status³⁴ and range condition^{35, 36} of the lands capable³⁷ of supporting livestock grazing, spruce-fir forest PNVT ranks 13th out of the 14 PNVTs in the amount of capable grazing lands not meeting desired conditions, roughly 24 percent (Appendix D - addendum figure 8).

Threats: The most important threat, based on high likelihood of occurrence and high threat severity, under Forest Service management authority to spruce-fir forest is (Appendix E table 8) the potential for human-caused fires. This threat type presents the possibility for habitat conversion which have negative consequences to ecological composition, structure, function and processes. Other anthropogenic threats include feral equine, wild ungulate and livestock grazing/browsing, and off highway vehicles (OHV); invasive plants are an additional threat. The most important threat, based on high likelihood of occurrence and high threat severity outside of agency authority is climate change, and this is likely to intensify (Beschta et al., 2013) and be compounding all other identified threats. Other threats outside Forest Service management authority include insect, disease, parasites and/or pathogens outbreaks (epidemic), and wild ungulate grazing/browsing. These threats types include habitat conversion and invasive species which have negative consequences to ecological composition, structure, function and processes. Uncharacteristic wildfire is an additional threat. Climate-related changes can not only affect public-land ecosystems directly, but may exacerbate the aggregate effects of non-climatic stressors, such as habitat modification and pollution caused by logging, mining, grazing, roads, water diversions, and recreation (Root et al., 2003; CEQ, 2010; Barnosky et al., 2012; Beschta et al., 2013).

Risks: Under current management, risks are addressed.

Opportunities: Vegetation treatments and silvicultural opportunities that restore and promote forest vegetative structure and composition that approximates HRV; manage fire as an integral component of ecosystem sustainability; aggressive invasive plant management and implementation of applicable BMPs. Evaluate the ecological costs and appropriateness of livestock grazing within this forested PNVT given the extensive amount of herbaceous understory vegetation acres classified as being in moderately-low

ecological status (roughly 24 percent) not meeting desired conditions, and the extent of moderate and high burn severity acres. Continuing livestock grazing use should be assessed to determine if it is consistent with ecological recovery, particularly as the climate shifts (Karr and Rossano, 2001; Karr, 2004; LaPaix et al., 2009; Beschta et al., 2013) to reduce or eliminate cascading effects (Kondolf, 1994; Rhodes et al., 1994; Beschta et al., 2013), and to be compatible with maintaining or recovering key ecological functions and native species and habitats (Beschta et al., 2013). In addition, implement the recommended guidelines for restocking burned area (USFS, 2008c) as the consequence of fire.

Improved travel management, and road maintenance and design; and implementation of applicable BMPs. Implement aggressive invasive plant management; because, according to Jordan et al. (2008), recent evidence suggests that positive feedbacks between invasive plants and soils could contribute significantly to plant invasions (Corbin and D'Antonio, 2004; Ehrenfeld, 2004; Scott et al., 2001; Wolfe and Klironomos, 2005; Reinhart and Callaway, 2006; Eppstein and Molofsky, 2007), perhaps exemplifying 'ecological engineering' by biological invaders (Cuddington and Hastings, 2004). Invasive species modify soils that they occupy (Ramakrishnan and Vitousek, 1989) in ways that increase their own fitness relative to that of native species (Vivrette and Muller, 1977; Jordan et al., 2008), and therefore, are more competitive in site occupation.

Ecological Need for Change in Management Activities

Emerging and related concerns are the homogenization of the flora of this PNV. The diversity of native plants contributes to the maintenance and enhancement of above- and belowground biological interactions that keep ecological interactions intact (Printz et al., 2014). Disruptions in plant diversity by loss of species that are potentially important to the site and the threat to native species posed by exotic species that spread in response to human activities create a host of issues related to ecosystem health. There is a need for ecological change within this PNV so that it is more resistant (withstand and maintain normal function) and resilient (recover from) to disturbances within its HRV. Resiliency requires forest characteristics such as fuel loading, species composition and stand structures be compatible with restoration of frequent surface fire functional processes. Desired changes include management activities that also influence understory herbaceous species cover and species richness that is more closely associated with HRV by:

- Stabilizing soils and re-establish dominance of the native plant communities on moderate to high severity burn areas
- Restoring understory herbaceous vegetation to moderately-high to high ecological condition
- Preventing human-caused fires
- Preventing, controlling and eradicating invasive plants

There is a need to maintain ecosystem conditions to be resistant to and resilient in response to climate change.

Appendix E table 8. A-SNFs' risks to the spruce-fir forest PNVT based on identified threats. Threats are categorized as either under agency management authority or outside agency management authority as well as threat type and estimated risk of high (H), moderate (M), or low (L)

Threat	Threat Type	Estimated Risk ¹		Risk Consequence to Ecological Characteristics ²			
		likelihood of occurrence	severity	composition (C)	structure (S)	function (F)	services (Sv)
Under Agency Management Authority							
Feral equine-ungulate grazing/browsing	Consumptive biological use/modification of natural processes/habitat conversion	H	M ³	✓	✓	✓	✓
Forest management practices (vegetation treatments)	Consumptive biological use/modification of natural processes/habitat conversion	H	M	✓	✓	✓	
Human-caused fire	Habitat conversion	H	H	✓	✓	✓	✓
Invasive plant species	Modification of natural processes/habitat conversion	H	M	✓	✓	✓	✓
Livestock grazing/browsing	Consumptive biological use/modification of natural processes/habitat conversion	H	M ³	✓	✓	✓	✓
Outside Agency Management Authority							
Climate change	Modification of natural processes/habitat conversion	H	H	✓	✓	✓	✓
Drought	Habitat conversion	M	M	✓	✓	✓	✓
Insect, disease, parasites and/or pathogens outbreaks (epidemic)	Invasive species/habitat conversion	H	H	✓	✓	✓	✓
Uncharacteristic wildfire	Habitat conversion	M	H	✓	✓	✓	✓
Wild ungulate grazing/browsing	Consumptive biological use/modification of natural processes/habitat conversion	H	M ³	✓	✓	✓	✓
Wind events (blowdown)	Habitat conversion	L	L	✓	✓		✓
Total (under/outside agency management authority)				5/6	5/6	5/5	4/6

¹ Estimated Risk is divided into Likelihood of Occurrence (defined as the probability of a significant departure from reference conditions) and Severity (defined as the magnitude of the departure from reference conditions)

² Risks are assessed as affecting changes in one or more of the following ecosystem characteristics: vegetation composition (C), vegetation structure (S); vegetation function (F) and/or ecological services (Sv). Composition (C) is the biological elements within the different levels of biological organizations, from genes and species to communities and ecosystems. Structure (S) is the organization and physical arrangement of biological elements such as snags and down woody debris, vertical and horizontal distribution of vegetation, stream habitat complexity, landscape pattern, and connectivity. Function (F) is the ecological processes, such as energy flow; nutrient cycling and retention; soil development and retention; predation and herbivory; and natural disturbances such as wind, fire, and floods. Services (Sv) are the provisioning services - such as clean air and fresh water, as well as energy, fuel, forage, fiber, and minerals; regulating services - such as longterm storage of carbon, climate regulation, water filtration, purification and storage, soil stabilization, flood control, and disease regulation; and supporting services - such as pollination, seed dispersal, soil formation, and nutrient cycling. Not all aspects of structure, composition, function and/or services may be affected because of the occurrence of a threat or threat type

³ Given the extensive amount of moderate and high burn severity acres within this PNVT

Threat/Risk Assessment for Woodland PNVTs

Madrean Pine-Oak Woodland PNVT

When assessing threats and risks to Madrean pine-oak woodland it is necessary to evaluate the relationship between current departure from HRV and trend in relation to HRV (Appendix E table 9). In this case, assess legacy of past management or deviation from ongoing management activities, evaluate threats/risks and system reversibility. In relation to HRV, departure is high, and the current trend is away from HRV; risks are not addressed. Discontinue current management and identify restoration opportunities for this PNVT.

Appendix E table 9. Recommended actions in evaluating threats/risks for the Madrean pine-oak woodland PNVT in relation to its high woody overstory vegetation departure from HRV and current trend away from HRV

Current Departure from HRV ¹ is 72 Percent	Madrean Pine-Oak Woodland PNVT Trend in Relation to HRV		
	static (neither towards nor away)	towards HRV	away from HRV (or unknown) ²
Significant (low, moderate, HIGH or severe)	Legacy of past management or deviation from ongoing activities; evaluate threats/risks and system reversibility	Risk addressed; continue current management and identify restoration opportunities	Potential for high risk; evaluate threats and system reversibility
Non-significant (within HRV)	No risk; continue current management	No risk; continue current management	Potential risk; evaluate magnitude of future deviations, threats and system reversibility

¹ Departure is separated into 5 categories: 1. Within HRV (departure index of 0-20%); 2. low (departure index of 21-40%); 3. moderate (departure index of 41-60%); 4. high (departure index of 61-80%); and 5. severe (departure index of 81-100%)

² See figure 13; under current management (Alternative A), within the 15-year planning period, movement is away from HRV

In regards to the current herbaceous understory vegetation ecological status³⁴ and range condition^{35, 36} of the lands capable³⁷ of supporting livestock grazing, Madrean pine-oak woodland PNVT ranks 11th out of the 14 PNVTs in the amount of capable grazing lands not meeting desired conditions, roughly 46 percent (Appendix D - addendum figure 11).

Threats: The most important threats, based on high likelihood of occurrence and high threat severity, under Forest Service management authority to Madrean pine-oak woodland include (Appendix E table 10) fire suppression and human-caused fires. These threats types include modification of natural processes and habitat conversion which have negative consequences to ecological composition, structure, function and processes. Other anthropogenic threats include feral equine, wild ungulate and livestock grazing/browsing, and off highway vehicles (OHV); invasive plants are an additional threat. The most important threat, based on high likelihood of occurrence and high threat severity outside of agency authority is climate change, and this is likely to intensify (Beschta et al., 2013) and be compounding all other identified threats. According to Barger et al. (2009), given future climate projections of increasing temperature and more extended drought periods, regeneration of piñon populations following the recent dieback throughout the Southwest may be slow. Moreover, prolonged drought combined with potentially slow regeneration for piñon under future climate scenarios could result in substantial declines in piñon populations across the Southwest. Robles and Enquist (2010) have identified Madrean pine-oak woodland as one of the most vulnerable habitats to climate change in the Southwest, based on temperature change and the number of species of conservation concern. According to Clifford et al. (2011), regional-scale climatic influences may be more important than land use legacies in controlling tree cover of semiarid woodlands over long time scales. Climate-related changes can not only affect public-land ecosystems directly, but may exacerbate the aggregate effects of non-climatic stressors, such as habitat modification and pollution caused by logging, mining, grazing, roads, water diversions, and recreation (Root et al.,

2003; CEQ, 2010; Barnosky et al., 2012; Beschta et al., 2013). Other threats outside Forest Service management authority include insect, disease, parasites and/or pathogens outbreaks (epidemic), and wild ungulate grazing/browsing. These threats types include habitat conversion and invasive species which have negative consequences to ecological composition, structure, function and processes. Uncharacteristic erosion, sedimentation and wildfire are additional threats.

Quite possibly, the most important and far reaching threats under agency authority for Madrean pine-oak woodland include managing the legacy of past and current livestock grazing/browsing and fire suppression. According to Schussman and Gori (2006), the cessation of widespread fires in the Madrean pine-oak woodlands in the late 1880s has been attributed to the lack of fine fuel availability due to heavy livestock grazing (Bahre, 1991; Swetnam et al., 1992; Swetnam and Baisan, 1996; Swetnam and Betancourt, 1998; Fulé et al., 2005), and the introduction of invasive plants. Jones (2000) found that livestock grazing had significantly detrimental impacts on dry ecosystems. Soils, litter cover, and biomass were found to be the most negatively affected variables.

Risks: The above threats pose the following risks, many of these risks when functioning together are additive and have compounding affects with negative consequences to ecological composition, structure, function and processes. Specifically by affecting vegetation health (atypical composition, structure and function), soil compaction, erosion, sedimentation and loss of soil fertility, altered watershed and hydrologic functions, reduced water quality and quantity, riparian, aquatic and terrestrial locales loss, degradation and fragmentation of these habitats within this PNVN, altered fire regime, introduction and spread of invasive plants, modification of natural processes, change in ecological potentials, species extinction or reduction in population(s) and/or habitat(s), uncharacteristic wildfire, and inability to re-establish natural wildfire processes.

Reversibility: Some threats/risks are not reversible under Forest Service authority such as drought. Even though this threat/risk is not within agency authority, the forests have a responsibility to assess, address, develop and implement appropriate management responses that mitigate undesirable consequences to National Forest System Lands. On the other hand, some threats/risks may be reversible such as, epidemic insect, disease and parasites and/or pathogens outbreaks depending on spatial scale. With uncharacteristic fires – there may be irreversible conditions – soil loss, uncharacteristic succession, habitat modification, loss and/or fragmentation (reduces species' population and/or viability). Some effects of infestations by invasive plants and areas of infestation are reversible depending on species and spatial scale. Risks from fire suppression and human-caused fires can be minimized and in many cases reversed. Some effects of livestock grazing/browsing are also reversible depending on severity of change and spatial scale. According to Loeser et al. (2007), changes in climate affecting precipitation, may cause some ecological alterations to be persistent.

Appendix E table 10. A-SNFs' risks to the Madrean pine-oak woodland PNVT based on identified threats. Threats are categorized as either under agency management authority or outside agency management authority as well as threat type and estimated risk of high (H) or moderate (M)

Threat	Threat Type	Estimated Risk ¹		Risk Consequence to Ecological Characteristics ²			
		likelihood of occurrence	severity	composition (C)	structure (S)	function (F)	services (Sv)
Under Agency Management Authority							
Feral equine-ungulate grazing/browsing	Consumptive biological use/modification of natural processes/habitat conversion	H	M-H ³	✓	✓	✓	✓
Fire suppression policy	Modification of natural processes	H	H	✓	✓	✓	✓
Forest management practices (vegetation treatments)	Consumptive biological use	M	M	✓	✓	✓	
Human-caused fire	Habitat conversion	H	H	✓	✓	✓	✓
Invasive plant species	Modification of natural processes/habitat conversion	H	M	✓	✓	✓	✓
Livestock grazing/browsing	Consumptive biological use/modification of natural processes/habitat conversion	H	M-H ³	✓	✓	✓	✓
Outside Agency Management Authority							
Climate change	Modification of natural processes/habitat conversion	H	H	✓	✓	✓	✓
Drought	Habitat conversion	M	M	✓	✓	✓	✓
Insect, disease, parasites and/or pathogens outbreaks (epidemic)	Invasive species/habitat conversion	H	H	✓	✓	✓	✓
Uncharacteristic erosion	Habitat conversion	M	H	✓	✓	✓	✓
Uncharacteristic sedimentation	Habitat conversion	M	H	✓	✓	✓	✓
Uncharacteristic wildfire	Habitat conversion	M	H	✓	✓	✓	✓
Wild ungulate grazing/browsing	Consumptive biological use/modification of natural processes/habitat conversion	H	M-H ³	✓	✓	✓	✓
Total (under/outside agency management authority)				6/7	6/7	6/7	5/7

¹ Estimated Risk is divided into Likelihood of Occurrence (defined as the probability of a significant departure from reference conditions) and Severity (defined as the magnitude of the departure from reference conditions)

² Risks are assessed as affecting changes in one or more of the following ecosystem characteristics: vegetation composition (C), vegetation structure (S); vegetation function (F) and/or ecological services (Sv). Composition (C) is the biological elements within the different levels of biological organizations, from genes and species to communities and ecosystems. Structure (S) is the organization and physical arrangement of biological elements such as snags and down woody debris, vertical and horizontal distribution of vegetation, stream habitat complexity, landscape pattern, and connectivity. Function (F) is the ecological processes, such as energy flow; nutrient cycling and retention; soil development and retention; predation and herbivory; and natural disturbances such as wind, fire, and floods. Services (Sv) are the provisioning services - such as clean air and fresh water, as well as energy, fuel, forage, fiber, and minerals; regulating services - such as longterm storage of carbon, climate regulation, water filtration, purification and storage, soil stabilization, flood control, and disease regulation; and supporting services - such as pollination, seed dispersal, soil formation, and nutrient cycling. Not all aspects of structure, composition, function and/or services may be affected because of the occurrence of a threat or threat type

³ Given the extensive amount of herbaceous understory vegetation acres classified as being in low to moderately-low ecological status not meeting desired conditions, and the extent of moderate and high burn severity acres within this PNVT

Opportunities: Vegetation treatments and silvicultural opportunities that restore and promote woodland vegetative structure and composition that approximates HRV to promote stands of larger trees in more open canopy configuration and reduction in the small sized trees with closed canopies.; manage fire as an integral component of ecosystem sustainability; restoration of natural processes and existing conditions that have been compromised by the legacy of livestock management and fire suppression. Evaluate the ecological costs and appropriateness of livestock grazing within this woodland PNVT given the extensive amount of herbaceous understory vegetation acres classified as being in low to moderately-low ecological status (roughly 46 percent) not meeting desired conditions, and the extent of moderate and high burn severity acres. Continuing livestock grazing use should be assessed to determine if it is consistent with ecological recovery, particularly as the climate shifts (Karr and Rossano, 2001; Karr, 2004; LaPaix et al., 2009; Beschta et al., 2013) to reduce or eliminate cascading effects (Kondolf, 1994; Rhodes et al., 1994; Beschta et al., 2013), and to be compatible with maintaining or recovering key ecological functions and native species and habitats (Beschta et al., 2013). In addition, implement the recommended guidelines for restocking burned area (USFS, 2008c) as the consequence of fire.

Improved travel management, and road maintenance and design; and implementation of applicable BMPs. Implement aggressive invasive plant management; because, according to Jordan et al. (2008), recent evidence suggests that positive feedbacks between invasive plants and soils could contribute significantly to plant invasions (Corbin and D'Antonio, 2004; Ehrenfeld, 2004; Scott et al., 2001; Wolfe and Klironomos, 2005; Reinhart and Callaway, 2006; Eppstein and Molofsky, 2007), perhaps exemplifying 'ecological engineering' by biological invaders (Cuddington and Hastings, 2004). Invasive species modify soils that they occupy (Ramakrishnan and Vitousek, 1989) in ways that increase their own fitness relative to that of native species (Vivrette and Muller, 1977; Jordan et al., 2008), and therefore, are more competitive in site occupation.

Ecological Need for Change in Management Activities

Emerging and related concerns are the homogenization of the flora of this PNVT. The diversity of native plants contributes to the maintenance and enhancement of above- and belowground biological interactions that keep ecological interactions intact (Printz et al., 2014). Disruptions in plant diversity by loss of species that are potentially important to the site and the threat to native species posed by exotic species that spread in response to human activities create a host of issues related to ecosystem health. There is a need for ecological change within this PNVT so that it is more resistant (withstand and maintain normal function) and resilient (recover from) to disturbances within its HRV. Resiliency requires forest characteristics such as fuel loading, species composition and stand structures be compatible with restoration of frequent surface fire functional processes. There is a need for ecological change because this PNVT has experienced similar stand structural shifts as in the ponderosa pine and dry mixed conifer forest PNVTS. More woody stems per acre have resulted in decreased herbaceous vegetation, increased bare ground with subsequent reductions in organic matter, soil fertility and concurrent increases in erosion and sedimentation.

There is an ecological need to restore composition and structure and sustain ecological processes in this woodland community. Within the Madrean pine-oak woodland there is an over representation of young aged woody species with a closed canopy aspect. The current type and rate of management activities (where recurring disturbances, such as grazing (e.g., zootic disclimax³⁸) exert the predominant influence

³⁸ Disclimax or "disturbance climax" describes a community that is held at an earlier successional stage by repeated but unpredictable disturbances that prevent succession from reaching the climax community that might be expected for the climate of the area. A zootic or "animal" disclimax describes a community that is held at an earlier successional stage by some animal influence such as domestic livestock, for example; a grassland community that has been altered to woodland/shrubland by overgrazing.

in maintaining the structure and composition of the steady-state vegetation within this PNVT) will not restore or move the composition and structure of these woodlands on the A-SNFs to anything approaching their HRV, and therefore, will not likely prevent additional losses of soil and site productivity or to reduce the fire severity or change fire frequency. There has been a steady-state shift in herbaceous understory vegetation structure and composition from tall- and mid-grass cool-season species to mid- and short-grass warm-season species. This PNVT contributes roughly 20 percent of the A-SNFs' acres and is continuing to expand its range into neighboring grassland communities. In addition, invasive plants will continue to displace native species and disrupt and/or modify ecological processes within these communities. There is a need for change to prevent, eradicate and/or control invasive plant infestations to avert the loss of biological diversity, disruption and/or modification ecological processes within these woodlands.

Because of the degree of departure and proportion of this PNVT off-forest; the A-SNFs provide a notable contribution to the sustainability of this woodland PNVT. Desired changes include management activities that also influence understory herbaceous species cover and species richness that is more closely associated with HRV by:

- Stabilizing soils and re-establish dominance of the native plant communities on moderate to high severity burn areas
- Reducing overstory density to restore open woodland conditions
- Reducing grazing pressure
- Restoring understory herbaceous vegetation to moderately-high to high ecological condition
- Restoring dominance of seral fire-adapted species
- Promoting regeneration of shade intolerant seral species
- Reducing understory and overstory dominance of shade tolerant species
- Restoring frequent surface fire as a functional ecological process
- Preventing, controlling and eradicating invasive plants

There is also a need to maintain or improve ecosystem conditions to be resistant to and resilient in response to climate change.

Piñon-Juniper Woodland PNVT

When assessing threats and risks to piñon-juniper woodland it is necessary to evaluate the relationship between current departure from HRV and trend in relation to HRV (Appendix E table 11). In this case, assess the legacy of past management or deviation from ongoing management activities, evaluate threats/risks and system reversibility. In relation to HRV, departure is low; however, the current trend is toward from HRV; risks are addressed. Continue current management; however, restoration opportunities should be identified for this PNVT.

In regards to the current herbaceous understory vegetation ecological status³⁴ and range condition^{35, 36} of the lands capable³⁷ of supporting livestock grazing, piñon-juniper woodland PNVT ranks 1st out of the 14 PNVTs in the amount of capable grazing lands not meeting desired conditions, roughly 91 percent (Appendix D - addendum figure 12).

Threats: Quite possibly, the most important and far reaching threats under agency authority for piñon-juniper woodland include managing the legacy of past and current livestock grazing/browsing and fire suppression. According to Gori and Bate (2007), the cessation of widespread fires in the piñon-juniper woodlands in the late 1880s has been attributed to the lack of fine fuels available due to heavy livestock

grazing (McPherson and Wright, 1990; Bahre, 1991; Swetnam et al., 1992; Swetnam and Baisan, 1996; Swetnam and Betancourt, 1998; Fulé et al., 2005), and the introduction of invasive plants.

The most important threats, based on high likelihood of occurrence and high threat severity, under Forest Service management authority to piñon-juniper woodland include (Appendix E table 12) fire suppression, human-caused fires and roads, highways and utility corridors. These threats types include modification of natural processes, transportation and habitat conversion which have negative consequences to ecological composition, structure, function and processes. Other anthropogenic threats include feral equine, wild ungulate and livestock grazing/browsing, and off highway vehicles (OHV); invasive plants are an additional threat. The most important threat, based on high likelihood of occurrence and high threat severity outside of agency authority is climate change, and this is likely to intensify (Beschta et al., 2013) and be compounding all other identified threats. According to Barger et al. (2009), given future climate projections of increasing temperature and more extended drought periods, regeneration of piñon populations following the recent dieback throughout the Southwest may be slow. Moreover, prolonged drought combined with potentially slow regeneration for piñon under future climate scenarios could result in substantial declines in piñon populations across the Southwest. Robles and Enquist (2010) have identified piñon-juniper woodland as one of the most vulnerable habitats to climate change in the Southwest, based on temperature change and the number of species of conservation concern. According to Clifford et al. (2011), regional-scale climatic influences may be more important than land use legacies in controlling tree cover of semiarid woodlands over long time scales. Climate-related changes can not only affect public-land ecosystems directly, but may exacerbate the aggregate effects of non-climatic stressors, such as habitat modification and pollution caused by logging, mining, grazing, roads, water diversions, and recreation (Root et al., 2003; CEQ, 2010; Barnosky et al., 2012; Beschta et al., 2013). Other threats outside Forest Service management authority include insect, disease, parasites and/or pathogens outbreaks (epidemic), wild ungulate grazing/browsing, and urban development. These threats types include habitat conversion and invasive species which have negative consequences to ecological composition, structure, function and processes. Excessive ungulate grazing/browsing, uncharacteristic erosion and sedimentation are additional threats.

Appendix E table 11. Recommended actions in evaluating threats/risks for the piñon-juniper woodland PNVT in relation to its low woody overstory vegetation departure from HRV and current trend toward HRV

Current Departure from HRV ¹ is 26 Percent	Piñon-Juniper Woodland PNVT Trend in Relation to HRV		
	static (neither towards nor away)	towards HRV ²	away from HRV (or unknown)
Significant (LOW , moderate, high or severe)	Legacy of past management or deviation from ongoing activities; evaluate threats/risks and system reversibility	Risk addressed; continue current management and identify restoration opportunities	Potential for high risk; evaluate threats and system reversibility
Non-significant (within HRV)	No risk; continue current management	No risk; continue current management	Potential risk; evaluate magnitude of future deviations, threats and system reversibility

¹ Departure is separated into 5 categories: 1. Within HRV (departure index of 0-20%); 2. low (departure index of 21-40%); 3. moderate (departure index of 41-60%); 4. high (departure index of 61-80%); and 5. severe (departure index of 81-100%)

² See figure 14; under current management (Alternative A), within the 15-year planning period, movement is towards HRV

Risks: The above threats pose the following risks, many of these risks when functioning together are additive and have compounding affects with negative consequences to ecological composition, structure, function and processes. Specifically by affecting vegetation health (atypical composition, structure and function), soil compaction, erosion, sedimentation and loss of soil fertility, altered watershed and hydrologic functions, reduced water quality and quantity, riparian, aquatic and terrestrial locales loss, degradation and fragmentation of these habitats within this PNVT, altered fire regime, introduction and spread of invasive plants, modification of natural processes, change in ecological potentials, species

extinction or reduction in population(s) and/or habitat(s), uncharacteristic wildfire, and inability to re-establish natural wildfire processes.

Again, the decline in herbaceous cover due to livestock grazing in concert with the disruption of the fire regime has been cited in a number of studies as the primary causative factor for the observed increase in tree densities in many piñon-juniper woodlands over the last 120 years (Brown, 1950; Bahre and Shelton, 1993; Bock and Bock, 1993; Briggs et al., 2002b). Subtle shifts in herbaceous composition also occurred with grazing, with warm-season perennial grasses being favored at the expense of cool-season species (Jameson et al., 1962; Arnold et al., 1964; Baxter, 1977). Ungulate herbivory can alter vegetation composition, structure and function, as well as cause soil compaction and erosion, loss of soil microorganisms, reduction of moisture infiltration rates and increased runoff (Stoddart and Smith, 1955; Klemmedson, 1956; Ellison, 1960; Heady, 1975; Stoddart et al., 1975; Wood, 1980; Holechek et al., 1998; Heitschmidt and Stuth, 1991; Fleischner, 1994; Belsky et al., 1999; Jamison and Raish, 2000; among others). Jones (2000) found that livestock grazing had significantly detrimental impacts on soils, litter cover, and biomass. The decline in herbaceous cover along with the direct effects of livestock grazing on soil compaction have also led to increased soil erosion rates at many sites (Baxter, 1977; Carrara and Carroll, 1979; Gottfried et al., 1995; Ernst and Pieper, 1996; Wilcox et al., 1996; Bogan et al., 1998; Allen, 2001; Wood and Javed, 2001; Huffman et al., 2006b; among others). When erosion is severe, changes in the physical properties of soils and in the distribution and abundance of limiting nutrients can impede the re-establishment of herbaceous vegetation even when livestock grazing is eliminated (Koniak and Everett; 1982; Klopatek; 1987; Klopatek and Klopatek; 1987; Klopatek et al., 1990; Laycock; 1991; Gottfried et al., 1995; Davenport et al., 1998; Breshears and Barnes; 1999; Allen; 2001; among others).

Alternative hypotheses implicating livestock grazing (without fire regime disruption), drought and climate variation in the post-settlement loss of grass cover, tree increases, and increased soil erosion have also been proposed (Floyd et al., 2000 and 2004; Romme et al., 2003). Additional studies are needed to unravel the effects of these factors on the historical fire regime and on post-settlement structural changes in the piñon-juniper woodland. Most piñon-juniper woodlands in the Southwest have high soil erosion potential (i.e. erosion rates are more sensitive to changing vegetative cover and can cross a threshold more easily than in regions with lower intensity precipitation events) (Gori and Bate, 2007). In addition, there has been a loss of cool season perennial grasses which historically predominate in the herbaceous layer where winter rainfall exceeded summer (Ernest et al., 1993). It has also been reported (Brockway et al., 2002), that a combination of frequent fire and competition from cool-season grasses effectively exclude juniper during the critical period of seedling establishment.

Reversibility: Some threats/risks are not reversible under Forest Service authority such as urban development. Even though this threat/risk is not within agency authority, the forests have a responsibility to assess, address, develop and implement appropriate management responses that mitigate undesirable consequences to National Forest System Lands. On the other hand, some threats/risks may be reversible such as, epidemic insect, disease and parasites and/or pathogens outbreaks depending on spatial scale. With uncharacteristic erosion – there may be irreversible conditions – soil loss, uncharacteristic succession, habitat modification, loss and/or fragmentation (reduces species' population and/or viability). Some effects of infestations by invasive plants and areas of infestation are reversible depending on species and spatial scale. Risks from fire suppression and human-caused fires can be minimized and in many cases reversed. Some effects of livestock grazing and OHVs are also reversible depending on severity of change and spatial scale. According to Loeser et al. (2007), changes in climate affecting precipitation, may cause some ecological alterations to be persistent.

Appendix E table 12. A-SNFs' risks to the piñon-juniper woodland PNVT based on identified threats. Threats are categorized as either under agency management authority or outside agency management authority as well as threat type and estimated risk of high (H) or moderate (M)

Threat	Threat Type	Estimated Risk ¹		Risk Consequence to Ecological Characteristics ²			
		likelihood of occurrence	severity	composition (C)	structure (S)	function (F)	services (Sv)
Under Agency Management Authority							
Feral equine-ungulate grazing/browsing	Consumptive biological use/modification of natural processes/habitat conversion	H	M-H ³	✓	✓	✓	✓
Fire suppression policy	Modification of natural processes	H	H	✓	✓	✓	✓
Forest management practices (vegetation treatments)	Consumptive biological use	M	M	✓	✓	✓	
Human-caused fire	Habitat conversion	H	H	✓	✓	✓	✓
Invasive plant species	Modification of natural processes/habitat conversion	H	M	✓	✓	✓	✓
Livestock grazing/browsing	Consumptive biological use/modification of natural processes/habitat conversion	H	M-H ³	✓	✓	✓	✓
Off-highway vehicles (OHVs)	Non-consumptive biological use	M	H	✓		✓	✓
Roads, highways and utility corridors	Transportation/habitat conversion	H	H	✓	✓		✓
Outside Agency Management Authority							
Climate change	Modification of natural processes/habitat conversion	H	H	✓	✓	✓	✓
Drought	Habitat conversion	M	M	✓	✓	✓	✓
Insect, disease, parasites and/or pathogens outbreaks (epidemic)	Invasive species/habitat conversion	H	H	✓	✓	✓	✓
Uncharacteristic erosion	Habitat conversion	M	H	✓	✓	✓	✓
Uncharacteristic sedimentation	Habitat conversion	M	H	✓	✓	✓	✓
Urban development	Habitat conversion	H	H	✓	✓	✓	
Wild ungulate grazing/browsing	Consumptive biological use/modification of natural processes/habitat conversion	H	M-H ³	✓	✓	✓	✓
Total (under/outside agency management authority)				8/7	7/7	7/7	7/6

¹ Estimated Risk is divided into Likelihood of Occurrence (defined as the probability of a significant departure from reference conditions) and Severity (defined as the magnitude of the departure from reference conditions)

² Risks are assessed as affecting changes in one or more of the following ecosystem characteristics: vegetation composition (C), vegetation structure (S); vegetation function (F) and/or ecological services (Sv). Composition (C) is the biological elements within the different levels of biological organizations, from genes and species to communities and ecosystems. Structure (S) is the organization and physical arrangement of biological elements such as snags and down woody debris, vertical and horizontal distribution of vegetation, stream habitat complexity, landscape pattern, and connectivity. Function (F) is the ecological processes, such as energy flow; nutrient cycling and retention; soil development and retention; predation and herbivory; and natural disturbances such as wind, fire, and floods. Services (Sv) are the provisioning services - such as clean air and fresh water, as well as energy, fuel, forage, fiber, and minerals; regulating services - such as longterm storage of carbon, climate regulation, water filtration, purification and storage, soil stabilization, flood control, and disease regulation; and supporting services - such as pollination, seed dispersal, soil formation, and nutrient cycling. Not all aspects of structure, composition, function and/or services may be affected because of the occurrence of a threat or threat type

³ Given the extensive amount of herbaceous understory vegetation acres classified as being in low to moderately-low ecological status not meeting desired conditions within this PNVT

Opportunities: Vegetation treatments and silvicultural opportunities that restore and promote woodland vegetative structure and composition that approximates HRV to promote stands of larger trees in more open canopy configuration and reduction in the small sized trees with closed canopies.; manage fire as an integral component of ecosystem sustainability; restoration of natural processes and existing conditions that have been compromised by the legacy of livestock management and fire suppression. Evaluate the ecological costs and appropriateness of livestock grazing within this woodland PNVt given the extensive amount of herbaceous understory vegetation acres classified as being in low to moderately-low ecological status (roughly 90 percent) not meeting desired conditions. Continuing livestock grazing use should be assessed to determine if it is consistent with ecological recovery, particularly as the climate shifts (Karr and Rossano, 2001; Karr, 2004; LaPaix et al., 2009; Beschta et al., 2013) to reduce or eliminate cascading effects (Kondolf, 1994; Rhodes et al., 1994; Beschta et al., 2013), and to be compatible with maintaining or recovering key ecological functions and native species and habitats (Beschta et al., 2013). In addition, implement the recommended guidelines for restocking burned area (USFS, 2008c) as the consequence of fire.

Improved travel management, and road maintenance and design; and implementation of applicable BMPs. Implement aggressive invasive plant management; because, according to Jordan et al. (2008), recent evidence suggests that positive feedbacks between invasive plants and soils could contribute significantly to plant invasions (Corbin and D'Antonio, 2004; Ehrenfeld, 2004; Scott et al., 2001; Wolfe and Klironomos, 2005; Reinhart and Callaway, 2006; Eppstein and Molofsky, 2007), perhaps exemplifying 'ecological engineering' by biological invaders (Cuddington and Hastings, 2004). Invasive species modify soils that they occupy (Ramakrishnan and Vitousek, 1989) in ways that increase their own fitness relative to that of native species (Vivrette and Muller, 1977; Jordan et al., 2008), and therefore, are more competitive in site occupation.

Ecological Need for Change in Management Activities

Emerging and related concerns are the homogenization of the flora of this PNVt. The diversity of native plants contributes to the maintenance and enhancement of above- and belowground biological interactions that keep ecological interactions intact (Printz et al., 2014). Disruptions in plant diversity by loss of species that are potentially important to the site and the threat to native species posed by exotic species that spread in response to human activities create a host of issues related to ecosystem health. There is a need for ecological change within this PNVt so that it is more resistant (withstand and maintain normal function) and resilient (recover from) to disturbances within its HRV. Resiliency requires forest characteristics such as fuel loading, species composition and stand structures be compatible with restoration of frequent surface fire functional processes. There is a need for ecological change because this PNVt has experienced similar stand structural shifts as in the ponderosa pine and dry mixed conifer forest PNVts. More woody stems per acre have resulted in decreased herbaceous vegetation, increased bare ground with subsequent reductions in organic matter, soil fertility and concurrent increases in erosion and sedimentation.

There is an ecological need to restore composition and structure and sustain ecological processes in this woodland community. Within the piñon-juniper woodland there is an over representation of young-aged woody species with a closed canopy aspect. The current type and rate of management activities (where recurring disturbances, such as grazing (e.g., zootic disclimax) exert the predominant influence in maintaining the structure and composition of the steady-state vegetation within this PNVt) will not restore or move the composition and structure of these woodlands on the A-SNFs to anything approaching their HRV, and therefore, will not likely prevent additional losses of soil and site productivity or to reduce the fire severity or change fire frequency. There has been a steady-state shift in herbaceous understory vegetation structure and composition from tall- and mid-grass cool-season species to mid- and short-grass warm-season species. This PNVt contributes roughly 12 percent of the A-SNFs'

acres and is continuing to expand its range into neighboring grassland communities. In addition, invasive plants will continue to displace native species and disrupt and/or modify ecological processes within these communities. There is a need for change to prevent, eradicate and/or control invasive plant infestations to avert the loss of biological diversity, disruption and/or modification ecological processes within these woodlands.

Because of the degree of departure and proportion of this PNVF off-forest; the A-SNFs provide a notable contribution to the sustainability of this woodland PNVF. Desired changes include management activities that also influence understory herbaceous species cover and species richness that is more closely associated with HRV by:

- Stabilizing soils and re-establish dominance of the native plant communities on moderate to high severity burn areas
- Reducing overstory density to restore open woodland conditions
- Reducing grazing pressure
- Restoring understory herbaceous vegetation to moderately-high to high ecological condition
- Restoring dominance of seral fire-adapted species
- Promoting regeneration of shade intolerant seral species
- Reducing understory and overstory dominance of shade tolerant species
- Restoring frequent surface fire as a functional ecological process
- Preventing, controlling and eradicating invasive plants

There is also a need to maintain or improve ecosystem conditions to be resistant to and resilient in response to climate change.

Threat/Risk Assessment for Grassland PNVFs

Great Basin Grassland PNVF

When assessing threats and risks to Great Basin grassland it is necessary to evaluate the relationship between current departure from HRV and trend in relation to HRV (Appendix E table 13). In this case, assess the legacy of past management or deviation from ongoing management activities, evaluate threats/risks and system reversibility. In relation to HRV, departure is high, and the current trend is away from HRV; risks are not addressed. Discontinue current management and identify restoration opportunities for this PNVF.

In regards to the current herbaceous understory vegetation ecological status³⁴ and range condition^{35, 36} of the lands capable³⁷ of supporting livestock grazing, Great Basin grassland ranks 2nd out of the 14 PNVFs in the amount of capable grazing lands not meeting desired conditions, roughly 87 percent (Appendix D - addendum figure 16).

Threats: Noss et al. (1995) conclude that grasslands were among the most endangered ecosystems in the U.S., and that of those ecotypes that were most severely degraded, grasslands suffered areal losses that were threefold greater than any other ecosystem. The most important threats, based on high likelihood of occurrence and high threat severity, under Forest Service management authority to Great Basin grassland include (Appendix E table 14) fire suppression, woody species encroachment and establishment, human-caused fires and roads, highways and corridors. These threats types include modification of natural

processes and habitat conversion which have negative consequences to ecological composition, structure, function and processes. Other include feral equine, wild ungulate and livestock grazing/browsing, and off highway vehicles (OHV); invasive plants are an additional threat. The most important threat, based on high likelihood of occurrence and high threat severity outside of agency authority is climate change, and this is likely to intensify (Beschta et al., 2013) and be compounding all other identified threats. Climate-related changes can not only affect public-land ecosystems directly, but may exacerbate the aggregate effects of non-climatic stressors, such as habitat modification and pollution caused by logging, mining, grazing, roads, water diversions, and recreation (Root et al., 2003; CEQ, 2010; Barnosky et al., 2012; Beschta et al., 2013). Other threats outside Forest Service management authority include urban development, wild ungulate grazing/browsing, uncharacteristic erosion, sedimentation and wildfire. These threats types include habitat conversion and consumptive biological uses which have negative consequences to ecological composition, structure, function and processes. Drought is an additional threat.

Appendix E table 13. Recommended actions in evaluating threats/risks for the Great Basin grassland PNV in relation to its high woody overstory vegetation departure from HRV and current trend away from HRV

Current Departure from HRV ¹ is 67 Percent	Great Basin Grassland PNV Trend in Relation to HRV		
	static (neither towards nor away)	towards HRV	away from HRV (or unknown) ²
Significant (low, moderate, HIGH or severe)	Legacy of past management or deviation from ongoing activities; evaluate threats/risks and system reversibility	Risk addressed; continue current management and identify restoration opportunities	Potential for high risk; evaluate threats and system reversibility
Non-significant (within HRV)	No risk; continue current management	No risk; continue current management	Potential risk; evaluate magnitude of future deviations, threats and system reversibility

¹ Departure is separated into 5 categories: 1. Within HRV (departure index of 0-20%); 2. low (departure index of 21-40%); 3. moderate (departure index of 41-60%); 4. high (departure index of 61-80%); and 5. severe (departure index of 81-100%)

² See figure 17; under current management (Alternative A), within the 15-year planning period, movement is away from HRV

Risks: The above threats pose the following risks with negative consequences to ecological composition, structure, function and processes. Specifically by affecting vegetation health (atypical composition, structure and function), soil compaction, erosion, sedimentation and loss of soil fertility, altered watershed and hydrologic functions, reduced water quality and quantity, riparian, aquatic and terrestrial locales loss, degradation and fragmentation of these habitats within this PNV, altered fire regime, introduction and spread of invasive plants, modification of natural processes, change in ecological potentials, species extinction or reduction in population(s) and/or habitat(s), uncharacteristic wildfire, and inability to re-establish natural wildfire processes.

According to Gori and Enquist (2003) and Enquist and Gori (2005), changes in the structure and function of grassland systems have been noted as the primary cause of the loss of native diversity within grasslands (Stacey 1995). Finch (2004) identified and summarized the major threats to grassland biological diversity as the loss of natural fire cycles, overgrazing by livestock (Fleischner et al., 1994), prairie dog eradication, exotic grasses, shrub encroachment, erosion, and habitat fragmentation. The *Arizona Statewide Grasslands Assessment* (Gori and Enquist, 2003; Enquist and Gori, 2005) documented several of these factors as threats to grasslands on the A-SNFs. In particular, over 70 percent of grasslands on the A-SNFs whose current condition were assessed are woody species invaded.

Reversibility: Some threats/risks are not reversible under Forest Service authority such as: drought, uncharacteristic erosion and sedimentation and excessive ungulate grazing. Even though these threats/risks are not within agency authority, the forests have a responsibility to assess, address, develop and implement appropriate management responses that mitigate undesirable consequences to National Forest System Lands. On the other hand, some threats/risks are reversible such as: potential decline from

uncharacteristic erosion may be partially reversible depending on scale. With uncharacteristic fires – there may be irreversible conditions - soil loss, uncharacteristic succession, habitat modification/loss/fragmentation (reduces species' population and/or viability), Some effects of infestations by invasive plants and areas of infestation are reversible depending on species and spatial scale, Risks from fire suppression, human-caused fires and roads, highways and corridors can be minimized and in many cases be reversed, Some effects of livestock grazing/browsing are reversible depending on severity of change and spatial scale. However, according to Loeser et al. (2007), changes in climate affecting precipitation, may cause some ecological alterations to be persistent.

There is increasing evidence that climate change is resulting in more ecosystems crossing thresholds of change (CCSP, 2009; Bush et al., 2010). Woody species encroachment and establishment into the Great Basin grasslands has been extensive spatially. It is estimated that roughly 68 percent or over 120,800 acres have been invaded, to a lesser or greater degree. Roughly 70 percent or over 84,500 acres may not be restorable to their former grassland state depending on the severity of change (presence of woody species, loss of soil, productivity and production potential).

Opportunities: Vegetation treatments and silvicultural opportunities that restore and promote grassland vegetative structure and composition that approximates HRV; manage fire as an integral component of ecosystem sustainability; restoration of natural processes and existing conditions that have been compromised by the legacy of livestock management. Evaluate the ecological costs and appropriateness of livestock grazing within this grassland PNVT given the extensive amount of herbaceous understory vegetation acres classified as being in low to moderately-low ecological status (roughly 90 percent) not meeting desired conditions. Continuing livestock grazing use should be assessed to determine if it is consistent with ecological recovery, particularly as the climate shifts (Karr and Rossano, 2001; Karr, 2004; LaPaix et al., 2009; Beschta et al., 2013) to reduce or eliminate cascading effects (Kondolf, 1994; Rhodes et al., 1994; Beschta et al., 2013), and to be compatible with maintaining or recovering key ecological functions and native species and habitats (Beschta et al., 2013). In addition, implement the recommended guidelines for restocking burned area (USFS, 2008c) as the consequence of fire. As noted by Finch (2004), maintaining grasslands at sufficient scales is vital for supporting grassland-dependent species, as habitat fragmentation has detrimental effects on grassland biological diversity. These grassland areas provide a valuable opportunity to manage grasslands on the forests, and to partner with adjacent landowners, to restore grassland function and structure at sufficient scales to ensure the sustainability of species that depend on this system.

Improved travel management, and road maintenance and design; and implementation of applicable BMPs. Implement aggressive invasive plant management; because, according to Jordan et al. (2008), recent evidence suggests that positive feedbacks between invasive plants and soils could contribute significantly to plant invasions (Corbin and D'Antonio, 2004; Ehrenfeld, 2004; Scott et al., 2001; Wolfe and Klironomos, 2005; Reinhart and Callaway, 2006; Eppstein and Molofsky, 2007), perhaps exemplifying 'ecological engineering' by biological invaders (Cuddington and Hastings, 2004). Invasive species modify soils that they occupy (Ramakrishnan and Vitousek, 1989) in ways that increase their own fitness relative to that of native species (Vivrette and Muller, 1977; Jordan et al., 2008), and therefore, are more competitive in site occupation.

Appendix E table 14. A-SNFs' risks to the Great Basin grassland PNVT based on identified threats. Threats are categorized as either under agency management authority or outside agency management authority as well as threat type and estimated risk of high (H) or moderate (M)

Threat	Threat Type	Estimated Risk ¹		Risk Consequence to Ecological Characteristics ²			
		likelihood of occurrence	severity	composition (C)	structure (S)	function (F)	services (Sv)
Under Agency Management Authority							
Feral equine-ungulate grazing/browsing	Consumptive biological use/modification of natural processes/habitat conversion	H	H ³	✓	✓	✓	✓
Fire suppression policy	Modification of natural processes	H	H	✓	✓	✓	✓
Human-caused fire	Habitat conversion	H	H	✓	✓	✓	✓
Invasive plant species	Modification of natural processes/habitat conversion	H	M	✓	✓	✓	✓
Livestock grazing/browsing	Consumptive biological use/modification of natural processes/habitat conversion	H	H ³	✓	✓	✓	✓
Off-highway vehicles (OHVs)	Non-consumptive biological use	M	H	✓		✓	✓
Roads, highways and utility corridors	Transportation/habitat conversion	H	H	✓	✓	✓	✓
Woody species encroachment and establishment	Modification of natural processes/habitat conversion	H	H ³	✓	✓	✓	✓
Outside Agency Management Authority							
Climate change	Modification of natural processes/habitat conversion	H	H	✓	✓	✓	✓
Drought	Habitat conversion	M	M	✓	✓	✓	✓
Excessive ungulate grazing/browsing	Consumptive biological use	M	H	✓	✓	✓	✓
Uncharacteristic erosion	Habitat conversion	M	H	✓	✓	✓	✓
Uncharacteristic sedimentation	Habitat conversion	M	H	✓	✓	✓	✓
Uncharacteristic wildfire	Habitat conversion	M	H	✓	✓	✓	✓
Urban development	Habitat conversion	H	H	✓	✓	✓	
Wild ungulate grazing/browsing	Consumptive biological use/modification of natural processes/habitat conversion	H	H ³	✓	✓	✓	✓
Total (under/outside agency management authority)				8/8	7/8	8/8	8/7

¹ Estimated Risk is divided into Likelihood of Occurrence (defined as the probability of a significant departure from reference conditions) and Severity (defined as the magnitude of the departure from reference conditions)

² Risks are assessed as affecting changes in one or more of the following ecosystem characteristics: vegetation composition (C), vegetation structure (S); vegetation function (F) and/or ecological services (Sv). Composition (C) is the biological elements within the different levels of biological organizations, from genes and species to communities and ecosystems. Structure (S) is the organization and physical arrangement of biological elements such as snags and down woody debris, vertical and horizontal distribution of vegetation, stream habitat complexity, landscape pattern, and connectivity. Function (F) is the ecological processes, such as energy flow; nutrient cycling and retention; soil development and retention; predation and herbivory; and natural disturbances such as wind, fire, and floods. Services (Sv) are the provisioning services - such as clean air and fresh water, as well as energy, fuel, forage, fiber, and minerals; regulating services - such as longterm storage of carbon, climate regulation, water filtration, purification and storage, soil stabilization, flood control, and disease regulation; and supporting services - such as pollination, seed dispersal, soil formation, and nutrient cycling. Not all aspects of structure, composition, function and/or services may be affected because of the occurrence of a threat or threat type

³ Given the extensive amount of herbaceous understory vegetation acres classified as being in low to moderately-low ecological status not meeting desired conditions within this PNVT

Ecological Need for Change in Management Activities

Encroachment of woody tree species is so extensive; that while standing within many areas of this PNVТ actually gives one the impression of being in a piñon-juniper woodland rather than a grassland. Emerging and related concerns are the homogenization of the flora of this PNVТ and the loss of diversity and the threat to native species posed by exotic species that spread in response to human activities. There is an ecological need to restore composition and structure and sustain ecological processes in this woodland community. Restoration of conditions such that the Great Basin grassland is resistant and resilient to disturbances within its HRV. The *Arizona Statewide Grassland Assessment* (Gori and Enquist, 2003; Enquist and Gori, 2005) identified approximately 346,700 acres of extant and historic grasslands on the A-SNFs consisting of both the Great Basin and semi-desert grasslands (Appendix E table 15), representing approximately 14 percent of the Forests. An additional 23,600 acres of historic grassland were identified, but no locations were given; however, the current condition of these grasslands was not determined and these acres are not included in percentage calculations. Overall, the A-SNFs manage roughly 18 percent of all grasslands, 23 percent of restorable grasslands, and 40 percent of former grasslands that occur on National Forests in Arizona. The majority (70 percent) of grasslands on the A-SNFs are in restorable native condition, with the remainder (30 percent) in former grassland condition.

Appendix E table 15. Acres of Great Basin grassland PNVТ in two condition types, restorable and non-restorable occurring on three ranger districts on the A-SNFs (adopted and modified from Gori and Enquist, 2003; Schussman and Gori, 2004; Enquist and Gori, 2005; Vander Lee et al., 2006)

Ranger District	Great Basin Grassland PNVТ					
	restorable ¹		non-restorable (former grassland) ¹		total	
	acres	percent ²	acres	percent ²	acres	percent ³
Black Mesa	105,617	100	0	0	105,617	57
Lakeside	23,164	31	52,785	70	75,949	41
Springerville	0	0	3,956	100	3,956	2
Total	128,782	-	56,741	-	185,523	100

¹ Based on data from Gori and Enquist (2003)

² Percent of total grasslands on each ranger district in that grassland condition type

³ Percent of total grasslands on A-SNFs on each ranger district

The largest proportion of identified Great Basin grassland occurs on the Black Mesa RD followed by the Lakeside RD. According to Gori and Enquist (2003), all of the grasslands on the Black Mesa RD were identified as being in restorable native condition, meaning that they have been encroached by woody species, but have the potential to be restored to open native condition. This area of restorable grasslands is the largest contiguous area on National Forests in Arizona with this potential. On the Lakeside RD, a large proportion of grasslands has woody species encroachment, and has likely undergone a type conversion with little potential to be restored to open native grassland condition.

A key characteristic of these encroached grasslands are their potential for restoration. However, without drastic measures such as mechanical removal of shrubs, it is unlikely that management of fire and grazing regimes alone will be sufficient to restore historic grass dominance (Briggs et al., 2005). The potential to restore woody encroached grasslands is affected by a complex web of interacting physical and biological factors that include soil, climate, topography, grazing, invasive plants, and fire. Woody cover can be reduced with prescribed burns when sufficient fuels are present to carry a fire of adequate intensity (Gori and Backer, 2005). Often, the fuels required to allow fires of adequate intensity to achieve this goal are lacking, and areas must be rested from grazing to allow fuels to accumulate. The number of growing seasons of rest needed to accumulate these fuels varies from site to site.

Approximately 129,866 acres (70%) of the Great Basin grasslands on the A-SNFs have exceeded a threshold of woody canopy cover between 10 and 30 percent and another 33,394 acres (18%) have exceeded a threshold of woody canopy cover greater than 30 percent. These numbers indicate a type conversion from grassland to shrub/woodland. This transition can result in a likely permanent loss of grassland systems and the species that depend on them. Even given long periods (50 years) of grazing rest, it is unlikely that some of these former grasslands can be restored to open native conditions (Hennessey et al., 1983). While increases in perennial grass cover may occur (Valone et al., 2002) at certain sites based upon soil type, erosion, levels of soil trampling and compaction and shrub species composition, it is unlikely that these sites will accumulate sufficient fine fuels to carry a fire intense enough to reduce shrub cover and restore open grassland conditions.

Because of the degree of departure and proportion of this PNVT off-forest; the A-SNFs provide a notable contribution to the sustainability of this woodland PNVT. Desired changes include management activities that also influence understory herbaceous species cover and species richness that is more closely associated with HRV by:

- Stabilizing soils and re-establish dominance of the native plant communities on moderate to high severity burn areas
- Restoring herbaceous vegetation to moderately-high to high ecological condition
- Reducing grazing pressure
- Reducing overstory density to restore open grassland conditions
- Restoring dominance of seral fire-adapted species
- Promoting regeneration of shade intolerant seral species
- Restoring frequent surface fire as a functional ecological process
- Preventing, controlling and eradicating invasive plants

There is also a need to maintain or improve ecosystem conditions to be resistant to and resilient in response to climate change.

Semi-desert Grassland PNVT

When assessing threats and risks to semi-desert grassland it is necessary to evaluate the relationship between current departure from HRV and trend in relation to HRV (Appendix E table 16). In this case, assess the legacy of past management or deviation from ongoing management activities, evaluate threats/risks and system reversibility. In relation to HRV, departure is high, and the current trend is away from HRV; risks are not addressed. Discontinue current management and identify restoration opportunities for this PNVT.

In regards to the current herbaceous understory vegetation ecological status³⁴ and range condition^{35, 36} of the lands capable³⁷ of supporting livestock grazing, semi-desert grassland PNVT ranks 9th out of the 14 PNVTs in the amount of capable grazing lands not meeting desired conditions, roughly 52 percent (Appendix D - addendum figure 17).

Appendix E table 16. Recommended actions in evaluating threats/risks for the semi-desert grassland PNVT in relation to its high woody overstory vegetation departure from HRV and current trend away from HRV

Current Departure from HRV ¹ is 79 Percent	Semi-desert Grassland PNVT Trend in Relation to HRV		
	static (neither towards nor away)	towards HRV	away from HRV (or unknown) ²
Significant (low, moderate, HIGH or severe)	Legacy of past management or deviation from ongoing activities; evaluate threats/risks and system reversibility	Risk addressed; continue current management and identify restoration opportunities	Potential for high risk; evaluate threats and system reversibility
Non-significant (within HRV)	No risk; continue current management	No risk; continue current management	Potential risk; evaluate magnitude of future deviations, threats and system reversibility

¹ Departure is separated into 5 categories: 1. Within HRV (departure index of 0-20%); 2. low (departure index of 21-40%); 3. moderate (departure index of 41-60%); 4. high (departure index of 61-80%); and 5. severe (departure index of 81-100%)

² See figure 18; under current management (Alternative A), within the 15-year planning period, movement away from HRV

Threats: Noss et al. (1995) concluded that grasslands were among the most endangered ecosystems in the U.S., and that of those ecotypes that were most severely degraded, grasslands suffered areal losses that were threefold greater than any other ecosystem. The most important threats, based on high likelihood of occurrence and high threat severity, under Forest Service management authority to semi-desert grassland include (Appendix E table 17) fire suppression, woody species encroachment and establishment, human-caused fires and roads, highways and corridors. These threats types include modification of natural processes and habitat conversion which have negative consequences to ecological composition, structure, function and processes. Other anthropogenic threats include feral equine, wild ungulate and livestock grazing, and off highway vehicles (OHV); invasive plants are an additional threat. The most important threat, based on high likelihood of occurrence and high threat severity outside of agency authority is climate change, and this is likely to intensify (Beschta et al., 2013) and be compounding all other identified threats. Climate-related changes can not only affect public-land ecosystems directly, but may exacerbate the aggregate effects of non-climatic stressors, such as habitat modification and pollution caused by logging, mining, grazing, roads, water diversions, and recreation (Root et al., 2003; CEQ, 2010; Barnosky et al., 2012; Beschta et al., 2013). Other threats outside Forest Service management authority include urban development, wild ungulate grazing/browsing, uncharacteristic erosion, sedimentation and wildfire. These threats types include habitat conversion and consumptive biological uses which have negative consequences to ecological composition, structure, function and processes. Drought is an additional threat.

Risks: The above threats pose the following risks with negative consequences to ecological composition, structure, function and processes. Specifically by affecting vegetation health (atypical composition, structure and function), soil compaction, erosion, sedimentation and loss of soil fertility, altered watershed and hydrologic functions, reduced water quality and quantity, riparian, aquatic and terrestrial locales loss, degradation and fragmentation of these habitats within this PNVT, altered fire regime, introduction and spread of invasive plants, modification of natural processes, change in ecological potentials, species extinction or reduction in population(s) and/or habitat(s), uncharacteristic wildfire, and inability to re-establish natural wildfire processes.

According to Gori and Enquist (2003), changes in the structure and function of grassland systems have been noted as the primary cause of the loss of native diversity within grasslands (Stacey, 1995). Finch (2004) identified and summarized the major threats to grassland biological diversity as the loss of natural fire cycles, overgrazing by livestock (Fleischner et al., 1994), prairie dog eradication, exotic grasses, shrub encroachment, erosion, and habitat fragmentation. The Arizona Statewide Grasslands Assessment (Gori and Enquist, 2003; Enquist and Gori, 2005) documented several of these factors as threats to grasslands on the A-SNFs. In particular, over 70 percent of grasslands on the A-SNFs whose current condition were assessed are encroached by woody species.

Reversibility: Some threats/risks are not reversible under Forest Service authority such as: drought, uncharacteristic erosion and sedimentation and excessive ungulate grazing. Even though these threats/risks are not within agency authority, the forests have a responsibility to assess, address, develop and implement appropriate management responses that mitigate undesirable consequences to National Forest System Lands. On the other hand, some threats/risks are reversible such as: potential decline from uncharacteristic erosion may be partially reversible depending on scale. With uncharacteristic fires – there may be irreversible conditions – soil loss, uncharacteristic succession, habitat modification/loss/fragmentation (reduces species' population and/or viability), Some effects of infestations by invasive plants and areas of infestation are reversible depending on species and spatial scale, Risks from fire suppression, human-caused fires and roads, highways and corridors can be minimized and in many cases be reversed, Some effects of livestock grazing/browsing are reversible depending on severity of change and spatial scale. However, according to Loeser et al. (2007), changes in climate affecting precipitation, may cause some ecological alterations to be persistent. Peters et al. (2012) suggest that a long-term decrease in precipitation will accelerate current desertification trends with continuing loss of grasslands. On the contrary, they also suggest that a multi-year increase in precipitation can act to: (1) decrease the rate of grassland to shrubland conversion, and (2) convert desertified shrublands to savannas containing mixtures of shrubs and grasses, and potentially a return to grasslands in the future.

However, there is increasing evidence that climate change is resulting in more ecosystems crossing thresholds of change (CCSP, 2009; Bush et al., 2010). Woody species encroachment and establishment into the semi-desert grasslands has been extensive spatially. It is estimated that roughly 80 percent or over 86,000 acres have been encroached, to a lesser or greater degree. Roughly 36 percent or nearly 38,500 acres may not be restorable to their former grassland state depending on the severity of change (presence of woody species, loss of soil, productivity and production potential).

Opportunities: Vegetation treatments and silvicultural opportunities that restore and promote grassland vegetative structure and composition that approximates HRV; manage fire as an integral component of ecosystem sustainability; restoration of natural processes and existing conditions that have been compromised by the legacy of livestock management. Evaluate the ecological costs and appropriateness of livestock grazing within this grassland PNVNT given the extensive amount of herbaceous understory vegetation acres classified as being in low to moderately-low ecological status (roughly 60 percent) not meeting desired conditions. Continuing livestock grazing use should be assessed to determine if it is consistent with ecological recovery, particularly as the climate shifts (Karr and Rossano, 2001; Karr, 2004; LaPaix et al., 2009; Beschta et al., 2013) to reduce or eliminate cascading effects (Kondolf, 1994; Rhodes et al., 1994; Beschta et al., 2013), and to be compatible with maintaining or recovering key ecological functions and native species and habitats (Beschta et al., 2013). In addition, implement the recommended guidelines for restocking burned area (USFS, 2008c) as the consequence of fire. As noted by Finch (2004), maintaining grasslands at sufficient scales is vital for supporting grassland-dependent species, as habitat fragmentation has detrimental effects on grassland biological diversity. These grassland areas provide a valuable opportunity to manage grasslands on the forests, and to partner with adjacent landowners, to restore grassland function and structure at sufficient scales to ensure the sustainability of species that depend on this system.

Appendix E table 17. A-SNFs' risks to the semi-desert grassland PNVT based on identified threats. Threats are categorized as either under agency management authority or outside agency management authority as well as threat type and estimated risk of high (H) or moderate (M)

Threat	Threat Type	Estimated Risk ¹		Risk Consequence to Ecological Characteristics ²			
		likelihood of occurrence	severity	composition (C)	structure (S)	function (F)	services (Sv)
Under Agency Management Authority							
Feral equine-ungulate grazing/browsing	Consumptive biological use/modification of natural processes/habitat conversion	H	H ³	✓	✓	✓	✓
Fire suppression policy	Modification of natural processes	H	H	✓	✓	✓	✓
Human-caused fire	Habitat conversion	H	H	✓	✓	✓	✓
Invasive plant species	Modification of natural processes/habitat conversion	H	M	✓	✓	✓	✓
Livestock grazing/browsing	Consumptive biological use/modification of natural processes/habitat conversion	H	H ³	✓	✓	✓	✓
Off-highway vehicles (OHVs)	Non-consumptive biological use	M	H	✓		✓	✓
Roads, highways and utility corridors	Transportation/habitat conversion	H	H	✓	✓	✓	✓
Woody species encroachment and establishment	Modification of natural processes/habitat conversion	H	H ³	✓	✓	✓	✓
Outside Agency Management Authority							
Climate change	Modification of natural processes/habitat conversion	H	H	✓	✓	✓	✓
Drought	Habitat conversion	M	M	✓	✓	✓	✓
Uncharacteristic erosion	Habitat conversion	M	H	✓	✓	✓	✓
Uncharacteristic sedimentation	Habitat conversion	M	H	✓	✓	✓	✓
Uncharacteristic wildfire	Habitat conversion	M	H	✓	✓	✓	✓
Urban development	Habitat conversion	H	H	✓	✓	✓	
Wild ungulate grazing/browsing	Consumptive biological use/modification of natural processes/habitat conversion	H	H ³	✓	✓	✓	✓
Total (under/outside agency management authority)				8/7	7/7	8/7	8/6

¹ Estimated Risk is divided into Likelihood of Occurrence (defined as the probability of a significant departure from reference conditions) and Severity (defined as the magnitude of the departure from reference conditions)

² Risks are assessed as affecting changes in one or more of the following ecosystem characteristics: vegetation composition (C), vegetation structure (S); vegetation function (F) and/or ecological services (Sv). Composition (C) is the biological elements within the different levels of biological organizations, from genes and species to communities and ecosystems. Structure (S) is the organization and physical arrangement of biological elements such as snags and down woody debris, vertical and horizontal distribution of vegetation, stream habitat complexity, landscape pattern, and connectivity. Function (F) is the ecological processes, such as energy flow; nutrient cycling and retention; soil development and retention; predation and herbivory; and natural disturbances such as wind, fire, and floods. Services (Sv) are the provisioning services - such as clean air and fresh water, as well as energy, fuel, forage, fiber, and minerals; regulating services - such as longterm storage of carbon, climate regulation, water filtration, purification and storage, soil stabilization, flood control, and disease regulation; and supporting services - such as pollination, seed dispersal, soil formation, and nutrient cycling. Not all aspects of structure, composition, function and/or services may be affected because of the occurrence of a threat or threat type

³ Given the extensive amount of herbaceous understory vegetation acres classified as being in low to moderately-low ecological status not meeting desired conditions within this PNVT

Improved travel management, and road maintenance and design; and implementation of applicable BMPs. Implement aggressive invasive plant management; because, according to Jordan et al. (2008), recent evidence suggests that positive feedbacks between invasive plants and soils could contribute significantly to plant invasions (Corbin and D'Antonio, 2004; Ehrenfeld, 2004; Scott et al., 2001; Wolfe and Klironomos, 2005; Reinhart and Callaway, 2006; Eppstein and Molofsky, 2007), perhaps exemplifying 'ecological engineering' by biological invaders (Cuddington and Hastings, 2004). Invasive species modify soils that they occupy (Ramakrishnan and Vitousek, 1989) in ways that increase their own fitness relative to that of native species (Vivrette and Muller, 1977; Jordan et al., 2008), and therefore, are more competitive in site occupation.

Ecological Need for Change in Management Activities

Encroachment of woody tree species is so extensive; that while standing within many areas of this PNVN actually gives one the impression of being in a pine-oak woodland rather than a grassland. Emerging and related concerns are the homogenization of the flora of this PNVN and the loss of diversity and the threat to native species posed by exotic species that spread in response to human activities. There is an ecological need to restore composition and structure and sustain ecological processes in this woodland community; restoration of conditions such that the semi-desert grassland is resistant and resilient to disturbances within its HRV. Gori and Enquist (2003) identified approximately 346,700 acres of extant and historic grasslands on the A-SNFs consisting of both the semi-desert and Great Basin grasslands, representing approximately 14 percent of the Forests.

A key characteristic of woody invaded grasslands is its restoration potential. However, without drastic measures such as mechanical removal of shrubs, it is unlikely that management of fire and grazing regimes alone will be sufficient to restore historic grass dominance (Briggs et al., 2005). The potential to restore woody-invaded grasslands is affected by a complex web of interacting physical and biological factors that include climate, topography, grazing, invasive plants, and fire. Woody cover can be reduced with prescribed burns when sufficient fuels are present to carry a fire of adequate intensity (Gori and Backer 2005). Often, the fuels required to allow fires of adequate intensity to achieve this goal are lacking, and areas must be rested from grazing to allow fuels to accumulate. The number of growing seasons of rest needed to accumulate these fuels varies from site to site.

According to Gori and Enquist (2003), approximately 30 percent of grasslands on the A-SNFs have exceeded a threshold of 35 percent woody cover that indicates a type conversion from grassland to shrub/woodland (Appendix E table 18). This transition can result in a likely permanent loss of grassland systems and the species that depend on them. Even given long periods (50 years) of grazing rest, it is unlikely that some of these former grasslands can be restored to open native conditions (Hennessy et al., 1983). While increases in perennial grass cover may occur (Valone et al., 2002) at certain sites based upon soil type, erosion and shrub species composition, it is unlikely that these sites will accumulate sufficient fine fuels to carry a fire intense enough to reduce shrub cover and restore open grassland conditions.

There is increasing evidence that climate change is resulting in more ecosystems crossing thresholds of change (CCSP, 2009; Bush et al., 2010). Approximately 23,529 acres (22%) of the semi-desert grasslands on the A-SNFs have exceeded a threshold of woody canopy cover between 10 and 30 percent and another 60,963 acres (57%) have exceeded a threshold of woody canopy cover greater than 30 percent. These numbers indicate a type conversion from grassland to shrub/woodland. This transition can result in a likely permanent loss of grassland systems and the species that depend on them. Even given long periods (50 years) of grazing rest, it is unlikely that some of these former grasslands can be restored to open native conditions (Hennessy et al., 1983). While increases in perennial grass cover may occur (Valone et al., 2002) at certain sites based upon soil type, erosion, levels of soil trampling and compaction, and shrub

species composition, it is unlikely that these sites will accumulate sufficient fine fuels to carry a fire intense enough to reduce shrub cover and restore open grassland conditions.

Appendix E table 18. Acres of semi-desert grassland PNVT in two condition types, restorable and non-restorable occurring on the A-SNFs (adopted and modified from Gori and Enquist, 2003; Schussman and Gori, 2004; Enquist and Gori, 2005; Vander Lee et al., 2006)

Clifton Ranger District	Semi-desert Grassland PNVT					
	restorable ¹		non-restorable (former grassland) ¹		total	
	acres	percent ²	acres	percent ²	acres	percent ³
Total	68,664	64.2	38,288	35.8	106,592	100.0

¹Based on data from Gori and Enquist (2003)

²Percent of total grasslands on each ranger district in that grassland condition type

³Percent of total grasslands on A-SNFs on each ranger district

Because of the degree of departure and proportion of this PNVT off-forest; the A-SNFs provide a notable contribution to the sustainability of this woodland PNVT. Desired changes include management activities that also influence understory herbaceous species cover and species richness that is more closely associated with HRV by:

- Stabilizing soils and restoring ground cover
- Restoring herbaceous vegetation to moderately-high to high ecological condition
- Reducing grazing pressure
- Reducing overstory density to restore open grassland conditions
- Restoring dominance of seral fire-adapted species
- Promoting regeneration of shade intolerant seral species
- Restoring frequent surface fire as a functional ecological process
- Preventing, controlling and eradicating invasive plants

There is also a need to maintain or improve ecosystem conditions to be resistant to and resilient in response to climate change.

Montane/Subalpine Grasslands PNVT

When assessing threats and risks to montane/subalpine grasslands it is necessary to evaluate the relationship between current departure from HRV and trend in relation to HRV (Appendix E table 19). In this case, assess the legacy of past management or deviation from ongoing management activities, evaluate threats/risks and system reversibility. In relation to HRV, departure is moderate; however, the current trend is away from HRV; risks are not addressed. Discontinue current management and identify restoration opportunities for this PNVT.

In regards to the current herbaceous understory vegetation ecological status³⁴ and range condition^{35, 36} of the lands capable³⁷ of supporting livestock grazing, montane/subalpine grasslands PNVT has the least out of the 14 PNVTs in the amount of capable grazing lands not meeting desired conditions, roughly 20 percent (Appendix D - addendum figure 18).

Appendix E table 19. Recommended actions in evaluating threats/risks for the montane/subalpine grasslands PNVT in relation to its moderate woody overstory vegetation departure from HRV and current trend away from HRV

Current Departure from HRV ¹ is 54 Percent	Montane/Subalpine Grasslands PNVT Trend in Relation to HRV		
	static (neither towards nor away)	towards HRV	away from HRV (or unknown)
Significant (low, MODERATE , high or severe)	Legacy of past management or deviation from ongoing activities; evaluate threats/risks and system reversibility	Risk addressed; continue current management and identify restoration opportunities	Potential for high risk; evaluate threats and system reversibility
Non-significant (within HRV)	No risk; continue current management	No risk; continue current management	Potential risk; evaluate magnitude of future deviations, threats and system reversibility

¹ Departure is separated into 5 categories: 1. Within HRV (departure index of 0-20%); 2. low (departure index of 21-40%); 3. moderate (departure index of 41-60%); 4. high (departure index of 61-80%); and 5. severe (departure index of 81-100%)

Threats: As mentioned previously, Noss et al. (1995) concluded that grasslands were among the most endangered ecosystems in the U.S., and that of those ecotypes that were most severely degraded, grasslands suffered areal losses that were threefold greater than any other ecosystem. The most important threats, based on high likelihood of occurrence and high threat severity, under Forest Service management authority to montane/subalpine grasslands include (Appendix E table 20) fire suppression, woody species encroachment and establishment, human-caused fires and roads, highways and corridors. These threats types include modification of natural processes and habitat conversion which have negative consequences to ecological composition, structure, function and processes. Other anthropogenic threats include feral equine, wild ungulate and livestock grazing, and off highway vehicles (OHV); invasive plants are an additional threat. The most important threat, based on high likelihood of occurrence and high threat severity outside of agency authority is climate change, and this is likely to intensify (Beschta et al., 2013) and be compounding all other identified threats. Climate-related changes can not only affect public-land ecosystems directly, but may exacerbate the aggregate effects of non-climatic stressors, such as habitat modification and pollution caused by logging, mining, grazing, roads, water diversions, and recreation (Root et al., 2003; CEQ, 2010; Barnosky et al., 2012; Beschta et al., 2013). Other threats outside Forest Service management authority include urban development, wild ungulate grazing/browsing, uncharacteristic erosion, sedimentation and wildfire. These threats types include habitat conversion and consumptive biological uses which have negative consequences to ecological composition, structure, function and processes.

The major anthropogenic processes that cause changes in high elevation grasslands include grazing by sheep and cattle, with the concomitant reduction in fire frequency, and the introduction of Rocky Mountain elk (White, 2002), all of which have led to increased encroachment by coniferous trees (Allen, 1984; Moore and Huffman, 2004), and loss of soil, soil compaction, and soil productivity (White, 2002). Early settlers and their grazing animals also have likely introduced one or more non-native grass species (Allen, 1984), of which Kentucky bluegrass (*Poa pratensis* L.) and Canada bluegrass (*P. compressa* L.) have proven to be successful in out-competing and replacing native perennial bunchgrasses in wet meadows and other valley bottom grasslands. Long-term, chronically low to high levels of grazing by introduced herbivores have resulted in shifts in species composition away from palatable species to dominance by less palatable grasses and forbs (White, 2002), although the specific mechanisms and community composition changes have not been well described. The interaction of late 18th century and early 19th century grazing and fire suppression has led to tree encroachment of many, but not all high elevation grasslands. In some areas, tree encroachment appears to be correlated with changes in climate that occurred around the same time as changes in grazing practices (Dyer and Moffett, 1999). Many of the valley bottom grasslands have been impacted by the change in dominance from native perennial bunchgrasses to non-native Canada and Kentucky bluegrasses (Dick-Peddie, 1993) and low seral forb species (White, 2002).

Risks: The above threats pose the following risks with negative consequences to ecological composition, structure, function and processes. Specifically by affecting vegetation health (atypical composition, structure and function), soil compaction, erosion, sedimentation and loss of soil fertility, altered watershed and hydrologic functions, reduced water quality and quantity, riparian, aquatic and terrestrial locales loss, degradation and fragmentation of these habitats within this PNVT, altered fire regime, introduction and spread of invasive plants, modification of natural processes, change in ecological potentials, species extinction or reduction in population(s) and/or habitat(s), uncharacteristic wildfire, and inability to re-establish natural wildfire processes.

According to Gori and Enquist (2003), changes in the structure and function of grassland systems have been noted as the primary cause of the loss of native diversity within grasslands (Stacey, 1995). Finch (2004) identified and summarized the major threats to grassland biological diversity as the loss of natural fire cycles, overgrazing by livestock (Fleischner et al., 1994), prairie dog eradication, exotic grasses, shrub encroachment, erosion, and habitat fragmentation.

Reversibility: Some threats/risks are not reversible under Forest Service authority such as: drought, uncharacteristic erosion and sedimentation and excessive ungulate grazing. Even though these threats/risks are not within agency authority, the forests have a responsibility to assess, address, develop and implement appropriate management responses that mitigate undesirable consequences to National Forest System Lands. On the other hand, some threats/risks are reversible such as: potential decline from uncharacteristic erosion may be partially reversible depending on scale. With uncharacteristic fires – there may be irreversible conditions – soil loss, uncharacteristic succession, habitat modification/loss/fragmentation (reduces species' population and/or viability), Some effects of infestations by invasive plants and areas of infestation are reversible depending on species and spatial scale, Risks from fire suppression, human-caused fires and roads, highways and corridors can be minimized and in many cases be reversed, Some effects of livestock grazing/browsing are reversible depending on severity of change and spatial scale. However, according to Loeser et al. (2007), changes in climate affecting precipitation, may cause some ecological alterations to be persistent.

Woody species encroachment and establishment into the montane/subalpine grasslands has not been extensive spatially. It is estimated that roughly 10 percent or over 5,600 acres have been invaded, to a lesser or greater degree. There is no estimate of how many acres may not be restorable to their former grassland state depending on the severity of change (presence of woody species, loss of soil, productivity and production potential).

Appendix E table 20. A-SNFs' risks to the montane/subalpine grasslands PNVT based on identified threats. Threats are categorized as either under agency management authority or outside agency management authority as well as threat type and estimated risk of high (H) or moderate (M)

Threat	Threat Type	Estimated Risk ¹		Risk Consequence to Ecological Characteristics ²			
		likelihood of occurrence	severity	composition (C)	structure (S)	function (F)	services (Sv)
Under Agency Management Authority							
Feral equine-ungulate grazing/browsing	Consumptive biological use/modification of natural processes/habitat conversion	H	M-H ³	✓	✓	✓	✓
Fire suppression policy	Modification of natural processes	H	H	✓	✓	✓	✓
Human-caused fire	Habitat conversion	H	H	✓	✓	✓	✓
Invasive plant species	Modification of natural processes/habitat conversion	H	M	✓	✓	✓	✓
Livestock grazing/browsing	Consumptive biological use/modification of natural processes/habitat conversion	H	M-H ³	✓	✓	✓	✓
Off-highway vehicles (OHVs)	Non-consumptive biological use	M	H	✓		✓	✓
Roads, highways and utility corridors	Transportation/habitat conversion	H	H	✓	✓	✓	✓
Woody species encroachment and establishment	Modification of natural processes/habitat conversion	H	H ³	✓	✓	✓	✓
Outside Agency Management Authority							
Climate change	Modification of natural processes/habitat conversion	H	H	✓	✓	✓	✓
Drought	Habitat conversion	M	M	✓	✓	✓	✓
Uncharacteristic erosion	Habitat conversion	M	H	✓	✓	✓	✓
Uncharacteristic sedimentation	Habitat conversion	M	H	✓	✓	✓	✓
Uncharacteristic wildfire	Habitat conversion	M	H	✓	✓	✓	✓
Urban development	Habitat conversion	H	H	✓	✓	✓	
Wild ungulate grazing/browsing	Consumptive biological use/modification of natural processes/habitat conversion	H	M-H ³	✓	✓	✓	✓
Total (under/outside agency management authority)				8/8	7/8	8/8	8/7

¹ Estimated Risk is divided into Likelihood of Occurrence (defined as the probability of a significant departure from reference conditions) and Severity (defined as the magnitude of the departure from reference conditions)

² Risks are assessed as affecting changes in one or more of the following ecosystem characteristics: vegetation composition (C), vegetation structure (S); vegetation function (F) and/or ecological services (Sv). Composition (C) is the biological elements within the different levels of biological organizations, from genes and species to communities and ecosystems. Structure (S) is the organization and physical arrangement of biological elements such as snags and down woody debris, vertical and horizontal distribution of vegetation, stream habitat complexity, landscape pattern, and connectivity. Function (F) is the ecological processes, such as energy flow; nutrient cycling and retention; soil development and retention; predation and herbivory; and natural disturbances such as wind, fire, and floods. Services (Sv) are the provisioning services - such as clean air and fresh water, as well as energy, fuel, forage, fiber, and minerals; regulating services - such as longterm storage of carbon, climate regulation, water filtration, purification and storage, soil stabilization, flood control, and disease regulation; and supporting services - such as pollination, seed dispersal, soil formation, and nutrient cycling. Not all aspects of structure, composition, function and/or services may be affected because of the occurrence of a threat or threat type

³ Given the extensive amount of herbaceous understory vegetation acres classified as being in low to moderately-low ecological status not meeting desired conditions within this PNVT

Opportunities: Vegetation treatments and silvicultural opportunities that restore and promote grassland vegetative structure and composition that approximates HRV; manage fire as an integral component of ecosystem sustainability; restoration of natural processes and existing conditions that have been compromised by the legacy of livestock management. Evaluate the ecological costs and appropriateness of livestock grazing within this grassland PNVNT given the extensive amount of herbaceous understory vegetation acres classified as being in low to moderately-low ecological status (roughly 20 percent) not meeting desired conditions. Continuing livestock grazing use should be assessed to determine if it is consistent with ecological recovery, particularly as the climate shifts (Karr and Rossano, 2001; Karr, 2004; LaPaix et al., 2009; Beschta et al., 2013) to reduce or eliminate cascading effects (Kondolf, 1994; Rhodes et al., 1994; Beschta et al., 2013), and to be compatible with maintaining or recovering key ecological functions and native species and habitats (Beschta et al., 2013). In addition, implement the recommended guidelines for restocking burned area (USFS, 2008c) as the consequence of fire. As noted by Finch (2004), maintaining grasslands at sufficient scales is vital for supporting grassland-dependent species, as habitat fragmentation has detrimental effects on grassland biological diversity. These grassland areas provide a valuable opportunity to manage grasslands on the forests, and to partner with adjacent landowners, to restore grassland function and structure at sufficient scales to ensure the sustainability of species that depend on this system.

Improved travel management, and road maintenance and design; and implementation of applicable BMPs. Implement aggressive invasive plant management; because, according to Jordan et al. (2008), recent evidence suggests that positive feedbacks between invasive plants and soils could contribute significantly to plant invasions (Corbin and D'Antonio, 2004; Ehrenfeld, 2004; Scott et al., 2001; Wolfe and Klironomos, 2005; Reinhart and Callaway, 2006; Eppstein and Molofsky, 2007), perhaps exemplifying 'ecological engineering' by biological invaders (Cuddington and Hastings, 2004). Invasive species modify soils that they occupy (Ramakrishnan and Vitousek, 1989) in ways that increase their own fitness relative to that of native species (Vivrette and Muller, 1977; Jordan et al., 2008), and therefore, are more competitive in site occupation.

Ecological Need for Change in Management Activities

Emerging and related concerns are the homogenization of the flora of this PNVNT and the loss of diversity and the threat to native species posed by exotic species that spread in response to human activities. There is an ecological need to restore composition and structure and sustain ecological processes in this grassland community; restoration of conditions such that the montane/subalpine grasslands are resistant and resilient to disturbances within its HRV. Fire management has led to uncharacteristic conditions and has moved this PNVNT from a FRCC of I to II. Past and current wild and domestic ungulate herbivory management has led to uncharacteristic conditions. Substantial change has occurred across the Montane/subalpine grasslands where bare ground has increased, on average, nearly 116 percent (White, 2002). Conversely, vegetation and litter cover have declined by nearly 39 and 29 percent, respectively. According to Smith and Wischmeier (1962) the amount and distribution of exposed soil is one of the most important contributors to site stability relative to site potential and is a direct indication of site susceptibility to accelerated wind or water erosion.

A key characteristic of woody encroached grasslands is its restoration potential. The potential to restore woody-encroached grasslands is affected by a complex web of interacting physical and biological factors that include climate, topography, grazing, invasive plants, and fire. Woody cover can be reduced with prescribed burns when sufficient fuels are present to carry a fire of adequate intensity (Gori and Backer, 2005). Often, the fuels required to allow fires of adequate intensity to achieve this goal are lacking, and areas must be rested from grazing to allow fuels to accumulate. The number of growing seasons of rest needed to accumulate these fuels varies from site to site.

According to Gori and Enquist (2003), approximately 30 percent of grasslands on the A-SNFs have exceeded a threshold of 35 percent woody cover that indicates a type conversion from grassland to shrub/woodland. This transition can result in a likely permanent loss of grassland systems and the species that depend on them. Even given long periods (50 years) of grazing rest, it is unlikely that some of these former grasslands can be restored to open native conditions (Hennessey et al., 1983). While increases in perennial grass cover may occur (Valone et al., 2002) at certain sites based upon soil type, erosion, levels of soil trampling and compaction, and shrub species composition, it is unlikely that these sites will accumulate sufficient fine fuels to carry a fire intense enough to reduce shrub cover and restore open grassland conditions.

Changes in the structure and function of grassland systems have been noted as the primary cause of the loss of native diversity within grasslands (Stacey, 1995; Gori and Enquist, 2003; Enquist and Gori, 2005). Finch (2004) identified and summarized the major threats to grassland biological diversity as the loss of natural fire cycles, overgrazing by livestock (Fleischner et al., 1994), prairie dog eradication, exotic grasses, shrub encroachment, erosion, and habitat fragmentation. Gori and Enquist (2003), and Enquist and Gori (2005), documented several of these factors as threats to grasslands on the A-SNFs. In particular, over 70 percent of all grasslands on the A-SNFs whose current condition were assessed are woody species invaded.

Because of the degree of departure and proportion of this PNVT off-forest; the A-SNFs provide a notable contribution to the sustainability of this woodland PNVT. Desired changes include management activities that also influence understory herbaceous species cover and species richness that is more closely associated with HRV by:

- Stabilizing soils and re-establish dominance of the native plant communities on moderate to high severity burn areas
- Restoring herbaceous vegetation to moderately-high to high ecological condition
- Reducing grazing pressure
- Reducing overstory density to restore open grassland conditions
- Restoring dominance of seral fire-adapted species
- Promoting regeneration of shade intolerant seral species
- Restoring frequent surface fire as a functional ecological process
- Preventing, controlling and eradicating invasive plants

There is also a need to maintain or improve ecosystem conditions to be resistant to and resilient in response to climate change.

Threat/Risk Assessment for Chaparral PNVT

Interior Chaparral PNVT

When assessing threats and risks to interior chaparral it is necessary to evaluate the relationship between current departure from HRV and trend in relation to HRV (Appendix E table 21). In this case, assess legacy of past management or deviation from ongoing management activities, evaluate threats/risks and system reversibility. In relation to HRV, there is no departure and the current trend is static; risks are addressed. Continue current management however, restoration opportunities should be identified for this PNVT.

Appendix E table 21. Recommended actions in evaluating threats/risks for the interior chaparral PNVNT in relation to its non-significant woody overstory departure from HRV and current static trend in relation to HRV

Current Departure from HRV ¹ is 8 Percent	Interior Chaparral PNVNT Trend in Relation to HRV		
	static (neither towards nor away)	towards HRV	away from HRV (or unknown)
Significant (low, moderate, high or severe)	Legacy of past management or deviation from ongoing activities; evaluate threats/risks and system reversibility	Risk addressed; continue current management and identify restoration opportunities	Potential for high risk; evaluate threats and system reversibility
Non-significant (WITHIN HRV)	No risk; continue current management	No risk; continue current management	Potential risk; evaluate magnitude of future deviations, threats and system reversibility

¹ Departure is separated into 5 categories: 1. Within HRV (departure index of 0-20%); 2. low (departure index of 21-40%); 3. moderate (departure index of 41-60%); 4. high (departure index of 61-80%); and 5. severe (departure index of 81-100%)

In regards to the current herbaceous understory vegetation ecological status³⁴ and range condition^{35, 36} of the lands capable³⁷ of supporting livestock grazing, interior chaparral PNVNT ranks 12th out of the 14 PNVNTs in the amount of capable grazing lands not meeting desired conditions, roughly 40 percent (Appendix D - addendum figure 13).

Threats: The most important threat, based on high likelihood of occurrence and high threat severity, under Forest Service management authority to interior chaparral is (Appendix E table 22) the potential for human-caused fires. This threat type presents the possibility for habitat conversion which have negative consequences to ecological composition, structure, function and processes. Other anthropogenic threats include feral equine, wild ungulate and livestock grazing/browsing, and off highway vehicles (OHV); invasive plants are an additional threat. The most important threat, based on high likelihood of occurrence and high threat severity outside of agency authority is climate change, and this is likely to intensify (Beschta et al., 2013) and be compounding all other identified threats. Climate-related changes can not only affect public-land ecosystems directly, but may exacerbate the aggregate effects of non-climatic stressors, such as habitat modification and pollution caused by logging, mining, grazing, roads, water diversions, and recreation (Root et al., 2003; CEQ, 2010; Barnosky et al., 2012; Beschta et al., 2013). Other threats outside Forest Service management authority include uncharacteristic erosion and sedimentation, and wild ungulate grazing/browsing. These threats types result in habitat conversion which has negative consequences to ecological composition, structure, function and processes.

Opportunities: Evaluate the ecological costs and appropriateness of livestock grazing within this chaparral PNVNT given the extensive amount of herbaceous understory vegetation acres classified as being in moderately-low ecological status (roughly 45 percent) not meeting desired conditions. Continuing livestock grazing use should be assessed to determine if it is consistent with ecological recovery, particularly as the climate shifts (Karr and Rossano, 2001; Karr, 2004; LaPaix et al., 2009; Beschta et al., 2013) to reduce or eliminate cascading effects (Kondolf, 1994; Rhodes et al., 1994; Beschta et al., 2013), and to be compatible with maintaining or recovering key ecological functions and native species and habitats (Beschta et al., 2013). In addition, implement the recommended guidelines for restocking burned area (USFS, 2008c) as the consequence of fire.

Appendix E table 22. A-SNFs' risks to the interior chaparral PNVT based on identified threats. Threats are categorized as either under agency management authority or outside agency management authority as well as threat type and estimated risk of high (H) or moderate (M)

Threat	Threat Type	Estimated Risk ¹		Risk Consequence to Ecological Characteristics ²			
		likelihood of occurrence	severity	composition (C)	structure (S)	function (F)	services (Sv)
Under Agency Management Authority							
Feral equine-ungulate grazing/browsing	Consumptive biological use/modification of natural processes/habitat conversion	H	M-H ³	✓	✓	✓	✓
Human-caused fire	Habitat conversion	H	H	✓	✓	✓	✓
Invasive plant species	Modification of natural processes/habitat conversion	H	M	✓	✓	✓	✓
Livestock grazing/browsing	Consumptive biological use/modification of natural processes/habitat conversion	H	M-H ³	✓	✓	✓	✓
Outside Agency Management Authority							
Climate change	Modification of natural processes/habitat conversion	H	H	✓	✓	✓	✓
Uncharacteristic erosion	Habitat conversion	M	H	✓	✓	✓	✓
Uncharacteristic sedimentation	Habitat conversion	M	H	✓	✓	✓	✓
Wild ungulate grazing/browsing	Consumptive biological use/modification of natural processes/habitat conversion	H	M-H ³	✓	✓	✓	✓
Total (under/outside agency management authority)				4/4	4/4	4/4	4/4

¹ Estimated Risk is divided into Likelihood of Occurrence (defined as the probability of a significant departure from reference conditions) and Severity (defined as the magnitude of the departure from reference conditions)

² Risks are assessed as affecting changes in one or more of the following ecosystem characteristics: vegetation composition (C), vegetation structure (S); vegetation function (F) and/or ecological services (Sv). Composition (C) is the biological elements within the different levels of biological organizations, from genes and species to communities and ecosystems. Structure (S) is the organization and physical arrangement of biological elements such as snags and down woody debris, vertical and horizontal distribution of vegetation, stream habitat complexity, landscape pattern, and connectivity. Function (F) is the ecological processes, such as energy flow; nutrient cycling and retention; soil development and retention; predation and herbivory; and natural disturbances such as wind, fire, and floods. Services (Sv) are the provisioning services - such as clean air and fresh water, as well as energy, fuel, forage, fiber, and minerals; regulating services - such as longterm storage of carbon, climate regulation, water filtration, purification and storage, soil stabilization, flood control, and disease regulation; and supporting services - such as pollination, seed dispersal, soil formation, and nutrient cycling. Not all aspects of structure, composition, function and/or services may be affected because of the occurrence of a threat or threat type

³ Given the extensive amount of herbaceous understory vegetation acres classified as being in low to moderately-low ecological status not meeting desired conditions within this PNVT

Improved travel management, and road maintenance and design; and implementation of applicable BMPs. Implement aggressive invasive plant management; because, according to Jordan et al. (2008), recent evidence suggests that positive feedbacks between invasive plants and soils could contribute significantly to plant invasions (Corbin and D'Antonio, 2004; Ehrenfeld, 2004; Scott et al., 2001; Wolfe and Klironomos, 2005; Reinhart and Callaway, 2006; Eppstein and Molofsky, 2007), perhaps exemplifying 'ecological engineering' by biological invaders (Cuddington and Hastings, 2004). Invasive species modify soils that they occupy (Ramakrishnan and Vitousek, 1989) in ways that increase their own fitness relative to that of native species (Vivrette and Muller, 1977; Jordan et al., 2008), and therefore, are more competitive in site occupation

Risks: Under current management, risks to interior chaparral are addressed.

Ecological Need for Change in Management Activities

At this time, there is no ecological need to restore overstory composition and structure and sustain ecological processes in this PNV. However, there is a need to restore understory vegetation to moderately-high to high ecological condition. In addition, in those areas burned by the 2011 Wallow Fire; there is a need to stabilize soils and restore ground cover to help maintain ecosystem conditions to be resistant to and resilient in response to management actions and climate change.

Threat/Risk Assessment for Riparian Areas and Riparian Forest PNVTs

Wetland/Cienega Riparian Areas PNVT

When assessing threats and risks to wetland/cienega riparian areas it is necessary to evaluate the relationship between current departure from HRV and trend in relation to HRV (Appendix E table 23). In this case, assess legacy of past management or deviation from ongoing management activities, evaluate threats/risks and system reversibility. In relation to HRV, departure is low; however, the current trend is away from HRV; risks are not addressed. Discontinue current management and identify restoration opportunities for this PNVT.

Appendix E table 23. Recommended actions in evaluating threats/risks for the wetland/cienega riparian areas PNVT in relation to its low woody overstory vegetation departure from HRV and current trend away from HRV

Current Departure from HRV ¹ is 36 Percent	Wetland/Cienega Riparian Areas PNVT Trend in Relation to HRV		
	static (neither towards nor away)	towards HRV	away from HRV (or unknown)
Significant (LOW , moderate, high or severe departure)	Legacy of past management or deviation from ongoing activities; evaluate threats/risks and system reversibility	Risk addressed; continue current management and identify restoration opportunities	Potential for high risk; evaluate threats and system reversibility
Non-significant (within HRV)	No risk; continue current management	No risk; continue current management	Potential risk; evaluate magnitude of future deviations, threats and system reversibility

¹ Departure is separated into 5 categories: 1. Within HRV (departure index of 0-20%); 2. low (departure index of 21-40%); 3. moderate (departure index of 41-60%); 4. high (departure index of 61-80%); and 5. severe (departure index of 81-100%)

In regards to the current herbaceous understory vegetation ecological status³⁴ and range condition^{35, 36} of the lands capable³⁷ of supporting livestock grazing, wetland/cienega riparian areas PNVT ranks 10th out of the 14 PNVTs in the amount of capable grazing lands not meeting desired conditions, roughly 48 percent (Appendix D - addendum figure 21).

Threats: The most important threats, based on high likelihood of occurrence and high threat severity, under Forest Service management authority to wetland/cienega riparian areas include (Appendix E table 24) livestock grazing/browsing, fire suppression, inundation (diversions, dams and impoundments) and drying of the riparian communities below the impoundment and concurrently flooding those communities above the impoundment, human-caused fires and roads, highways and corridors. These threats types include modification of natural processes and habitat conversion which have negative consequences to ecological composition, structure, function and processes. Other anthropogenic threats include feral equine and wild ungulate grazing/browsing, and off highway vehicles (OHV); invasive plants are an additional threat. The most important threat, based on high likelihood of occurrence and high threat severity outside of agency authority is climate change, and this is likely to intensify (Beschta et al., 2013) and be compounding all other identified threats. Climate-related changes can not only affect public-land ecosystems directly, but may exacerbate the aggregate effects of non-climatic stressors, such as habitat modification and pollution caused by logging, mining, grazing, roads, water diversions, and recreation (Root et al., 2003; CEQ, 2010; Barnosky et al., 2012; Beschta et al., 2013). Other threats outside Forest Service management authority include groundwater depletion/contamination. This threat type includes habitat conversion which has negative consequences to ecological composition, structure, function and processes. Uncharacteristic erosion, sedimentation and wildfire are additional threats.

The major anthropogenic processes that cause changes in wetland/cienega riparian areas included grazing by sheep and cattle, and the introduction of Rocky Mountain elk (White, 2002), all of which have led to increased encroachment by coniferous trees, and loss of soil, soil compaction, and soil productivity, as well as herbaceous vegetation compositional changes (White, 2002). Early settlers and their grazing animals also have likely introduced one or more non-native grass species (Allen, 1984), of which Kentucky bluegrass (*Poa pratensis* L.) and Canada bluegrass (*P. compressa* L.) have proven to be successful in out-competing and replacing native perennial bunchgrasses in wet meadows and other valley bottom grasslands. Long-term, chronically low to high levels of grazing by introduced herbivores have resulted in shifts in species composition away from palatable species to dominance by less palatable grasses and forbs (White, 2002), although the specific mechanisms and community composition changes have not been well described. Many of the wetland/cienegas have been impacted by the change in dominance from native perennial bunchgrasses to non-native Canada and Kentucky bluegrasses, and both warm- and cool-season low seral forb species (White, 2002).

Risks: The above threats pose the following risks with negative consequences to ecological composition, structure, function and processes. Specifically by loss of wetlands/cienegas themselves, as-well-as affects to vegetation health (atypical composition, structure and function), soil compaction, erosion, sedimentation and loss of soil fertility, altered watershed and hydrologic functions, reduced water quality and quantity, altered fire regime, introduction and spread of invasive plants, modification of natural processes, change in ecological potentials, species extinction or reduction in population(s) and/or habitat(s), uncharacteristic wildfire, and inability to re-establish natural wildfire processes.

Appendix E table 24. A-SNFs' risks to the wetland/cienega riparian areas PNVT based on identified threats. Threats are categorized as either under agency management authority or outside agency management authority as well as threat type and estimated risk of high (H), moderate (M) or low (L)

Threat	Threat Type	Estimated Risk ¹		Risk Consequence to Ecological Characteristics ²			
		likelihood of occurrence	severity	composition (C)	structure (S)	function (F)	services (Sv)
Under Agency Management Authority							
Channelization	Modification of natural processes/habitat conversion	L	H	✓	✓		✓
Feral equine-ungulate grazing/browsing	Consumptive biological use/modification of natural processes/habitat conversion	H	H ³	✓	✓	✓	✓
Fire suppression	Modification of natural processes	H	H	✓	✓	✓	✓
Human-caused fire	Habitat conversion	H	H	✓	✓	✓	✓
Inundation (diversions, dams and impoundments)/de-watering	Modification of natural processes/habitat conversion	H	H	✓	✓	✓	✓
Invasive plant species	Modification of natural processes/habitat conversion	H	M	✓	✓	✓	✓
Livestock grazing/browsing	Consumptive biological use/modification of natural processes/habitat conversion	H	H ³	✓	✓	✓	✓
Off-highway vehicles (OHVs)	Non-consumptive biological use	M	H	✓		✓	✓
Roads, highways and utility corridors	Transportation/habitat conversion	H	H	✓	✓		✓
Outside Agency Management Authority							
Channelization	Modification of natural processes/habitat conversion	L	H	✓	✓		✓
Climate change	Modification of natural processes/habitat conversion	H	H	✓	✓	✓	✓
Drought	Habitat conversion	M	M	✓	✓	✓	✓
Groundwater depletion/contamination	Habitat conversion	H	H			✓	✓
Inundation/de-watering	Habitat conversion	M	M	✓	✓		
Uncharacteristic erosion	Habitat conversion	M	H	✓	✓	✓	✓
Uncharacteristic sedimentation	Habitat conversion	M	H	✓	✓	✓	✓
Uncharacteristic wildfire	Habitat conversion	M	H	✓	✓	✓	✓
Water withdrawal	Abiotic resource use	L	H	✓	✓	✓	-
Wild ungulate grazing/browsing	Consumptive biological use/modification of natural processes/habitat conversion	H	H ³	✓	✓	✓	✓
Total (under/outside agency management authority)				9/9	8/9	7/8	9/8

¹ Estimated Risk is divided into Likelihood of Occurrence (defined as the probability of a significant departure from reference conditions) and Severity (defined as the magnitude of the departure from reference conditions)

² Risks are assessed as affecting changes in one or more of the following ecosystem characteristics: vegetation composition (C); vegetation structure (S); vegetation function (F); and/or ecological services (Sv). Composition (C) is the biological elements within the different levels of biological organizations, from genes and species to communities and ecosystems. Structure (S) is the organization and physical arrangement of biological elements such as snags and down woody debris, vertical and horizontal distribution of vegetation, stream habitat complexity, landscape pattern, and connectivity. Function (F) is the ecological processes, such as energy flow; nutrient cycling and retention; soil development and retention; predation and herbivory; and natural disturbances such as wind, fire, and floods. Services (Sv) are the provisioning services - such as clean air and fresh water, as well as energy, fuel, forage, fiber, and minerals; regulating services - such as longterm storage of carbon, climate regulation, water filtration, purification and storage, soil stabilization, flood control, and disease regulation; and supporting services - such as pollination, seed dispersal, soil formation, and nutrient cycling. Not all aspects of structure, composition, function and/or services may be affected because of the occurrence of a threat or threat type

³ Given the extensive amount of herbaceous understory vegetation acres classified as being in low to moderately-low ecological status not meeting desired conditions within this PNVT

Changes in the structure and function of wetland/cienega riparian areas have been noted as the primary cause of the loss of biological diversity within these systems. The causes of adverse change in the ecological character of these systems can be grouped in five broad categories (Abouguendia 2001):

- stream channel morphology
- hydrology and stream flow
- water quality
- riparian zone soils
- riparian and aquatic organism

Because riparian areas are relatively rare (in relation to other ecosystems on the A-SNFs), they have become a focal point for wild ungulate, livestock, and human activity. This affected riparian and stream habitats by reducing riparian vegetation cover or altering its structure and by physically altering soil or site properties. Such changes result in adverse impacts on hydrologic functioning of the riparian area. Healthy riparian vegetation and soils are important for hydrological processes including flow-energy dissipation, bank building, ground water storage, aquifer recharge, and flood control. Vegetation reduces stream velocity, thereby decreasing erosion and increasing deposition of materials on banks (Abouguendia, 2001).

Reversibility: Some threats/risks are not reversible under Forest Service authority such as: uncharacteristic erosion and sedimentation, and excessive wild ungulate and domestic livestock grazing. Even though these threats/risks are not within agency authority, the forests have a responsibility to assess, address, develop and implement appropriate management responses that mitigate undesirable consequences to National Forest System Lands. On the other hand, some threats/risks are reversible such as: potential decline from uncharacteristic erosion may be partially reversible depending on scale. With uncharacteristic fires – there may be irreversible conditions – soil loss, uncharacteristic succession, Habitat modification/loss/fragmentation (reduces species' population and/or viability), some effects of infestations by invasive plants and areas of infestation are reversible depending on species and spatial scale. Risks from fire suppression and human-caused fires can be minimized and in many cases be reversed. Some effects of livestock grazing/browsing are reversible depending on severity of change and spatial scale. However, according to Loeser et al. (2007), changes in climate affecting precipitation, may cause some ecological alterations to be persistent.

Opportunities: Riparian ecosystems are naturally resilient, provide linear habitat connectivity, link aquatic and terrestrial ecosystems, and create thermal refugia for wildlife: all characteristics that can contribute to ecological adaptation to climate change (Seavy et al., 2009). Vegetation management that promotes structural composition that approximates HRV. Manage fire as an integral component of ecosystem sustainability; Restoration of natural processes and existing conditions that have been compromised by livestock grazing. Evaluate the ecological costs and appropriateness of livestock grazing within this riparian PNVNT given the extensive amount of herbaceous understory vegetation acres classified as being in low to moderately-low ecological status (roughly 49 percent) not meeting desired conditions. Continuing livestock grazing use should be assessed to determine if it is consistent with ecological recovery, particularly as the climate shifts (Karr and Rossano, 2001; Karr, 2004; LaPaix et al., 2009; Beschta et al., 2013) to reduce or eliminate cascading effects (Kondolf, 1994; Rhodes et al., 1994; Beschta et al., 2013), and to be compatible with maintaining or recovering key ecological functions and native species and habitats (Beschta et al., 2013). In addition, implement the recommended guidelines for restocking burned area (USFS, 2008c) as the consequence of fire.

Improved travel management, and road maintenance and design; and implementation of applicable BMPs. Implement aggressive invasive plant management; because, according to Jordan et al. (2008), recent

evidence suggests that positive feedbacks between invasive plants and soils could contribute significantly to plant invasions (Corbin and D'Antonio, 2004; Ehrenfeld, 2004; Scott et al., 2001; Wolfe and Klironomos, 2005; Reinhart and Callaway, 2006; Eppstein and Molofsky, 2007), perhaps exemplifying 'ecological engineering' by biological invaders (Cuddington and Hastings, 2004). Invasive species modify soils that they occupy (Ramakrishnan and Vitousek, 1989) in ways that increase their own fitness relative to that of native species (Vivrette and Muller, 1977; Jordan et al., 2008), and therefore, are more competitive in site occupation.

Ecological Need for Change in Management Activities

Heavy grazing in riparian areas has many effects and can compact the soil, reduce infiltration, and increase runoff, erosion, sediments, and nutrients (Hoorman and McCutcheon, 2005a and 2005b). Livestock compact soil by trampling it, making paths, or repeatedly congregating in the same areas. This reduces the ability of riparian areas to absorb and hold water, and breaks down streambanks. Vegetation removal leads to higher stream water temperature (Li et al., 1994). Higher water temperatures result due to a lack of shade. Unrestricted livestock will feed selectively on preferred lush forages in riparian areas, reducing the ability of these species to survive or reproduce. This creates bare areas and promotes the growth of weeds. Livestock also transport noxious weed seed and vegetative growth into riparian areas.

Emerging and related concerns are the homogenization of the flora of this PNVT and the loss of diversity and the threat to native species posed by exotic species that spread in response to human activities. There is an ecological need to restore composition and structure and sustain ecological processes in this woodland community. The wetland/cienega riparian areas PNVT on the A-SNFs has the second greatest road density of any riparian PNVT; nearly 2.9 linear miles of road per one square mile. Rehabilitating land that has been roaded is difficult at best. Desired changes include management activities that influence herbaceous species cover and species richness more closely associated with proper functioning conditions by:

- Maintain and/or improve hydrologic and hydraulic processes
- Maintain and/or improve geomorphic processes
- Maintain and/or improve physical and chemical characteristics
- Maintain and/or improve biological community characteristics
- Maintain and/or improving functions and dynamic equilibrium
- Re-establish dominance of the native plant community
- Restore herbaceous vegetation to moderately-high to high ecological condition
- Reduce grazing pressure
- Limit the presence of invasive plants

Cottonwood-Willow Riparian Forest PNVT

When assessing threats and risks to cottonwood-willow riparian forest it is necessary to evaluate the relationship between current departure from HRV and trend in relation to HRV (Appendix E table 25). In this case, assess the legacy of past management or deviation from ongoing management activities, evaluate threats/risks and system reversibility. In relation to HRV, there is no departure, however, the current trend is away from HRV; risks are not addressed. Discontinue current management and identify restoration opportunities for this PNVT.

Appendix E table 25. Recommended actions in evaluating threats/risks for the cottonwood-willow riparian forest PNVt in relation to its non-significant woody overstory vegetation departure from HRV and current trend away from HRV

Current Departure from HRV ¹ is 20 Percent	Cottonwood-Willow Riparian Forest PNVt Trend in Relation to HRV		
	static (neither towards nor away)	towards HRV	away from HRV (or unknown)
Significant (low, moderate, high or severe departure)	Legacy of past management or deviation from ongoing activities; evaluate threats/risks and system reversibility	Risk addressed; continue current management and identify restoration opportunities	Potential for high risk; evaluate threats and system reversibility
Non-significant (<u>WITHIN HRV</u>)	No risk; continue current management	No risk; continue current management	Potential risk; evaluate magnitude of future deviations, threats and system reversibility

¹ Departure is separated into 5 categories: 1. Within HRV (departure index of 0-20%); 2. low (departure index of 21-40%); 3. moderate (departure index of 41-60%); 4. high (departure index of 61-80%); and 5. severe (departure index of 81-100%)

In regards to the current herbaceous understory vegetation ecological status³⁴ and range condition^{35, 36} of the lands capable³⁷ of supporting livestock grazing, cottonwood-willow riparian forest PNVt ranks 3rd out of the 14 PNVts in the amount of capable grazing lands not meeting desired conditions, roughly 86 percent (Appendix D - addendum figure 22).

Threats: The most important threats, based on high likelihood of occurrence and high threat severity, under Forest Service management authority to cottonwood-willow riparian forest include (Appendix E table 26) livestock grazing/browsing, fire suppression, inundation (diversions, dams and impoundments) and drying of the riparian communities below the impoundment and concurrently flooding those communities above the impoundment, human-caused fires and roads, highways and corridors. These threats types include modification of natural processes and habitat conversion which have negative consequences to ecological composition, structure, function and processes. Other anthropogenic threats include feral equine and wild ungulate grazing/browsing, OHVs and recreation. Invasive plants are an additional threat. The most important threat, based on high likelihood of occurrence and high threat severity outside of agency authority is climate change, and this is likely to intensify (Beschta et al., 2013) and be compounding all other identified threats. Climate-related changes can not only affect public-land ecosystems directly, but may exacerbate the aggregate effects of non-climatic stressors, such as habitat modification and pollution caused by logging, mining, grazing, roads, water diversions, and recreation (Root et al., 2003; CEQ, 2010; Barnosky et al., 2012; Beschta et al., 2013). Other threats outside Forest Service management authority include groundwater depletion/contamination, wild ungulate grazing/browsing, and urban development. These threat types include habitat conversion which has negative consequences to ecological composition, structure, function and processes. Uncharacteristic soil compaction and erosion, sedimentation and wildfire are additional threats.

Risks: The above threats pose the following risks with negative consequences to ecological composition, structure, function and processes. Specifically by loss of these riparian areas themselves, as-well-as affects to vegetation health (atypical composition, structure and function), soil compaction, erosion, sedimentation and loss of soil fertility, altered watershed and hydrologic functions, reduced water quality and quantity, altered fire regime, introduction and spread of invasive plants, modification of natural processes, change in ecological potentials, species extinction or reduction in population(s) and/or habitat(s), and inability to re-establish natural wildfire processes.

Appendix E table 26. A-SNFs' risks to the cottonwood-willow riparian forest PNVT based on identified threats. Threats are categorized as either under agency management authority or outside agency management authority as well as threat type and estimated risk of high (H), moderate (M) or low (L)

Threat	Threat Type	Estimated Risk ¹		Risk Consequence to Ecological Characteristics ²			
		likelihood of occurrence	severity	composition (C)	structure (S)	function (F)	services (Sv)
Under Agency Management Authority							
Channelization	Modification of natural processes/habitat conversion	L	H	✓	✓		✓
Feral equine-ungulate grazing/browsing	Consumptive biological use/modification of natural processes/habitat conversion	H	H ³	✓	✓	✓	✓
Fire suppression	Modification of natural processes	H	H	✓	✓	✓	✓
Human-caused fire	Habitat conversion	H	H	✓	✓	✓	✓
Inundation (diversions, dams and impoundments)/de-watering	Modification of natural processes/habitat conversion	H	H	✓	✓	✓	✓
Invasive plant species	Modification of natural processes/habitat conversion	H	M	✓	✓	✓	✓
Livestock grazing/browsing	Consumptive biological use/modification of natural processes/habitat conversion	M	H ³	✓	✓	✓	✓
Off-highway vehicles (OHVs)	Non-consumptive biological use	M	H	✓		✓	✓
Recreation activities	Non-consumptive biological use	M	M	✓		✓	✓
Roads, highways and utility corridors	Transportation/habitat conversion	H	H	✓	✓		✓
Outside Agency Management Authority							
Channelization	Modification of natural processes/habitat conversion	L	H	✓	✓		✓
Climate change	Modification of natural processes/habitat conversion	H	H	✓	✓	✓	✓
Drought	Habitat conversion	M	M	✓	✓	✓	✓
Inundation/de-watering	Habitat conversion	M	M	✓	✓		
Groundwater depletion/contamination	Habitat conversion	H	H			✓	✓
Uncharacteristic erosion	Habitat conversion	M	H	✓	✓	✓	✓
Uncharacteristic sedimentation	Habitat conversion	M	H	✓	✓	✓	✓
Uncharacteristic wildfire	Habitat conversion	M	H	✓	✓	✓	✓
Urban development	Habitat conversion	H	H	✓	✓	✓	
Water withdrawal	Abiotic resource use	L	H	✓	✓	✓	
Wild ungulate grazing/browsing	Consumptive biological use/modification of natural processes/habitat conversion	H	H ³	✓	✓	✓	✓
Total (under/outside agency management authority)				10/10	8/10	8/9	10/8

¹ Estimated Risk is divided into Likelihood of Occurrence (defined as the probability of a significant departure from reference conditions) and Severity (defined as the magnitude of the departure from reference conditions)

² Risks are assessed as affecting changes in one or more of the following ecosystem characteristics: vegetation composition (C), vegetation structure (S); vegetation function (F) and/or ecological services (Sv). Composition (C) is the biological elements within the different levels of biological organizations, from genes and species to communities and ecosystems. Structure (S) is the organization and physical arrangement of biological elements such as snags and down woody debris, vertical and horizontal distribution of vegetation, stream habitat complexity, landscape pattern, and connectivity. Function (F) is the ecological processes, such as energy flow; nutrient cycling and retention; soil development and retention; predation and herbivory; and natural disturbances such as wind, fire, and floods. Services (Sv) are the provisioning services - such as clean air and fresh water, as well as energy, fuel, forage, fiber, and minerals; regulating services - such as longterm storage of carbon, climate regulation, water filtration, purification and storage, soil stabilization, flood control, and disease regulation; and supporting services - such as pollination, seed dispersal, soil formation, and nutrient cycling. Not all aspects of structure, composition, function and/or services may be affected because of the occurrence of a threat or threat type

³ Given the extensive amount of herbaceous understory vegetation acres classified as being in low to moderately-low ecological status not meeting desired conditions within this PNVT

Changes in the structure and function of cottonwood-willow riparian forests have been noted as the primary cause of the loss of biological diversity within these systems. The causes of adverse change in the ecological character of these systems can be grouped in five broad categories (Abouguendia 2001):

- stream channel morphology
- hydrology and stream flow
- water quality
- riparian zone soils
- riparian and aquatic organism

Because riparian areas are relatively rare (in relation to other ecosystems on the A-SNFs), they have become a focal point for wild ungulate, livestock, and human activity. This affected riparian and stream habitats by reducing riparian vegetation cover or altering its structure and by physically altering soil or site properties. Such changes result in adverse impacts on hydrologic functioning of the riparian area. Healthy riparian vegetation and soils are important for hydrological processes including flow-energy dissipation, bank building, ground water storage, aquifer recharge, and flood control. Vegetation reduces stream velocity, thereby decreasing erosion and increasing deposition of materials on banks (Abouguendia, 2001).

Reversibility: Some threats/risks are not reversible under Forest Service authority such as: urban development, uncharacteristic erosion and sedimentation. Even though these threats/risks are not within agency authority, the forests have a responsibility to assess, address, develop and implement appropriate management responses that mitigate undesirable consequences to National Forest System Lands. On the other hand, some threats/risks are reversible such as: potential decline from uncharacteristic erosion may be partially reversible depending on scale. With OHVs – there may be irreversible conditions – soil loss, uncharacteristic succession, habitat modification/loss/fragmentation (reduces species' population and/or viability), some effects of infestations by invasive plants and areas of infestation are reversible depending on species and spatial scale. Risks from fire suppression and human-caused fires can be minimized and in many cases be reversed. Some effects of livestock grazing/browsing are reversible depending on severity of change and spatial scale. However, according to Loeser et al. (2007), changes in climate affecting precipitation, may cause some ecological alterations to be persistent.

Opportunities: Riparian ecosystems are naturally resilient, provide linear habitat connectivity, link aquatic and terrestrial ecosystems, and create thermal refugia for wildlife: all characteristics that can contribute to ecological adaptation to climate change (Seavy et al., 2009). Vegetation management that promotes structural composition that approximates HRV. Manage fire as an integral component of ecosystem sustainability; Restoration of natural processes and existing conditions that have been compromised by livestock grazing. Evaluate the ecological costs and appropriateness of livestock grazing within this riparian PNVNT given the extensive amount of herbaceous understory vegetation acres classified as being in low to moderately-low ecological status (roughly 89 percent) not meeting desired conditions. Livestock grazing negatively affects water quality and seasonal quantity, stream channel morphology, hydrology, riparian zone soils, instream and streambank vegetation, and aquatic and riparian wildlife (Belsky et al., 1999). Continuing livestock grazing use should be assessed to determine if it is consistent with ecological recovery, particularly as the climate shifts (Karr and Rossano, 2001; Karr, 2004; LaPaix et al., 2009; Beschta et al., 2013) to reduce or eliminate cascading effects (Kondolf, 1994; Rhodes et al., 1994; Beschta et al., 2013), and to be compatible with maintaining or recovering key ecological functions and native species and habitats (Beschta et al., 2013). In addition, implement the recommended guidelines for restocking burned area (USFS, 2008c) as the consequence of fire.

Improved travel management, and road maintenance and design; and implementation of applicable BMPs. Implement aggressive invasive plant management; because, according to Jordan et al. (2008), recent evidence suggests that positive feedbacks between invasive plants and soils could contribute significantly to plant invasions (Corbin and D'Antonio, 2004; Ehrenfeld, 2004; Scott et al., 2001; Wolfe and Klironomos, 2005; Reinhart and Callaway, 2006; Eppstein and Molofsky, 2007), perhaps exemplifying 'ecological engineering' by biological invaders (Cuddington and Hastings, 2004). Invasive species modify soils that they occupy (Ramakrishnan and Vitousek, 1989) in ways that increase their own fitness relative to that of native species (Vivrette and Muller, 1977; Jordan et al., 2008), and therefore, are more competitive in site occupation.

Ecological Need for Change in Management Activities

Heavy grazing in riparian areas has many effects and can compact the soil, reduce infiltration, and increase runoff, erosion, sediments, and nutrients (Hoorman and McCutcheon, 2005a and 2005b). Livestock compact soil by trampling it, making paths, or repeatedly congregating in the same areas. This reduces the ability of riparian areas to absorb and hold water, and breaks down streambanks. Vegetation removal leads to higher stream water temperature (Li et al., 1994). Higher water temperatures result due to a lack of shade. Unrestricted livestock will feed selectively on preferred lush forages in riparian areas, reducing the ability of these species to survive or reproduce. This creates bare areas and promotes the growth of weeds. Livestock also transport noxious weed seed and vegetative growth into riparian areas.

Emerging and related concerns are the homogenization of the flora of this PNVT and the loss of diversity and the threat to native species posed by exotic species that spread in response to human activities. There is an ecological need to restore composition and structure and sustain ecological processes in this woodland community. The cottonwood-willow riparian Forests PNVT on the A-SNFs has the third greatest road density of any riparian PNVT; nearly 2.6 linear miles of road per one square mile. Rehabilitating land that has been roaded is difficult at best. Desired changes include management activities that influence herbaceous species cover and species richness more closely associated with proper functioning conditions by:

- Maintain and/or improve hydrologic and hydraulic processes
- Maintain and/or improve geomorphic processes
- Maintain and/or improve physical and chemical characteristics
- Maintain and/or improve biological community characteristics
- Maintain and/or improving functions and dynamic equilibrium
- Re-establish dominance of the native plant community
- Restore understory herbaceous vegetation to moderately-high to high ecological condition
- Reduce grazing pressure
- Limit the presence of invasive plants

Mixed Broadleaf Deciduous Riparian Forest PNVT

When assessing threats and risks to mixed broadleaf deciduous riparian forest it is necessary to evaluate the relationship between current departure from HRV and trend in relation to HRV (Appendix E table 27). In this case, assess the legacy of past management or deviation from ongoing management activities, evaluate threats/risks and system reversibility. In relation to HRV, there is a low departure; however, the current trend is away from HRV; risks are not addressed. Discontinue current management and identify restoration opportunities for this PNVT.

Appendix E table 27. Recommended actions in evaluating threats/risks for the mixed broadleaf deciduous riparian forest PNVNT in relation to its low woody overstory vegetation departure from HRV and current trend away from HRV

Current Departure from HRV ¹ is 33 Percent	Mixed Broadleaf Deciduous Riparian Forest PNVNT Trend in Relation to HRV		
	static (neither towards nor away)	towards HRV	away from HRV (or unknown)
Significant (LOW , moderate, high or severe departure)	Legacy of past management or deviation from ongoing activities; evaluate threats/risks and system reversibility	Risk addressed; continue current management and identify restoration opportunities	Potential for high risk; evaluate threats and system reversibility
Non-significant (within HRV)	No risk; continue current management	No risk; continue current management	Potential risk; evaluate magnitude of future deviations, threats and system reversibility

¹ Departure is separated into 5 categories: 1. Within HRV (departure index of 0-20%); 2. low (departure index of 21-40%); 3. moderate (departure index of 41-60%); 4. high (departure index of 61-80%); and 5. severe (departure index of 81-100%)

In regards to the current herbaceous understory vegetation ecological status³⁴ and range condition^{35, 36} of the lands capable³⁷ of supporting livestock grazing, mixed broadleaf deciduous riparian forest PNVNT ranks 8th out of the 14 PNVNTs in the amount of capable grazing lands not meeting desired conditions, roughly 54 percent (Appendix D - addendum figure 23.)

Threats: The most important threats, based on high likelihood of occurrence and high threat severity, under Forest Service management authority to mixed broadleaf deciduous riparian forest include (Appendix E table 28) livestock grazing/browsing, inundation (diversions, dams and impoundments) and drying of the riparian communities below the impoundment and concurrently flooding those communities above the impoundment, human-caused fires and roads, highways and corridors. These threats types include modification of natural processes and habitat conversion which have negative consequences to ecological composition, structure, function and processes. Other anthropogenic threats include feral equine and wild ungulate grazing/browsing, and OHVs; and invasive plants are an additional threat. The most important threat, based on high likelihood of occurrence and high threat severity outside of agency authority is climate change. Climate-related changes can not only affect public-land ecosystems directly, but may exacerbate the aggregate effects of non-climatic stressors, such as habitat modification and pollution caused by logging, mining, grazing, roads, water diversions, and recreation (Root et al., 2003; CEQ, 2010; Barnosky et al., 2012; Beschta et al., 2013). Other threats outside Forest Service management authority include groundwater depletion/contamination, wild ungulate grazing/browsing, and urban development. These threat types include habitat conversion which has negative consequences to ecological composition, structure, function and processes. Uncharacteristic erosion and sedimentation are additional threats.

Risks: The above threats pose the following risks with negative consequences to ecological composition, structure, function and processes. Specifically by loss of these riparian areas themselves, as-well-as affects to vegetation health (atypical composition, structure and function), soil compaction, erosion, sedimentation and loss of soil fertility, altered watershed and hydrologic functions, reduced water quality and quantity, altered fire regime, introduction and spread of invasive plants, modification of natural processes, change in ecological potentials, species extinction or reduction in population(s) and/or habitat(s), and inability to re-establish natural wildfire processes.

Changes in the structure and function of mixed broadleaf deciduous riparian forests have been noted as the primary cause of the loss of biological diversity within these systems. The causes of adverse change in the ecological character of these systems can be grouped in five broad categories (Abouguendia, 2001):

- stream channel morphology

- hydrology and stream flow
- water quality
- riparian zone soils
- riparian and aquatic organism

Because riparian areas are relatively rare (in relation to other ecosystems on the A-SNFs), they have become a focal point for wild ungulate, livestock, and human activity. This affected riparian and stream habitats by reducing riparian vegetation cover or altering its structure and by physically altering soil or site properties. Such changes result in adverse impacts on hydrologic functioning of the riparian area. Healthy riparian vegetation and soils are important for hydrological processes including flow-energy dissipation, bank building, ground water storage, aquifer recharge, and flood control. Vegetation reduces stream velocity, thereby decreasing erosion and increasing deposition of materials on banks (Abouguendia, 2001).

Reversibility: Some threats/risks are not reversible under Forest Service authority such as: urban development, uncharacteristic erosion and sedimentation. Even though these threats/risks are not within agency authority, the forests have a responsibility to assess, address, develop and implement appropriate management responses that mitigate undesirable consequences to National Forest System Lands. On the other hand, some threats/risks are reversible such as: potential decline from uncharacteristic erosion may be partially reversible depending on scale. With OHVs – there may be irreversible conditions – soil compaction, soil erosion and soil loss, uncharacteristic succession, habitat modification, loss and/or fragmentation (reduces species' population and/or viability), some effects of infestations by invasive plants and areas of infestation are reversible depending on species and spatial scale, risks from fire suppression and human-caused fires can be minimized and in many cases be reversed. Some effects of livestock grazing/browsing are reversible depending on severity of change and spatial scale. However, according to Loeser et al. (2007), changes in climate affecting precipitation, may cause some ecological alterations to be persistent.

Opportunities: Riparian ecosystems are naturally resilient, provide linear habitat connectivity, link aquatic and terrestrial ecosystems, and create thermal refugia for wildlife: all characteristics that can contribute to ecological adaptation to climate change (Seavy et al., 2009). Vegetation management that promotes structural composition that approximates HRV. Manage fire as an integral component of ecosystem sustainability; restoration of natural processes and existing conditions that have been compromised by livestock grazing. Evaluate the ecological costs and appropriateness of livestock grazing within this riparian PNVT given the extensive amount of herbaceous understory vegetation acres classified as being in low to moderately-low ecological status (roughly 65 percent) not meeting desired conditions. Livestock grazing negatively affects water quality and seasonal quantity, stream channel morphology, hydrology, riparian zone soils, instream and streambank vegetation, and aquatic and riparian wildlife (Belsky et al., 1999). Continuing livestock grazing use should be assessed to determine if it is consistent with ecological recovery, particularly as the climate shifts (Karr and Rossano, 2001; Karr, 2004; LaPaix et al., 2009; Beschta et al., 2013) to reduce or eliminate cascading effects (Kondolf, 1994; Rhodes et al., 1994; Beschta et al., 2013), and to be compatible with maintaining or recovering key ecological functions and native species and habitats (Beschta et al., 2013). In addition, implement the recommended guidelines for restocking burned area (USFS, 2008c) as the consequence of fire.

Appendix E table 28. A-SNFs' risks to the mixed broadleaf deciduous riparian forest PNVT based on identified threats. Threats are categorized as either under agency management authority or outside agency management authority as well as threat type and estimated risk of high (H), moderate (M) or low (L)

Threat	Threat Type	Estimated Risk ¹		Risk Consequence to Ecological Characteristics ²			
		likelihood of occurrence	severity	composition (C)	structure (S)	function (F)	services (Sv)
Under Agency Management Authority							
Channelization	Modification of natural processes/habitat conversion	L	H	✓	✓		✓
Feral equine-ungulate grazing/browsing	Consumptive biological use/modification of natural processes/habitat conversion	H	H ³	✓	✓	✓	✓
Human-caused fire	Habitat conversion	H	H	✓	✓	✓	✓
Inundation (diversions, dams and impoundments)/de-watering	Modification of natural processes/habitat conversion	H	H	✓	✓	✓	✓
Invasive plant species	Modification of natural processes/habitat conversion	H	M	✓	✓	✓	✓
Livestock grazing/browsing	Consumptive biological use/modification of natural processes/habitat conversion	H	H ³	✓	✓	✓	✓
Off-highway vehicles (OHVs)	Non-consumptive biological use	M	H	✓		✓	✓
Recreation activities	Non-consumptive biological use	M	M	✓		✓	✓
Roads, highways and utility corridors	Transportation/habitat conversion	H	H	✓	✓		✓
Outside Agency Management Authority							
Channelization	Modification of natural processes/habitat conversion	L	H	✓	✓		✓
Climate change	Modification of natural processes/habitat conversion	H	H	✓	✓	✓	✓
Drought	Habitat conversion	M	M	✓	✓	✓	✓
Groundwater depletion/contamination	Habitat conversion	H	H			✓	✓
Inundation/de-watering	Habitat conversion	M	M	✓	✓		
Uncharacteristic erosion	Habitat conversion	M	H	✓	✓	✓	✓
Uncharacteristic sedimentation	Habitat conversion	M	H	✓	✓	✓	✓
Urban development	Habitat conversion	H	H	✓	✓	✓	
Water withdrawal	Abiotic resource use	L	H	✓	✓	✓	
Wild ungulate grazing/browsing	Consumptive biological use/modification of natural processes/habitat conversion	H	H ³	✓	✓	✓	✓
Total (under/outside agency management authority)				9/9	7/10	7/8	9/7

¹ Estimated Risk is divided into Likelihood of Occurrence (defined as the probability of a significant departure from reference conditions) and Severity (defined as the magnitude of the departure from reference conditions)

² Risks are assessed as affecting changes in one or more of the following ecosystem characteristics: vegetation composition (C), vegetation structure (S); vegetation function (F) and/or ecological services (Sv). Composition (C) is the biological elements within the different levels of biological organizations, from genes and species to communities and ecosystems. Structure (S) is the organization and physical arrangement of biological elements such as snags and down woody debris, vertical and horizontal distribution of vegetation, stream habitat complexity, landscape pattern, and connectivity. Function (F) is the ecological processes, such as energy flow; nutrient cycling and retention; soil development and retention; predation and herbivory; and natural disturbances such as wind, fire, and floods. Services (Sv) are the provisioning services - such as clean air and fresh water, as well as energy, fuel, forage, fiber, and minerals; regulating services - such as longterm storage of carbon, climate regulation, water filtration, purification and storage, soil stabilization, flood control, and disease regulation; and supporting services - such as pollination, seed dispersal, soil formation, and nutrient cycling. Not all aspects of structure, composition, function and/or services may be affected because of the occurrence of a threat or threat type

³ Given the extensive amount of herbaceous understory vegetation acres classified as being in low to moderately-low ecological status not meeting desired conditions within this PNVT

Improved travel management, and road maintenance and design; and implementation of applicable BMPs. Implement aggressive invasive plant management; because, according to Jordan et al. (2008), recent evidence suggests that positive feedbacks between invasive plants and soils could contribute significantly to plant invasions (Corbin and D'Antonio, 2004; Ehrenfeld, 2004; Scott et al., 2001; Wolfe and Klironomos, 2005; Reinhart and Callaway, 2006; Eppstein and Molofsky, 2007), perhaps exemplifying 'ecological engineering' by biological invaders (Cuddington and Hastings, 2004). Invasive species modify soils that they occupy (Ramakrishnan and Vitousek, 1989) in ways that increase their own fitness relative to that of native species (Vivrette and Muller, 1977; Jordan et al., 2008), and therefore, are more competitive in site occupation.

Ecological Need for Change in Management Activities

Heavy grazing in riparian areas has many effects and can compact the soil, reduce infiltration, and increase runoff, erosion, sediments, and nutrients (Hoorman and McCutcheon, 2005a and 2005b). Livestock compact soil by trampling it, making paths, or repeatedly congregating in the same areas. This reduces the ability of riparian areas to absorb and hold water, and breaks down streambanks. Vegetation removal leads to higher stream water temperature (Li et al., 1994). Higher water temperatures result due to a lack of shade. Unrestricted livestock will feed selectively on preferred lush forages in riparian areas, reducing the ability of these species to survive or reproduce. This creates bare areas and promotes the growth of weeds. Livestock also transport noxious weed seed and vegetative growth into riparian areas.

Emerging and related concerns are the homogenization of the flora of this PNVT and the loss of diversity and the threat to native species posed by exotic species that spread in response to human activities. There is an ecological need to restore composition and structure and sustain ecological processes in this riparian community. The mixed broadleaf deciduous riparian forests PNVT on the A-SNFs has the fourth greatest road density of any riparian PNVT; nearly 1.8 linear miles of road per one square mile. Rehabilitating land that has been roaded is difficult at best. Desired changes include management activities that influence herbaceous species cover and species richness more closely associated with proper functioning conditions by:

- Maintain and/or improve hydrologic and hydraulic processes
- Maintain and/or improve geomorphic processes
- Maintain and/or improve physical and chemical characteristics
- Maintain and/or improve biological community characteristics
- Maintain and/or improving functions and dynamic equilibrium
- Re-establish dominance of the native plant community
- Restore understory herbaceous vegetation to moderately-high to high ecological condition
- Reduce grazing pressure
- Limit the presence of invasive plants

Montane Willow Riparian Forest PNVT

When assessing threats and risks to montane willow riparian forest it is necessary to evaluate the relationship between current departure from HRV and trend in relation to HRV (Appendix E table 29). In this case, assess the legacy of past management or deviation from ongoing management activities, evaluate threats/risks and system reversibility. In relation to HRV, there is a low departure; however, the current trend is away from HRV; risks are not addressed. Discontinue current management and identify restoration opportunities for this PNVT.

Appendix E table 29. Recommended actions in evaluating threats/risks for the montane willow riparian forest PNVNT in relation to its low woody overstory vegetation departure from HRV and current trend away from HRV

Current Departure from HRV ¹ is 21 Percent	Montane Willow Riparian Forest PNVNT Trend in Relation to HRV		
	static (neither towards nor away)	towards HRV	away from HRV (or unknown)
Significant (LOW , moderate, high or severe departure)	Legacy of past management or deviation from ongoing activities; evaluate threats/risks and system reversibility	Risk addressed; continue current management and identify restoration opportunities	Potential for high risk; evaluate threats and system reversibility
Non-significant (within HRV)	No risk; continue current management	No risk; continue current management	Potential risk; evaluate magnitude of future deviations, threats and system reversibility

¹ Departure is separated into 5 categories: 1. Within HRV (departure index of 0-20%); 2. low (departure index of 21-40%); 3. moderate (departure index of 41-60%); 4. high (departure index of 61-80%); and 5. severe (departure index of 81-100%)

In regards to the current herbaceous understory vegetation ecological status³⁴ and range condition^{35, 36} of the lands capable³⁷ of supporting livestock grazing, montane willow riparian forest PNVNT ranks 5th out of the 14 PNVNTs in the amount of capable grazing lands not meeting desired conditions, roughly 80 percent (Appendix D - addendum figure 24.)

Threats: The most important threats, based on high likelihood of occurrence and high threat severity, under Forest Service management authority to montane willow riparian forest include (Appendix E table 30) livestock grazing/browsing, fire suppression, inundation (diversions, dams and impoundments) and drying of the riparian communities below the impoundment and concurrently flooding those communities above the impoundment, human-caused fires and roads, highways and corridors. These threats types include modification of natural processes and habitat conversion which have negative consequences to ecological composition, structure, function and processes. Other anthropogenic threats include feral equine and wild ungulate grazing/browsing, OHVs and recreation; and invasive plants are an additional threat. The most important threat, based on high likelihood of occurrence and high threat severity outside of agency authority is climate change, and this is likely to intensify (Beschta et al., 2013) and be compounding all other identified threats. Climate-related changes can not only affect public-land ecosystems directly, but may exacerbate the aggregate effects of non-climatic stressors, such as habitat modification and pollution caused by logging, mining, grazing, roads, water diversions, and recreation (Root et al., 2003; CEQ, 2010; Barnosky et al., 2012; Beschta et al., 2013). Other threats outside Forest Service management authority include groundwater depletion/contamination and urban development. These threat types include habitat conversion which has negative consequences to ecological composition, structure, function and processes. Uncharacteristic soil compaction, erosion and loss, sedimentation, wild ungulate grazing/browsing, and wildfire are additional threats.

Risks: The above threats pose the following risks with negative consequences to ecological composition, structure, function and processes. Specifically by loss of these riparian areas themselves, as-well-as affects to vegetation health (atypical composition, structure and function), soil compaction, erosion, sedimentation and loss of soil fertility, altered watershed and hydrologic functions, reduced water quality and quantity, altered fire regime, introduction and spread of invasive plants, modification of natural processes, change in ecological potentials, species extinction or reduction in population(s) and/or habitat(s), and inability to re-establish natural wildfire processes.

Changes in the structure and function of montane-willow riparian forests have been noted as the primary cause of the loss of biological diversity within these systems. The causes of adverse change in the ecological character of these systems can be grouped in five broad categories (Abouguendia, 2001):

- stream channel morphology
- hydrology and stream flow
- water quality
- riparian zone soils
- riparian and aquatic organism

Because riparian areas are relatively rare (in relation to other ecosystems on the A-SNFs), they have become a focal point for wild ungulate, livestock, and human activity. This affected riparian and stream habitats by reducing riparian vegetation cover or altering its structure and by physically altering soil or site properties. Such changes result in adverse impacts on hydrologic functioning of the riparian area. Healthy riparian vegetation and soils are important for hydrological processes including flow-energy dissipation, bank building, ground water storage, aquifer recharge, and flood control. Vegetation reduces stream velocity, thereby decreasing erosion and increasing deposition of materials on banks (Abouguendia, 2001).

Reversibility: Some threats/risks are not reversible under Forest Service authority such as: urban development, uncharacteristic erosion and sedimentation. Even though these threats/risks are not within agency authority, the forests have a responsibility to assess, address, develop and implement appropriate management responses that mitigate undesirable consequences to National Forest System Lands. On the other hand, some threats/risks are reversible such as: potential decline from uncharacteristic erosion may be partially reversible depending on scale. With OHVs – there may be irreversible conditions – soil loss, uncharacteristic succession, habitat modification/loss/fragmentation (reduces species' population and/or viability), some effects of infestations by invasive plants and areas of infestation are reversible depending on species and spatial scale. Risks from fire suppression and human-caused fires can be minimized and in many cases be reversed. Some effects of livestock grazing/browsing are reversible depending on severity of change and spatial scale. However, according to Loeser et al. (2007), changes in climate affecting precipitation, may cause some ecological alterations to be persistent.

Opportunities: Riparian ecosystems are naturally resilient, provide linear habitat connectivity, link aquatic and terrestrial ecosystems, and create thermal refugia for wildlife: all characteristics that can contribute to ecological adaptation to climate change (Seavy et al., 2009). Vegetation management that promotes structural composition that approximates HRV. Manage fire as an integral component of ecosystem sustainability; restoration of natural processes and existing conditions that have been compromised by livestock grazing. Evaluate the ecological costs and appropriateness of livestock grazing within this riparian PNVT given the extensive amount of herbaceous understory vegetation acres classified as being in low to moderately-low ecological status (roughly 89 percent) not meeting desired conditions. Livestock grazing negatively affects water quality and seasonal quantity, stream channel morphology, hydrology, riparian zone soils, instream and streambank vegetation, and aquatic and riparian wildlife (Belsky et al., 1999). Continuing livestock grazing use should be assessed to determine if it is consistent with ecological recovery, particularly as the climate shifts (Karr and Rossano, 2001; Karr, 2004; LaPaix et al., 2009; Beschta et al., 2013) to reduce or eliminate cascading effects (Kondolf, 1994; Rhodes et al., 1994; Beschta et al., 2013), and to be compatible with maintaining or recovering key ecological functions and native species and habitats (Beschta et al., 2013). In addition, implement the recommended guidelines for restocking burned area (USFS, 2008c) as the consequence of fire.

Appendix E table 30. A-SNFs' risks to the montane willow riparian forest PNVT based on identified threats. Threats are categorized as either under agency management authority or outside agency management authority as well as threat type and estimated risk of high (H), moderate (M) or low (L)

Threat	Threat Type	Estimated Risk ¹		Risk Consequence to Ecological Characteristics ²			
		likelihood of occurrence	severity	composition (C)	structure (S)	function (F)	services (Sv)
Under Agency Management Authority							
Channelization	Modification of natural processes/habitat conversion	L	H	✓	✓		✓
Feral equine-ungulate grazing/browsing	Consumptive biological use/modification of natural processes/habitat conversion	H	H ³	✓	✓	✓	✓
Fire suppression	Modification of natural processes	H	H	✓	✓	✓	✓
Human-caused fire	Habitat conversion	H	H	✓	✓	✓	✓
Inundation (diversions, dams and impoundments)/de-watering	Modification of natural processes/habitat conversion	H	H	✓	✓	✓	✓
Invasive plant species	Modification of natural processes/habitat conversion	H	M	✓	✓	✓	✓
Livestock grazing/browsing	Consumptive biological use/modification of natural processes/habitat conversion	M	H ³	✓		✓	✓
Off-highway vehicles (OHVs)	Non-consumptive biological use	M	H	✓		✓	✓
Recreation activities	Non-consumptive biological use	M	M	✓	✓		✓
Roads, highways and utility corridors	Transportation/habitat conversion	H	H				
Outside Agency Management Authority							
Channelization	Modification of natural processes/habitat conversion	L	H	✓	✓	✓	✓
Climate change	Modification of natural processes/habitat conversion	H	H	✓	✓	✓	✓
Drought	Habitat conversion	M	M			✓	✓
Inundation/de-watering	Habitat conversion	M	M	✓	✓		
Groundwater depletion/contamination	Habitat conversion	H	H	✓	✓	✓	✓
Uncharacteristic erosion	Habitat conversion	M	H	✓	✓	✓	✓
Uncharacteristic sedimentation	Habitat conversion	M	H	✓	✓	✓	
Uncharacteristic wildfire	Habitat conversion	M	H	✓	✓	✓	
Urban development	Habitat conversion	H	H	✓	✓	✓	✓
Water withdrawal	Abiotic resource use	L	H	✓	✓		✓
Wild ungulate grazing/browsing	Consumptive biological use/modification of natural processes/habitat conversion	H	H ³	✓	✓	✓	✓
Total (under/outside agency management authority)				10/10	8/10	8/8	10/7

¹ Estimated Risk is divided into Likelihood of Occurrence (defined as the probability of a significant departure from reference conditions) and Severity (defined as the magnitude of the departure from reference conditions)

² Risks are assessed as affecting changes in one or more of the following ecosystem characteristics: vegetation composition (C), vegetation structure (S); vegetation function (F) and/or ecological services (Sv). Composition (C) is the biological elements within the different levels of biological organizations, from genes and species to communities and ecosystems. Structure (S) is the organization and physical arrangement of biological elements such as snags and down woody debris, vertical and horizontal distribution of vegetation, stream habitat complexity, landscape pattern, and connectivity. Function (F) is the ecological processes, such as energy flow; nutrient cycling and retention; soil development and retention; predation and herbivory; and natural disturbances such as wind, fire, and floods. Services (Sv) are the provisioning services - such as clean air and fresh water, as well as energy, fuel, forage, fiber, and minerals; regulating services - such as longterm storage of carbon, climate regulation, water filtration, purification and storage, soil stabilization, flood control, and disease regulation; and supporting services - such as pollination, seed dispersal, soil formation, and nutrient cycling. Not all aspects of structure, composition, function and/or services may be affected because of the occurrence of a threat or threat type

³ Given the extensive amount of herbaceous understory vegetation acres classified as being in low to moderately-low ecological status not meeting desired conditions within this PNVT

Improved travel management, and road maintenance and design; and implementation of applicable BMPs. Implement aggressive invasive plant management; because, according to Jordan et al. (2008), recent evidence suggests that positive feedbacks between invasive plants and soils could contribute significantly to plant invasions (Corbin and D'Antonio, 2004; Ehrenfeld, 2004; Scott et al., 2001; Wolfe and Klironomos, 2005; Reinhart and Callaway, 2006; Eppstein and Molofsky, 2007), perhaps exemplifying 'ecological engineering' by biological invaders (Cuddington and Hastings, 2004). Invasive species modify soils that they occupy (Ramakrishnan and Vitousek, 1989) in ways that increase their own fitness relative to that of native species (Vivrette and Muller, 1977; Jordan et al., 2008), and therefore, are more competitive in site occupation.

Ecological Need for Change in Management Activities

Heavy grazing in riparian areas has many effects and can compact the soil, reduce infiltration, and increase runoff, erosion, sediments, and nutrients (Hoorman and McCutcheon, 2005a and 2005b). Livestock compact soil by trampling it, making paths, or repeatedly congregating in the same areas. This reduces the ability of riparian areas to absorb and hold water, and breaks down streambanks. Vegetation removal leads to higher stream water temperature (Li et al., 1994). Higher water temperatures result due to a lack of shade. Unrestricted livestock will feed selectively on preferred lush forages in riparian areas, reducing the ability of these species to survive or reproduce. This creates bare areas and promotes the growth of weeds. Livestock also transport noxious weed seed and vegetative growth into riparian areas.

Emerging and related concerns are the homogenization of the flora of this PNVT and the loss of diversity and the threat to native species posed by exotic species that spread in response to human activities. There is an ecological need to restore composition and structure and sustain ecological processes in this woodland community. The montane willow riparian forests PNVT on the A-SNFs has the greatest road density of any riparian PNVT; nearly 4.0 linear miles of road per one square mile. Rehabilitating land that has been roaded is difficult at best. Desired changes include management activities that influence herbaceous species cover and species richness more closely associated with proper functioning conditions by:

- Maintain and/or improve hydrologic and hydraulic processes
- Maintain and/or improve geomorphic processes
- Maintain and/or improve physical and chemical characteristics
- Maintain and/or improve biological community characteristics
- Maintain and/or improving functions and dynamic equilibrium
- Re-establish dominance of the native plant community
- Reduce grazing pressure
- Restore understory herbaceous vegetation to moderately-high to high ecological condition
- Limit the presence of invasive plants

Appendix F - Proposed Management Treatments and Acreages by Alternative

Alternative A Treatment Types

Appendix F table 1. Alternative A management treatment types, acres and percent of total PNVT treated annually, and number of years it would take to treat the entire PNVT at the annual rate for ponderosa pine, wet mixed conifer, dry mixed conifer and spruce-fir forests, and all A-SNFs forested PNVTs combined

Alternative A Treatment Types ¹	Alternative A Annual PNVT Acres Treated by Treatment Type				All A-SNFs Modeled Forested PNVTs 945,753 Acres
	ponderosa pine forest 602,206 acres	wet mixed conifer forest 177,995 acres	dry mixed conifer forest 147,885 acres	spruce-fir forest 17,667 acres	
	alternative A	alternative A	alternative A	alternative A	alternative A
B Free thin all sizes to target BA	1,240	150	221	3	1,614
C Thin from below to target BA	2,090	258	372	17	2,737
D Thin under 16-inch diameter to BA	1,999	600	355	18	2,972
E Group select with matrix thin	1,370	450	244	27	2,091
F Shelterwood seed cut to target BA	420	20	74		514
G Clearcut with legacy trees		34		10	44
H Clearcut-Coppice		34		17	51
I Plant Seedlings	450	325	100	5	880
J R _x FIRE ONLY low conditions	2,836	855	720	90	4,501
K R _x FIRE ONLY moderate conditions	316	96	80	10	502
L R _x FIRE ONLY high conditions					
M Thin under 9-inch diameter to BA		601	542	16	1,159
Total Acres Treated	10,721	3,423	2,708	213	17,065
Percent Acres Treated Annually	1.8	1.9	1.8	1.2	1.8
Years to Treat Entire PNVT(s)	56	52	55	83	55

¹ See the Silviculturalist (B,C,D,E,F,G,H,I,M) and Fire (J,K,L) Specialists' reports for a description of their respective treatment types

Alternative A Treatment Types

Appendix F table 2. Alternative A management treatment types, acres and percent of total PNVT treated annually (50-year average) as derived from VDDT modeling outputs, and number of years it would take to treat the entire PNVT at the annual rate for ponderosa pine, wet mixed conifer, dry mixed conifer and spruce-fir forests, and all A-SNFs forested PNVTs combined

Alternative A Treatment Types ¹	Alternative A Proposed 50-Year Average Annual PNVT Acres Treated by Treatment Type Based on VDDT Model Outputs				All A-SNFs Modeled Forested PNVTs
	ponderosa pine forest 602,206 acres	wet mixed conifer forest 177,995 acres	dry mixed conifer forest 147,885 acres	spruce-fir forest 17,667 acres	945,753 Acres
	alternative A	alternative A	alternative A	alternative A	alternative A
B Free thin all sizes to target BA	1,380	139	295	3	1,817
C Thin from below to target BA	2,327	349	496	26	3,198
D Thin under 16-inch diameter to BA	2,220	748	358	27	3,353
E Group select with matrix thin	1,522	383	246	31	2,182
F Shelterwood seed cut to target BA	467	12	75		554
G Clearcut with legacy trees		19		14	33
H Clearcut-Coppice		33		20	53
I Plant Seedlings	105	42	18	1	166
J R _x FIRE ONLY low conditions	3,199	1,601	496	102	5,398
K R _x FIRE ONLY moderate conditions	352	101	55	11	519
L R _x FIRE ONLY high conditions					
M Thin under 9-inch diameter to BA		937	376	23	1,336
Total Acres Treated	11,572	4,365	2,413	256	18,606
Percent Acres Treated Annually	1.9	2.5	1.6	1.5	2.0
Years to Treat Entire PNVT(s)	52	41	61	69	51

¹See the Silviculturalist (B,C,D,E,F,G,H,I,M) and Fire (J,K,L) Specialists' reports for a description of their respective treatment types

Alternative B Treatment Types

Appendix F table 3. Alternative B proposed management treatment types, acres and percent of total PNVT treated annually, and years it would take to treat the entire PNVT at the annual rate proposed for forested PNVTs; proposed high, average and low acre treatment objectives are presented for ponderosa pine, wet mixed conifer, dry mixed conifer and spruce-fir forests, and all A-SNFs forested PNVTs combined

Alternative B Treatment Types ¹	Alternative B Proposed Annual PNVT Acres Treated by Treatment Type												All A-SNFs Modeled Forested PNVTs 945,753 Acres		
	ponderosa pine forest 602,206 acres			wet mixed conifer forest 177,995 acres			dry mixed conifer forest 147,885 acres			spruce-fir forest 17,667 acres					
	high	average	low	high	average	low	high	average	low	high	average	low	high	average	low
B Free thin all sizes to target BA	2,814	1,605	396	94	54	14	110	65	19	3	3	0	3,021	1,725	429
C Thin from below to target BA	2,042	1,165	287	94	54	13	70	40	9	2	2	0	2,208	1,259	309
D Thin under 16-inch diameter to BA															
E Group select with matrix thin	4,807	2,742	677	2,000	1,143	286	1,585	906	227	70	40	10	8,462	4,831	1,200
F Shelterwood seed cut to target BA	1,362	777	192	20	12	3	175	99	23				1,557	888	218
G Clearcut with legacy trees				93	53	13				3	2	1	96	55	14
H Clearcut-Coppice				93	53	13				3	2	1	96	55	14
I Plant Seedlings	1,200	875	550	500	375	250	450	338	225	50	35	20	2,200	1,623	1,045
J R _x FIRE ONLY low conditions	3,858	2,205	551	1,107	620	132	693	396	99	201	115	28	5,859	3,335	810
K R _x FIRE ONLY moderate conditions	6,064	3,466	867	2,218	1,241	263	1,940	1,109	277	404	231	58	10,626	6,046	1,465
L R _x FIRE ONLY high conditions	1,102	630	158				277	159	40				1,379	789	198
M Thin under 9-inch diameter to BA				931		133	832	475	118	14		2	1,777	1,015	253
Total Acres Treated	23,249	13,464	3,678	7,150	4,135	1,120	6,132	3,585	1,037	750	433	116	37,281	21,618	5,955
Percent Acres Treated Annually	3.9	2.2	0.6	4.0	2.3	0.6	4.1	2.4	0.7	4.2	2.5	0.7	3.9	2.3	0.6
Years to Treat Entire PNVT(s)	26	45	164	25	43	159	24	41	143	24	41	147	25	44	159

¹See the Silviculturalist (B,C,D,E,F,G,H,I,M) and Fire (J,K,L) Specialists' reports for a description of their respective treatment types

Alternative B Treatment Types

Appendix F table 4. Alternative B proposed management treatment types, acres and percent treated annually (50-year average) as derived from VDDT modeling outputs, and years it would take to treat the entire PNVT at the annual rate for forested PNVTs; proposed high, average and low acre treatment objectives are presented for ponderosa pine, wet mixed conifer, dry mixed conifer and spruce-fir forests, and all A-SNFs forested PNVTs combined

Alternative B Treatment Types ¹	Alternative B Proposed 50-Year Average Annual PNVT Acres Treated by Treatment Type Based on VDDT Model Outputs												All A-SNFs Modeled Forested PNVTs 945,753 Acres		
	ponderosa pine forest 602,206 acres			wet mixed conifer forest 177,995 acres			dry mixed conifer forest 147,885 acres			spruce-fir forest 17,667 acres					
	high	average	low	high	average	low	high	average	low	high	average	low	high	average	low
B Free thin all sizes to target BA	3,674 ²	2,065 ²	456 ²	80	47	14	182 ²	102 ²	22 ²	3	2	0	3,939	2,216	492
C Thin from below to target BA	2,122	1,216	310	126	72	17	99	56	12	4	2	0	2,351	1,346	339
D Thin under 16-inch diameter to BA													0	0	0
E Group select with matrix thin	6,854 ³	3,822 ³	791 ³	1,608	903	198	1,835 ³	1,045 ³	254 ³	112	62	12	10,409	5,832	1,255
F Shelterwood seed cut to target BA	1,556	881	205	12	7	2	184	104	24				1,752	992	231
G Clearcut with legacy trees				43	25	8				4	3	1	47	28	9
H Clearcut-Coppice				77	43	10				4	3	1	81	46	11
I Plant Seedlings	260	192	123	73	52	31	93	71	49	6	4	2	432	319	205
J R _x FIRE ONLY low conditions	9,831	5,613	1,395	2,074	1,168	263	1,993	1,139	284	207	120	32	14,105	8,040	1,974
K R _x FIRE ONLY moderate conditions	1,028 ⁴	588 ⁴	148 ⁴	2,215	1,243	271	664 ⁴	380 ⁴	95 ⁴	360	212	63	4,267	2,423	577
L R _x FIRE ONLY high conditions	202 ⁴	116 ⁴	30 ⁴				157 ⁴	90 ⁴	23 ⁴				359	206	53
M Thin under 9-inch diameter to BA				1,460	832	203	1,048	598	148	19	11	3	2,527	1,441	354
Total Acres Treated	25,527	14,493	3,459	7,767	4,392	1,016	6,255	3,583	911	718	417	116	40,267	22,885	5,502
Percent Acres Treated Annually	4.2	2.4	0.6	4.4	2.5	0.6	4.2	2.4	0.6	4.1	2.4	0.7	4.3	2.4	0.6
Years to Treat Entire PNVT(s)	24	42	174	23	41	175	24	41	162	25	42	153	23	41	172

¹ See the Silviculturalist (B,C,D,E,F,G,H,I,M) and Fire (J,K,L) Specialists' reports for a description of their respective treatment types

² Based on specifically targeting closed canopy states F and G to maintain non-declining yield from suitable timber lands. 1982 Rule, Sec. 219.3 Definitions and terminology: Base sale schedule: A timber sale schedule formulated on the basis that the quantity of timber planned for sale and harvest for any future decade is equal to or greater than the planned sale and harvest for the preceding decade, and this planned sale and harvest for any decade is not greater than the long-term sustained yield capacity. Sale schedule: The quantity of timber planned for sale by time period from an area of suitable land covered by a forest plan. The first period, usually a decade, of the selected sale schedule provides the allowable sale quantity. Future periods are shown to establish that long-term sustained yield will be achieved and maintained

³ Based on specifically targeting closed canopy states H, I, L and M to maintain non-declining yield from suitable timber lands

⁴ Based on the removal of K R_x FIRE ONLY moderate conditions, and L R_x FIRE ONLY high conditions in all states within suitable timber lands

Alternative C Treatment Types

Appendix F table 5. Alternative C proposed management treatment types, acres and percent of total PNVT treated annually, and years it would take to treat the entire PNVT at the annual rate proposed for forested PNVTs; proposed high, average and low acre treatment objectives are presented for ponderosa pine, wet mixed conifer, dry mixed conifer and spruce-fir forests, and all A-SNFs forested PNVTs combined

Alternative C Treatment Types ¹	Alternative C Proposed Annual PNVT Acres Treated by Treatment Type												All A-SNFs Modeled Forested PNVTs 945,753 Acres		
	ponderosa pine forest 602,206 acres			wet mixed conifer forest 177,995 acres			dry mixed conifer forest 147,885 acres			spruce-fir forest 17,667 acres					
	high	average	low	high	average	low	high	average	low	high	average	low	high	average	low
B Free thin all sizes to target BA	6,826	3,755	683	254	140	26	192	106	20	7	4	1	7,279	4,005	730
C Thin from below to target BA	2,426	1,335	243	635	350	64	140	77	14	7	4	0	3,208	1,765	321
D Thin under 16-inch diameter to BA															
E Group select with matrix thin	10,706	5,889	1,071	3,423	1,885	346	3,961	2,171	380	137	74	11	18,227	10,018	1,808
F Shelterwood seed cut to target BA	4,297	2,363	429	211	116	21	660	360	60				5,168	2,839	510
G Clearcut with legacy trees				846	466	86				13	7	1	859	473	87
H Clearcut-Coppice				846	466	86				13	7	1	859	473	87
I Plant Seedlings	1,400	1,100	800	700	575	450	500	383	265	10	8	5	2,610	2,065	1,520
J R _x FIRE ONLY low conditions	3,565	1,965	364	1,044	575	105	660	363	66	297	164	31	5,566	3,066	566
K R _x FIRE ONLY moderate conditions	5,602	3,087	571	2,091	1,150	208	1,848	1,017	185	596	329	62	10,137	5,582	1,026
L R _x FIRE ONLY high conditions	1,020	562	104				264	145	26				1,284	707	130
M Thin under 9-inch diameter to BA				1,100	601	102	1,207	675	142	31	17	2	2,338	1,292	246
Total Acres Treated	35,842	20,054	4,265	11,150	6,322	1,494	9,432	5,295	1,158	1,111	616	114	57,535	32,283	7,031
Percent Acres Treated Annually	6.0	3.3	0.7	6.3	3.6	0.8	6.4	3.6	0.8	6.3	3.5	0.6	6.1	3.4	0.7
Years to Treat Entire PNVT(s)	17	30	141	16	28	119	16	28	128	16	29	155	16	29	135

¹See the Silviculturalist (B,C,D,E,F,G,H,I,M) and Fire (J,K,L) Specialists' reports for a description of their respective treatment types

Alternative C Treatment Types

Appendix F table 6. Alternative C proposed management treatment types, acres and percent treated annually (50-year average) as derived from VDDT modeling outputs, and years it would take to treat the entire PNVT at the annual rate for forested PNVTs; proposed high, average and low acre treatment objectives are presented for ponderosa pine, wet mixed conifer, dry mixed conifer and spruce-fir forests, and all A-SNFs forested PNVTs combined

Alternative C Treatment Types ¹	Alternative C Proposed 50-Year Average Annual PNVT Acres Treated by Treatment Type Based on VDDT Model Outputs												All A-SNFs Modeled Forested PNVTs 945,753 Acres		
	ponderosa pine forest 602,206 acres			wet mixed conifer forest 177,995 acres			dry mixed conifer forest 147,885 acres			spruce-fir forest 17,667 acres					
	high	average	low	high	average	low	high	average	low	high	average	low	high	average	low
B Free thin all sizes to target BA	7,150	3,958	766	228	126	25	246	136	26	6	4	1	7,630	4,224	818
C Thin from below to target BA	2,181	1,219	256	902	494	85	193	106	19	13	7	0	3,289	1,826	360
D Thin under 16-inch diameter to BA															
E Group select with matrix thin	10,602	5,883	1,163	2,613	1,423	233	3,807	2,097	387	232	123	14	17,254	9,526	1,797
F Shelterwood seed cut to target BA	4,823	2,644	466	97	55	12	644	354	63				5,564	3,053	541
G Clearcut with legacy trees				304	177	50				17	9	1	321	186	51
H Clearcut-Coppice				650	358	67				16	9	1	666	367	68
I Plant Seedlings	303	244	185	153	77	0	107	83	58	1	1	1	564	405	244
J R _x FIRE ONLY low conditions	3,873	2,139	406	1,906	1,057	208	844	465	85	301	169	36	6,924	3,830	735
K R _x FIRE ONLY moderate conditions	5,868	3,248	628	1,955	1,083	211	2,367	1,304	241	492	280	68	10,682	5,915	1,148
L R _x FIRE ONLY high conditions	1,089	600	112				628	344	60				1,717	944	172
M Thin under 9-inch diameter to BA				1,636	895	154	1,586	890	193	42	23	3	3,264	1,808	350
Total Acres Treated	35,890	19,935	3,981	10,443	5,744	1,044	10,423	5,778	1,132	1,121	623	124	57,877	32,080	6,281
Percent Acres Treated Annually	6.0	3.3	0.7	5.9	3.2	0.6	7.0	3.9	0.8	6.3	3.5	0.7	6.1	3.4	0.7
Years to Treat Entire PNVT(s)	17	30	151	17	31	170	14	26	131	16	28	142	16	29	151

¹See the Silviculturalist (B,C,D,E,F,G,H,I,M) and Fire (J,K,L) Specialists' reports for a description of their respective treatment types

Alternative D Treatment Types

Appendix F table 7. Alternative D proposed management treatment types, acres and percent of total PNVT treated annually, and years it would take to treat the entire PNVT at the annual rate proposed for forested PNVTs; proposed high, average and low acre treatment objectives are presented for ponderosa pine, wet mixed conifer, dry mixed conifer and spruce-fir forests, and all A-SNFs forested PNVTs combined

Alternative D Treatment Types ¹	Alternative D Proposed Annual PNVT Acres Treated by Treatment Type												All A-SNFs Modeled Forested PNVTs 945,753 Acres		
	ponderosa pine forest 602,206 acres			wet mixed conifer forest 177,995 acres			dry mixed conifer forest 147,885 acres			spruce-fir forest 17,667 acres					
	high	average	low	high	average	low	high	average	low	high	average	low	high	average	low
B Free thin all sizes to target BA	77	44	11										77	44	11
C Thin from below to target BA															
D Thin under 16-inch diameter to BA	8,987	5,168	1,348	1,973	987	0				31	18	5	10,991	6,172	1,353
E Group select with matrix thin	331	191	50	80	40	0							411	231	50
F Shelterwood seed cut to target BA	55	32	8										55	32	8
G Clearcut with legacy trees															
H Clearcut-Coppice															
I Plant Seedlings	400	263	125				200	150	100				600	413	225
J R _x FIRE ONLY low conditions	7,718	4,439	1,160	2,214	1,273	332	1,400	805	210	321	185	48	11,653	6,702	1,750
K R _x FIRE ONLY moderate conditions	12,128	6,974	1,820	4,436	2,551	665	3,920	2,254	588	643	370	97	21,127	12,149	3,170
L R _x FIRE ONLY high conditions	2,205	1,268	330				339	211	83				2,544	1,479	413
M Thin under 9-inch diameter to BA				798	613	428	1,207	784	360	5	3	1	2,010	1,400	789
Total Acres Treated	31,901	18,377	4,852	9,501	5,463	1,425	7,066	4,204	1,341	1,000	576	151	49,468	28,619	7,769
Percent Acres Treated Annually	5.3	3.1	0.8	5.3	3.1	0.8	4.8	2.8	0.9	5.7	3.3	0.9	5.2	3.0	0.8
Years to Treat Entire PNVT(s)	19	33	124	19	33	125	21	35	110	18	31	117	19	33	122

¹See the Silviculturalist (B,C,D,E,F,G,H,I,M) and Fire (J,K,L) Specialists' reports for a description of their respective treatment types

Alternative D Treatment Types

Appendix F table 8. Alternative D proposed management treatment types, acres and percent treated annually (50-year average) as derived from VDDT modeling outputs, and years it would take to treat the entire PNVT at the annual rate for forested PNVTs; proposed high, average and low acre treatment objectives are presented for ponderosa pine, wet mixed conifer, dry mixed conifer and spruce-fir forests, and all A-SNFs forested PNVTs combined

Alternative D Treatment Types ¹	Alternative D Proposed 50-Year Average Annual PNVT Acres Treated by Treatment Type Based on VDDT Model Outputs												All A-SNFs Modeled Forested PNVTs 945,753 Acres		
	ponderosa pine forest 602,206 acres			wet mixed conifer forest 177,995 acres			dry mixed conifer forest 147,885 acres			spruce-fir forest 17,667 acres			high	average	low
	high	average	low	high	average	low	high	average	low	high	average	low			
B Free thin all sizes to target BA	84	48	12										84	48	12
C Thin from below to target BA															
D Thin under 16-inch diameter to BA	10,450	5,970	1,490	2,929	1,464	0				68	38	8	13,447	7,472	1,498
E Group select with matrix thin	385	220	55	91	46	0							476	266	55
F Shelterwood seed cut to target BA	64	36	9										64	36	9
G Clearcut with legacy trees															
H Clearcut-Coppice															
I Plant Seedlings	116	75	34				44	36	28				160	111	62
J R _x FIRE ONLY low conditions	8,539	4,917	1,295	3,731	2,190	650	1,797	1,019	241	318	186	54	14,385	8,312	2,240
K R _x FIRE ONLY moderate conditions	13,167	7,585	2,004	4,450	2,570	690	5,028	2,853	677	608	356	104	23,253	13,364	3,475
L R _x FIRE ONLY high conditions	1,548	940	332				640	405	170				2,188	1,345	502
M Thin under 9-inch diameter to BA				12,496	1,005	714	1,505	1,106	706	7	4	1	14,008	2,115	1,421
Total Acres Treated	34,352	19,792	5,232	9,501	7,275	2,054	9,015	5,178	1,341	901	534	167	53,769	32,779	8,794
Percent Acres Treated Annually	5.7	3.3	0.9	7.0	4.1	1.2	6.1	3.7	1.2	5.1	3.0	0.9	5.7	3.5	0.9
Years to Treat Entire PNVT(s)	18	30	115	14	24	87	16	27	81	20	33	106	18	29	108

¹See the Silviculturalist (B,C,D,E,F,G,H,I,M) and Fire (J,K,L) Specialists' reports for a description of their respective treatment types

Alternative A Treatment Types

Appendix F table 9. Alternative A management treatment types, acres and percent of total PNVT treated annually, and number of years it would take to treat the entire PNVT at the annual rate for Madrean pine-oak and piñon-juniper woodlands, and all A-SNFs woodland PNVTs combined

Alternative A Treatment Types ¹	Alternative A Annual PNVT Acres Treated by Treatment Type		All A-SNFs Modeled Woodland PNVTs 617,094 Acres
	Madrean pine-oak woodland 394,928 acres	piñon-juniper woodland 222,166 acres	
	alternative A	alternative A	alternative A
B Free thin all sizes to target BA		180	180
C Thin from below to target BA			
D Thin under 16-inch diameter to BA		150	150
E Group select with matrix thin		40	40
F Shelterwood seed cut to target BA			
G Clearcut with legacy trees		130	130
H Clearcut-Coppice			
I Plant Seedlings			
J R _x FIRE ONLY low conditions		81	81
K R _x FIRE ONLY moderate conditions	797	9	806
L R _x FIRE ONLY high conditions	266		266
M Thin under 9-inch diameter to BA			
Total Acres Treated	1,063	590	1,653
Percent Acres Treated Annually	0.3	0.3	0.3
Years to Treat Entire PNVT(s)	372	377	373

¹ See the Silviculturalist (B,C,D,E,F,G,H,I,M) and Fire (J,K,L) Specialists' reports for a description of their respective treatment types

Alternative A Treatment Types

Appendix F table 10. Alternative A management treatment types, acres and percent of total PNVT treated annually (50-year average) as derived from VDDT modeling outputs, and number of years it would take to treat the entire PNVT at the annual rate for Madrean pine-oak and piñon-juniper woodlands, and all A-SNFs woodland PNVTs combined

Alternative A Treatment Types ¹	Alternative A Proposed 50-Year Average Annual PNVT Acres Treated by Treatment Type Based on VDDT Model Outputs		All A-SNFs Modeled Woodland PNVTs 617,094 Acres
	Madrean pine-oak woodland 394,928 acres	piñon-juniper woodland 222,166 acres	
	alternative A	alternative A	alternative A
B Free thin all sizes to target BA		176	176
C Thin from below to target BA			
D Thin under 16-inch diameter to BA		147	147
E Group select with matrix thin		38	38
F Shelterwood seed cut to target BA			
G Clearcut with legacy trees		131	131
H Clearcut-Coppice			
I Plant Seedlings			
J R _x FIRE ONLY low conditions		81	81
K R _x FIRE ONLY moderate conditions	791	18	809
L R _x FIRE ONLY high conditions	257		257
M Thin under 9-inch diameter to BA			
Total Acres Treated	1,048	591	1,639
Percent Acres Treated Annually	0.3	0.3	0.3
Years to Treat Entire PNVT(s)	377	377	377

¹See the Silviculturalist (B,C,D,E,F,G,H,I,M) and Fire (J,K,L) Specialists' reports for a description of their respective treatment types

Alternative B Treatment Types

Appendix F table 11. Alternative B proposed management treatment types, acres and percent of total PNVT treated annually, and years it would take to treat the entire PNVT at the annual rate proposed for forested PNVTs; proposed high, average and low acre treatment objectives are presented for Madrean pine-oak and piñon-juniper woodlands, and all A-SNFs woodland PNVTs combined

Alternative B Treatment Types ¹	Alternative B Proposed Annual PNVT Acres Treated by Treatment Type						All A-SNFs Modeled Woodland PNVTs 617,094 Acres		
	Madrean pine-oak woodland 394,928 acres			piñon-juniper woodland 222,166 acres					
	high	average	low	high	average	low	high	average	low
B Free thin all sizes to target BA									
C Thin from below to target BA									
D Thin under 16-inch diameter to BA									
E Group select with matrix thin				2,341	1,561	780	2,341	1,561	780
F Shelterwood seed cut to target BA									
G Clearcut with legacy trees									
H Clearcut-Coppice									
I Plant Seedlings									
J R _x FIRE ONLY low conditions									
K R _x FIRE ONLY moderate conditions	11,143	7,429	3,714	1,412	941	470	12,555	8,370	4,184
L R _x FIRE ONLY high conditions									
M Thin under 9-inch diameter to BA									
Total Acres Treated	11,143	7,429	3,714	3,753	2,502	1,250	14,896	9,930	4,964
Percent Acres Treated Annually	2.8	1.9	0.9	1.7	1.1	0.6	2.4	1.6	0.8
Years to Treat Entire PNVT(s)	35	53	106	59	89	178	41	62	124

¹See the Silviculturalist (B,C,D,E,F,G,H,I,M) and Fire (J,K,L) Specialists' reports for a description of their respective treatment types

Alternative B Treatment Types

Appendix F table 12. Alternative B proposed management treatment types, acres and percent treated annually (50-year average) as derived from VDDT modeling outputs, and years it would take to treat the entire PNVT at the annual rate for forested PNVTs; proposed high, average and low acre treatment objectives are presented for Madrean pine-oak and piñon-juniper woodlands, and all A-SNFs woodland PNVTs combined

Alternative B Treatment Types ¹	Alternative B Proposed 50-Year Average Annual PNVT Acres Treated by Treatment Type Based on VDDT Model Outputs						All A-SNFs Modeled Woodland PNVTs 617,094 Acres		
	Madrean pine-oak woodland 394,928 acres			piñon-juniper woodland 222,166 acres					
	high	average	low	high	average	low	high	average	low
B Free thin all sizes to target BA									
C Thin from below to target BA									
D Thin under 16-inch diameter to BA									
E Group select with matrix thin				2,149	1,444	738	2,149	1,444	738
F Shelterwood seed cut to target BA									
G Clearcut with legacy trees									
H Clearcut-Coppice									
I Plant Seedlings									
J R _x FIRE ONLY low conditions									
K R _x FIRE ONLY moderate conditions	7,784	5,538	3,292	1,930	1,387	843	9,714	6,925	4,135
L R _x FIRE ONLY high conditions									
M Thin under 9-inch diameter to BA									
Total Acres Treated	7,784	5,538	3,292	4,078	2,830	1,581	11,862	8,368	4,873
Percent Acres Treated Annually	2.0	1.4	0.8	1.8	1.3	0.7	1.9	1.4	0.8
Years to Treat Entire PNVT(s)	51	71	120	54	79	141	52	74	127

¹See the Silviculturalist (B,C,D,E,F,G,H,I,M) and Fire (J,K,L) Specialists' reports for a description of their respective treatment types

Alternative C Treatment Types

Appendix F table 13. Alternative C proposed management treatment types, acres and percent of total PNVТ treated annually, and years it would take to treat the entire PNVТ at the annual rate proposed for forested PNVТs; proposed high, average and low acre treatment objectives are presented for Madrean pine-oak and piñon-juniper woodlands, and all A-SNFs woodland PNVТs combined

Alternative C Treatment Types ¹	Alternative C Proposed Annual PNVТ Acres Treated by Treatment Type						All A-SNFs Modeled Woodland PNVТs 617,094 Acres		
	Madrean pine-oak woodland 394,928 acres			piñon-juniper woodland 222,166 acres					
	high	average	low	high	average	low	high	average	low
B Free thin all sizes to target BA				383	240	96	383	240	96
C Thin from below to target BA									
D Thin under 16-inch diameter to BA									
E Group select with matrix thin				3,830	2,394	957	3,830	2,394	957
F Shelterwood seed cut to target BA									
G Clearcut with legacy trees									
H Clearcut-Coppice									
I Plant Seedlings									
J R _x FIRE ONLY low conditions									
K R _x FIRE ONLY moderate conditions	5,000	3,125	1,250	600	375	150	11,743	7,804	3,864
L R _x FIRE ONLY high conditions									
M Thin under 9-inch diameter to BA									
Total Acres Treated	5,000	3,125	1,250	4,813	3,008	1,203	15,956	10,437	4,917
Percent Acres Treated Annually	1.3	0.8	0.3	2.2	1.4	0.5	2.6	1.7	0.8
Years to Treat Entire PNVТ(s)	79	126	316	46	74	185	39	59	126

¹ See the Silviculturalist (B,C,D,E,F,G,H,I,M) and Fire (J,K,L) Specialists' reports for a description of their respective treatment types

Alternative C Treatment Types

Appendix F table 14. Alternative C proposed management treatment types, acres and percent treated annually (50-year average) as derived from VDDT modeling outputs, and years it would take to treat the entire PNVt at the annual rate for forested PNVts; proposed high, average and low acre treatment objectives are presented for Madrean pine-oak and piñon-juniper woodlands, and all A-SNFs woodland PNVts combined

Alternative C Treatment Types ¹	Alternative C Proposed 50-Year Average Annual PNVt Acres Treated by Treatment Type Based on VDDT Model Outputs						All A-SNFs Modeled Woodland PNVts 617,094 Acres		
	Madrean pine-oak woodland 394,928 acres			piñon-juniper woodland 222,166 acres					
	high	average	low	high	average	low	high	average	low
B Free thin all sizes to target BA				369	240	95	369	240	95
C Thin from below to target BA									
D Thin under 16-inch diameter to BA									
E Group select with matrix thin				3,436	2,394	908	3,436	2,394	908
F Shelterwood seed cut to target BA									
G Clearcut with legacy trees									
H Clearcut-Coppice									
I Plant Seedlings									
J R _x FIRE ONLY low conditions									
K R _x FIRE ONLY moderate conditions	3,834	2,518	1,202	931	375	289	4,765	2,893	1,491
L R _x FIRE ONLY high conditions									
M Thin under 9-inch diameter to BA									
Total Acres Treated	3,834	2,518	1,202	4,736	3,014	1,292	8,570	5,532	2,494
Percent Acres Treated Annually	1.0	0.6	0.3	2.1	1.4	0.6	1.4	0.9	0.4
Years to Treat Entire PNVt(s)	103	157	329	47	74	172	72	112	247

¹See the Silviculturalist (B,C,D,E,F,G,H,I,M) and Fire (J,K,L) Specialists' reports for a description of their respective treatment types

Alternative D Treatment Types

Appendix F table 15. Alternative D proposed management treatment types, acres and percent of total PNVT treated annually, and years it would take to treat the entire PNVT at the annual rate proposed for forested PNVTs; proposed high, average and low acre treatment objectives are presented for Madrean pine-oak and piñon-juniper woodlands, and all A-SNFs woodland PNVTs combined

Alternative D Treatment Types ¹	Alternative D Proposed Annual PNVT Acres Treated by Treatment Type						All A-SNFs Modeled Woodland PNVTs 617,094 Acres		
	Madrean pine-oak woodland 394,928 acres			piñon-juniper woodland 222,166 acres					
	high	average	low	high	average	low	high	average	low
B Free thin all sizes to target BA									
C Thin from below to target BA									
D Thin under 16-inch diameter to BA				3,884	2,266	647	3,884	2,266	647
E Group select with matrix thin				158	92	26	158	92	26
F Shelterwood seed cut to target BA									
G Clearcut with legacy trees									
H Clearcut-Coppice									
I Plant Seedlings									
J R _x FIRE ONLY low conditions									
K R _x FIRE ONLY moderate conditions	22,335	13,029	3,722	3,443	2,009	575	25,778	15,038	4,297
L R _x FIRE ONLY high conditions									
M Thin under 9-inch diameter to BA									
Total Acres Treated	22,335	13,029	3,722	7,485	4,367	1,248	29,820	17,395	4,970
Percent Acres Treated Annually	5.7	3.3	0.9	3.4	2.0	0.6	4.8	2.8	0.8
Years to Treat Entire PNVT(s)	18	30	106	30	51	178	21	35	124

¹See the Silviculturalist (B,C,D,E,F,G,H,I,M) and Fire (J,K,L) Specialists' reports for a description of their respective treatment types

Alternative D Treatment Types

Appendix F table 16. Alternative D proposed management treatment types, acres and percent treated annually (50-year average) as derived from VDDT modeling outputs, and years it would take to treat the entire PNVT at the annual rate for forested PNVTs; proposed high, average and low acre treatment objectives are presented for Madrean pine-oak and piñon-juniper woodlands, and all A-SNFs woodland PNVTs combined

Alternative D Treatment Types ¹	Alternative D Proposed 50-Year Average Annual PNVT Acres Treated by Treatment Type Based on VDDT Model Outputs						All A-SNFs Modeled Woodland PNVTs 617,094 Acres		
	Madrean pine-oak woodland 394,928 acres			piñon-juniper woodland 222,166 acres					
	high	average	low	high	average	low	high	average	low
B Free thin all sizes to target BA									
C Thin from below to target BA									
D Thin under 16-inch diameter to BA				3,612	2,121	630	3,612	2,121	630
E Group select with matrix thin				135	80	24	135	80	24
F Shelterwood seed cut to target BA									
G Clearcut with legacy trees									
H Clearcut-Coppice									
I Plant Seedlings									
J R _x FIRE ONLY low conditions									
K R _x FIRE ONLY moderate conditions	11,945	7,614	3,282	3,047	2,021	995	14,992	9,635	4,277
L R _x FIRE ONLY high conditions									
M Thin under 9-inch diameter to BA									
Total Acres Treated	11,945	7,614	3,282	6,794	4,222	1,650	18,739	11,836	4,932
Percent Acres Treated Annually	3.0	1.9	0.8	3.1	1.9	0.6	3.0	1.9	0.8
Years to Treat Entire PNVT(s)	33	52	120	33	53	178	33	52	125

¹See the Silviculturalist (B,C,D,E,F,G,H,I,M) and Fire (J,K,L) Specialists' reports for a description of their respective treatment types

Alternative A Treatment Types

Appendix F table 17. Alternative A management treatment types, acres and percent of total PNVT treated annually, and number of years it would take to treat the entire PNVT at the annual rate for Great Basin and semi-desert grasslands, and all A-SNFs modeled grasslands PNVTs combined, and all A-SNFs modeled PNVTs combined

Alternative A Treatment Types ¹	Alternative A Annual PNVT Acres Treated by Treatment Type		All A-SNFs Modeled Grassland PNVTs 292,475 Acres	All A-SNFs Modeled PNVTs 1,855,322 Acres
	Great Basin grassland 185,523 acres	semi-desert grassland 106,952 acres		
	alternative A	alternative A	alternative A	alternative A
B Free thin all sizes to target BA				1,794
C Thin from below to target BA				2,737
D Thin under 16-inch diameter to BA				3,122
E Group select with matrix thin				2,131
F Shelterwood seed cut to target BA				514
G Clearcut with legacy trees	250		250	424
H Clearcut-Coppice				301
I Plant Seedlings				880
J R _x FIRE ONLY low conditions				5,038
K R _x FIRE ONLY moderate conditions	41	27	68	1,513
L R _x FIRE ONLY high conditions				293
M Thin under 9-inch diameter to BA				1,159
Total Acres Treated	291	27	568	19,286
Percent Acres Treated Annually	0.2	< 0.1	0.2	1.0
Years to Treat Entire PNVT(s)	638	3,961	515	96

¹See the Silviculturalist (B,C,D,E,F,G,H,I,M) and Fire (J,K,L) Specialists' reports for a description of their respective treatment types

Alternative A Treatment Types

Appendix F table 18. Alternative A management treatment types, acres and percent of total PNVT treated annually (50-year average) as derived from VDDT modeling outputs, and number of years it would take to treat the entire PNVT at the annual rate for Great Basin and semi-desert grasslands, and all A-SNFs modeled grassland PNVTs combined, and all A-SNFs modeled PNVTs combined

Alternative A Treatment Types ¹	Alternative A Proposed 50-Year Average Annual PNVT Acres Treated by Treatment Type Based on VDDT Model Outputs		All A-SNFs Modeled Grassland PNVTs	All A-SNFs Modeled PNVTs
	Great Basin grassland	semi-desert grassland	292,475 Acres	1,855,322 Acres
	185,523 acres	106,952 acres		
	alternative A	alternative A	alternative A	alternative A
B Free thin all sizes to target BA				2,169
C Thin from below to target BA				3,198
D Thin under 16-inch diameter to BA				3,647
E Group select with matrix thin				2,258
F Shelterwood seed cut to target BA				554
G Clearcut with legacy trees	235		250	795
H Clearcut-Coppice				53
I Plant Seedlings				166
J R _x FIRE ONLY low conditions				5,560
K R _x FIRE ONLY moderate conditions	39	29	68	2,273
L R _x FIRE ONLY high conditions				514
M Thin under 9-inch diameter to BA				1,336
Total Acres Treated	273	29	568	22,770
Percent Acres Treated Annually	0.1	< 0.1	0.2	1.2
Years to Treat Entire PNVT(s)	680	3,658	515	81

¹See the Silviculturalist (B,C,D,E,F,G,H,I,M) and Fire (J,K,L) Specialists' reports for a description of their respective treatment types

Alternative B Treatment Types

Appendix F table 19. Alternative B proposed management treatment types, acres and percent of total PNVT treated annually, and years it would take to treat the entire PNVT at the annual rate proposed for forested PNVTs; proposed high, average and low acre treatment objectives are presented for Great Basin and semi-desert grasslands, and all A-SNFs modeled grassland PNVTs combined, and all A-SNFs modeled PNVTs combined

Alternative B Treatment Types ¹	Alternative B Proposed Annual PNVT Acres Treated by Treatment Type						All A-SNFs Modeled Grassland PNVTs 292,475 Acres			All A-SNFs Modeled PNVTs 1,855,322 Acres		
	Great Basin grassland 185,523 acres			semi-desert grassland 106,952 acres								
	high	average	low	high	average	low	high	average	low	high	average	low
B Free thin all sizes to target BA										3,021	1,727	429
C Thin from below to target BA										2,208	1,260	309
D Thin under 16-inch diameter to BA												
E Group select with matrix thin										13,144	7,953	2,760
F Shelterwood seed cut to target BA										1,557	888	218
G Clearcut with legacy trees	10,269	7,702	5,135				10,269	7,702	5,135	96	55	14
H Clearcut-Coppice										96	55	14
I Plant Seedlings										2,200	1,623	1,045
J R _x FIRE ONLY low conditions										5,859	3,335	810
K R _x FIRE ONLY moderate conditions	10,000	7,500	5,000	2,000	1,667	1,333	12,000	9,167	6,333	35,736	22,786	9,833
L R _x FIRE ONLY high conditions				1,000	834	667	1,000	834	667	1,379	789	198
M Thin under 9-inch diameter to BA										1,777	475	253
Total Acres Treated	20,269	15,202	10,135	3,000	2,500	2,000	23,269	17,703	12,135	67,073	40,943	15,883
Percent Acres Treated Annually	10.9	8.2	5.5	2.8	2.3	1.9	8.0	6.1	4.1	3.6	2.2	0.9
Years to Treat Entire PNVT(s)	9	12	18	36	43	53	13	17	24	28	45	117

¹See the Silviculturalist (B,C,D,E,F,G,H,I,M) and Fire (J,K,L) Specialists' reports for a description of their respective treatment types

Alternative B Treatment Types

Appendix F table 20. Alternative B proposed management treatment types, acres and percent treated annually (50-year average) as derived from VDDT modeling outputs, and years it would take to treat the entire PNVt at the annual rate for forested PNVts; proposed high, average and low acre treatment objectives are presented for Great Basin and semi-desert grasslands, and all A-SNFs modeled grassland PNVts combined, and all A-SNFs modeled PNVts combined

Alternative B Treatment Types ¹	Alternative B Proposed 50-Year Average Annual PNVt Acres Treated by Treatment Type Based on VDDT Model Outputs						All A-SNFs Modeled Grassland PNVts 292,475 Acres			All A-SNFs Modeled PNVts 1,855,322 Acres		
	Great Basin grassland 185,523 acres			semi-desert grassland 106,952 acres			high	average	low	high	average	low
	high	average	low	high	average	low						
B Free thin all sizes to target BA										3,939	2,216	492
C Thin from below to target BA										2,351	1,346	339
D Thin under 16-inch diameter to BA												
E Group select with matrix thin										12,558	7,276	1,993
F Shelterwood seed cut to target BA										1,752	992	231
G Clearcut with legacy trees	2,906	2,687	2,467				2,906	2,687	2,467	2,953	2,715	2,476
H Clearcut-Coppice										81	46	11
I Plant Seedlings										432	319	205
J R _x FIRE ONLY low conditions										14,105	8,040	1,974
K R _x FIRE ONLY moderate conditions	2,830	2,616	2,402	1,577	1,369	1,162	4,407	3,985	3,564	18,388	13,333	8,276
L R _x FIRE ONLY high conditions				788	685	581	788	685	581	1,147	891	634
M Thin under 9-inch diameter to BA										2,527	1,441	354
Total Acres Treated	5,737	5,303	4,869	2,365	2,054	1,743	8,101	7,357	6,612	60,231	38,610	16,987
Percent Acres Treated Annually	3.1	2.9	2.6	2.2	1.9	1.6	2.8	2.5	2.3	3.2	2.1	0.9
Years to Treat Entire PNVt(s)	32	35	38	45	52	61	36	40	44	31	48	109

¹See the Silviculturalist (B,C,D,E,F,G,H,I,M) and Fire (J,K,L) Specialists' reports for a description of their respective treatment types

Alternative C Treatment Types

Appendix F table 21. Alternative C proposed management treatment types, acres and percent of total PNVT treated annually, and years it would take to treat the entire PNVT at the annual rate proposed for forested PNVTs; proposed high, average and low acre treatment objectives are presented for Great Basin and semi-desert grasslands, and all A-SNFs modeled grassland PNVTs combined, and all A-SNFs modeled PNVTs combined

Alternative C Treatment Types ¹	Alternative C Proposed Annual PNVT Acres Treated by Treatment Type						All A-SNFs Modeled Grassland PNVTs 292,475 Acres			All A-SNFs Modeled PNVTs 1,855,322 Acres		
	Great Basin grassland 185,523 acres			semi-desert grassland 106,952 acres								
	high	average	low	high	average	low	high	average	low	high	average	low
B Free thin all sizes to target BA										7,662	4,245	826
C Thin from below to target BA										3,208	1,769	321
D Thin under 16-inch diameter to BA												
E Group select with matrix thin										22,057	12,413	2,765
F Shelterwood seed cut to target BA										5,168	2,839	510
G Clearcut with legacy trees		250						250		859	723	87
H Clearcut-Coppice										859	723	87
I Plant Seedlings										2,610	2,066	1,520
J R _x FIRE ONLY low conditions										5,566	3,067	566
K R _x FIRE ONLY moderate conditions		41			27			68		15,737	9,151	2,426
L R _x FIRE ONLY high conditions										1,284	707	130
M Thin under 9-inch diameter to BA										2,338	1,293	246
Total Acres Treated		291			27			568		67,348	38,996	9,484
Percent Acres Treated Annually		0.2			< 0.1			0.2		3.6	2.1	0.5
Years to Treat Entire PNVT		638			3,961			515		28	48	196

¹See the Silviculturalist (B,C,D,E,F,G,H,I,M) and Fire (J,K,L) Specialists' reports for a description of their respective treatment types

Alternative C Treatment Types

Appendix F table 22. Alternative C proposed management treatment types, acres and percent treated annually (50-year average) as derived from VDDT modeling outputs, and years it would take to treat the entire PNVt at the annual rate for forested PNVts; proposed high, average and low acre treatment objectives are presented for Great Basin and semi-desert grasslands, and all A-SNFs modeled grassland PNVts combined, and all A-SNFs modeled PNVts combined

Alternative C Treatment Types ¹	Alternative C Proposed 50-Year Average Annual PNVt Acres Treated by Treatment Type Based on VDDT Model Outputs						All A-SNFs Modeled Grassland PNVts 292,475 Acres			All A-SNFs Modeled PNVts 1,855,322 Acres		
	Great Basin grassland 185,523 acres			semi-desert grassland 106,952 acres								
	high	average	low	high	average	low	high	average	low	high	average	low
B Free thin all sizes to target BA										7,999	4,464	913
C Thin from below to target BA										3,289	1,826	360
D Thin under 16-inch diameter to BA												
E Group select with matrix thin										20,690	11,920	2,705
F Shelterwood seed cut to target BA										5,564	3,053	541
G Clearcut with legacy trees		47						47		321	233	51
H Clearcut-Coppice										666	367	68
I Plant Seedlings										564	405	244
J R _x FIRE ONLY low conditions										6,924	3,830	735
K R _x FIRE ONLY moderate conditions		8			29			37		15,447	8,845	2,639
L R _x FIRE ONLY high conditions										1,717	944	172
M Thin under 9-inch diameter to BA										3,264	1,808	350
Total Acres Treated		56			29			84		66,447	37,697	8,775
Percent Acres Treated Annually		< 0.1			< 0.1			< 0.1		3.6	2.0	0.5
Years to Treat Entire PNVt		3,313			3,961			3,658		28	49	211

¹See the Silviculturalist (B,C,D,E,F,G,H,I,M) and Fire (J,K,L) Specialists' reports for a description of their respective treatment types

Alternative D Treatment Types

Appendix F table 23. Alternative D proposed management treatment types, acres and percent of total PNVT treated annually, and years it would take to treat the entire PNVT at the annual rate proposed for forested PNVTs; proposed high, average and low acre treatment objectives are presented for Great Basin and semi-desert grasslands, and all A-SNFs modeled grassland PNVTs combined, and all A-SNFs modeled PNVTs combined

Alternative D Treatment Types ¹	Alternative D Proposed Annual PNVT Acres Treated by Treatment Type						All A-SNFs Modeled Grassland PNVTs 292,475 Acres			All A-SNFs Modeled PNVTs 1,855,322 Acres		
	Great Basin grassland 185,523 acres			semi-desert grassland 106,952 acres								
	high	average	low	high	average	low	high	average	low	high	average	low
B Free thin all sizes to target BA										77	44	11
C Thin from below to target BA												
D Thin under 16-inch diameter to BA										14,875	3,271	2,000
E Group select with matrix thin										569	323	76
F Shelterwood seed cut to target BA										55	32	8
G Clearcut with legacy trees	6,161	4,621	3,081				6,161	4,621	3,081	6,161	4,621	3,081
H Clearcut-Coppice												
I Plant Seedlings										600	413	225
J R _x FIRE ONLY low conditions										11,653	6,702	1,750
K R _x FIRE ONLY moderate conditions	14,000	10,500	7,000	2,000	1,667	1,333	16,000	12,167	8,333	62,905	39,354	15,800
L R _x FIRE ONLY high conditions				1,000	834	667	1,000	834	667	3,544	2,313	1,080
M Thin under 9-inch diameter to BA										2,010	1,400	789
Total Acres Treated	20,161	15,121	10,081	3,000	2,500	2,000	23,161	17,621	12,081	102,449	58,473	24,820
Percent Acres Treated Annually	10.9	8.2	5.4	2.8	2.3	1.9	7.9	6.0	4.1	5.5	3.2	1.3
Years to Treat Entire PNVT(s)	9	12	18	36	43	53	13	17	24	18	32	75

¹See the Silviculturalist (B,C,D,E,F,G,H,I,M) and Fire (J,K,L) Specialists' reports for a description of their respective treatment types

Alternative D Treatment Types

Appendix F table 24. Alternative D proposed management treatment types, acres and percent treated annually (50-year average) as derived from VDDT modeling outputs, and years it would take to treat the entire PNVt at the annual rate for forested PNVts; proposed high, average and low acre treatment objectives are presented for Great Basin and semi-desert grasslands, and all A-SNFs modeled grassland PNVts combined, and all A-SNFs modeled PNVts combined

Alternative D Treatment Types ¹	Alternative D Proposed 50-Year Average Annual PNVt Acres Treated by Treatment Type Based on VDDT Model Outputs						All A-SNFs Modeled Grassland PNVts 292,475 Acres			All A-SNFs Modeled PNVts 1,855,322 Acres		
	Great Basin grassland 185,523 acres			semi-desert grassland 106,952 acres			high	average	low	high	average	low
	high	average	low	high	average	low						
B Free thin all sizes to target BA										84	48	12
C Thin from below to target BA										0	0	0
D Thin under 16-inch diameter to BA										17,059	9,593	2,128
E Group select with matrix thin										611	346	79
F Shelterwood seed cut to target BA										64	36	9
G Clearcut with legacy trees	1,935	1,729	1,522				1,935	1,729	1,522	1,935	1,729	1,522
H Clearcut-Coppice										0	0	0
I Plant Seedlings										160	111	62
J R _x FIRE ONLY low conditions										14,385	8,312	2,240
K R _x FIRE ONLY moderate conditions	4,398	3,927	3,457	1,577	1,370	1,162	5,975	5,297	4,619	44,220	28,296	12,371
L R _x FIRE ONLY high conditions				788	685	581	788	685	581	2,976	2,030	1,083
M Thin under 9-inch diameter to BA										14,008	2,115	1,421
Total Acres Treated	6,333	5,656	4,979	2,365	2,054	1,743	8,698	7,711	6,722	81,206	52,325	20,448
Percent Acres Treated Annually	3.4	3.0	2.7	2.2	2.3	1.9	3.0	2.6	2.3	4.4	2.8	1.1
Years to Treat Entire PNVt(s)	29	33	37	45	43	52	34	38	44	23	35	91

¹See the Silviculturalist (B,C,D,E,F,G,H,I,M) and Fire (J,K,L) Specialists' reports for a description of their respective treatment types

Appendix G - Tabular Summations of the 15-Year Planning Period and 50-Year Modeling Period Comparisons of the Environmental Consequences to the Vegetation Indicator Variables and Elements Between the Proposed High, Average, and Low Acre Treatment Objectives for Alternatives B, C and D, and Alternative A

All A-SNFs PNVTs

15-Year Planning Period Proposed High Acre Treatment Objectives

Appendix G table 1. Tabular summation and alternative ranking¹ of the 15-year planning period comparisons of the environmental consequences to the vegetation indicator variables and elements between the proposed high acre treatment objectives for alternatives B, C and D, and alternative A

Indicator Variables and Elements	Proposed High Acre Treatment Objectives								Alternative Ranking in Relation to Movement Toward Indicator Variables and Elements (from greatest to least)	
	Alternative A (current)		alternative B (preferred)		alternative C		alternative D			
	DC	HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV
Indicator and Elements - Vegetation Movement Toward DC And HRV										
Ponderosa pine forest PNV	1	1	2	3	4	4	3	2	C, D, B, A	C, B, D, A
Wet mixed conifer forest PNV	4	3	2	4	1	1	3	2	A, D, B, C	B, A, D, C
Dry mixed conifer forest PNV	1	1	3	3	4	4	2	2	C, B, D, A	C, B, D, A
Spruce-fir forest PNV	2	2	3	3	4	3	3	4	C, B/D, A	D, B/C, A
All A-SNFs Modeled Forest PNVs	2	3	3	3	4	4	1	2	C, B, A, D	C, A/B, D
Madrean pine-oak woodland PNV	1	1	3	3	2	2	4	4	D, B, C, A	D, B, C, A
Piñon-juniper woodland PNV	2	2	3	3	4	4	3	3	C, B/D, A	C, B/D, A
All A-SNFs Modeled Woodland PNVs	1	1	3	3	2	2	4	4	D, B, C, A	D, B, C, A
Great Basin grassland PNV	2	2	3	3	2	2	4	4	D, B, A/C	D, B, A/C
Semi-desert grassland PNV	3	3	4	4	3	3	4	4	B/D, A/C	B/D, A/C
Montane/subalpine grasslands PNV	3	3	4	4	4	4	4	4	B/C/D, A	B/C/D, A
All A-SNFs Modeled Grassland PNVs	2	2	3	3	2	2	4	4	D, B, A/C	D, B, A/C
All A-SNFs Modeled PNVs	3	2	2	4	4	3	1	4	C, A, B, D	A, C, B, D
Interior chaparral PNV	4	4	4	4	4	4	4	4	A/B/C/D	A/B/C/D
Wetland/cienega riparian areas PNV	3	3	4	4	3	3	4	4	B/D, A/C	B/D, A/C
Mixed broadleaf deciduous riparian forest PNV	3	3	4	4	3	3	4	4	B/D, A/C	B/D, A/C
Montane willow riparian forest PNV	3	3	4	4	3	3	4	4	B/D, A/C	B/D, A/C
Cottonwood-willow riparian forest PNV	3	3	4	4	3	3	4	4	B/D, A/C	B/D, A/C
All Riparian Areas/Forest PNVs	3	3	4	4	3	3	4	4	B/D, A/C	B/D, A/C
Overall Indicator Ranking - Vegetation Movement Toward DC and HRV	46/2.42	45/2.37	62/3.26	67/3.53	59/3.11	57/3.00	64/3.37	67/3.53	D, B, C, A	B/D, C, A
Indicator and Elements - Acres Of Old/Large Trees										
Ponderosa pine forest PNV	3		2		1		4		D, A, B, C	
Wet mixed conifer forest PNV	1		2		3		4		D, C, B, A	
Dry mixed conifer forest PNV	1		2		3		4		D, C, B, A	
Spruce-fir forest PNV	1		2		3		4		D, C, B, A	
Madrean pine-oak woodland PNV	2		3		1		4		D, B, A, C	
Piñon-juniper woodland PNV	1		2		3		4		D, C, B, A	
Overall Indicator Ranking - Acres of Old/Large Trees	9/1.50		13/2.17		14/2.33		24/4.00		D, C, B, A	
Indicator and Elements - Number Of Large Snags (≥ 18”) Per Acre										
Ponderosa pine forest PNV	3		4		4		2		B/C, A, D	
Wet mixed conifer forest PNV	4		3		2		1		A, B, C, D	
Dry mixed conifer forest PNV	4		1		2		3		A, D, C, B	

Appendix G table 1. Continued

Indicator Variables and Elements	Alternative A (current)	Proposed High Acre Treatment Objectives			Alternative Ranking in Relation to Movement Toward Indicator Variables and Elements (from greatest to least)
		alternative B (preferred)	alternative C	alternative D	
Spruce-fir forest PNV	4	3	2	1	A, B, C, D
Madrean pine-oak woodland PNV	4	4	4	4	A/B/C/D
Piñon-juniper woodland PNV	4	4	4	4	A/B/C/D
Overall Indicator Ranking - Number of Snags per Acre	23/3.83	19/3.17	18/3.00	15/2.50	A, B, C, D
Indicator and Elements - Tons of Coarse Woody Debris per Acre					
Ponderosa pine forest PNV	2	3	4	1	C, B, A, D
Wet mixed conifer forest PNV	3	3	4	2	C, A/B, D
Dry mixed conifer forest PNV	2	4	3	1	B, C, A, D
Spruce-fir forest PNV	3	2	1	4	D, A, B, C
Madrean pine-oak woodland PNV	1	3	2	4	D, B, C, A
Piñon-juniper woodland PNV	4	4	4	4	A/B/C/D
Overall Indicator Ranking - Tons of Coarse Woody Debris per Acre	15/2.50	19/3.17	18/3.00	16/2.67	B, C, D, A
Indicator and Elements - Enhancement/Maintenance Of Aspen					
Enhancement/maintenance of aspen	4.00	4.00	4.00	4.00	A/B/C/D
Indicator and Elements - Woody Overstory Canopy Cover/Herbaceous Understory Vegetation Relationship					
Ponderosa pine forest PNV	1	3	4	2	C, B, D, A
Dry mixed conifer forest PNV	1	3	4	2	C, B, D, A
All A-SNFs Modeled Naturally Open Canopy Forest PNVs	1	3	4	2	C, B, D, A
Wet mixed conifer forest PNV	2	4	3	4	B/D, C, A
Spruce-fir forest PNV	1	4	2	3	B, D, C, A
All A-SNFs Modeled Naturally Closed Canopy Forest PNVs	2	4	3	4	B/D, C, A
Madrean pine-oak woodland PNV	1	3	2	4	D, B, C, A
Piñon-juniper woodland PNV	1	3	2	4	D, B, C, A
All A-SNFs Modeled Woodland PNVs	1	3	2	4	D, B, C, A
Great Basin grassland PNV	2	4	1	3	B, D, A, C
Semi-desert grassland PNV	3	4	2	4	B/D, A, C
All A-SNFs Modeled Grassland PNVs	2	4	2	3	B, D, A/C
Overall Indicator Ranking - Vegetation Overstory Canopy Cover/ Herbaceous understory vegetation Relationship	18/1.50	42/3.50	31/2.58	39/3.25	B, D, C, A
Overall Alternative Comparison Ranking For All Indicators					
Total Score/Average Score	160/2.32	226/3.28	201/2.91	229/3.32	D, B, C, A

¹ Based on the results of analyses, each alternative was assigned a numerical value (1, 2, 3, or 4) depending on its overall movement toward desired conditions when compared to the other alternatives for each assessed indicator; one point was assigned for the least movement and four points were assigned for the greatest movement. Values were summed and an average determined. Each alternative was then ranked against each other alternative; results of that ranking are displayed in the column(s) on the left. Comparisons Example 1): C, B, A, D would be interpreted to mean that alternative C is better than alternatives B, A, and D; alternative B is poorer than alternative C but better than alternatives A and D; alternative A is poorer than alternatives C and B but better than alternative D; and alternative D is poorer than alternatives C, B and A. Comparisons Example 2): A, B/D, C would be interpreted to mean that alternative A is better than alternatives B, D and C; alternative B is poorer than alternative A but is equal to alternative D but is better than alternative C; alternative D is poorer than alternative A but is equal to alternative B but is better than alternative C; and alternative C is poorer than alternatives A, B and D.

Overall, by the end of the 15-year planning period, when comparing the proposed high acre treatment objectives, **alternative D** provides the greatest composite movement towards all DCs; followed by alternatives B, C, and A, from greatest to least, respectively.

All PNVTs

50-Year Modeling Period Proposed High Acre Treatment Objectives

Appendix G table 2. Tabular summation and alternative ranking¹ of the 50-year modeling period comparisons of the environmental consequences to the vegetation indicator variables and elements between the proposed high acre treatment objectives for alternatives B, C and D, and alternative A

Indicator Variables and Elements	Alternative A (current)		Proposed High Acre Treatment Objectives						Alternative Ranking in Relation to Movement Toward Indicator Variables and Elements (from greatest to least)	
			alternative B (preferred)		alternative C		alternative D			
	DC	HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV
Indicator and Elements - Vegetation Movement Toward DC And HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV
Ponderosa pine forest PNVt	2	1	4	3	3	2	2	4	B, C, A/D	D, B, C, A
Wet mixed conifer forest PNVt	4	4	2	3	1	2	3	3	A, D, B, C	A, B/D, C
Dry mixed conifer forest PNVt	1	2	4	4	3	3	2	3	B, C, D, A	B, C, D, A
Spruce-fir forest PNVt	2	2	3	3	4	4	4	3	C/D, B, A	C, B/D, A
All A-SNFs Modeled Forest PNVts	4	3	3	2	2	2	1	4	A, B, C, D	D, A, B/C
Madrean pine-oak woodland PNVt	1	1	3	3	2	2	4	4	D, B, C, A	D, B, C, A
Piñon-juniper woodland PNVt	1	1	3	3	2	2	4	4	D, B, C, A	D, B, C, A
All A-SNFs Modeled Woodland PNVts	1	1	3	3	2	2	4	4	D, B, C, A	D, B, C, A
Great Basin grassland PNVt	2	2	3	3	2	2	4	4	D, B, A/C	D, B, A/C
Semi-desert grassland PNVt	3	3	4	4	3	3	4	4	B/D, A/C	B/D, A/C
Montane/subalpine grasslands PNVt	3	3	4	4	4	4	4	4	B/C/D, A	B/C/D, A
All A-SNFs Modeled Grassland PNVts	2	2	3	3	2	2	4	4	D, B, A/C	D, B, A/C
All A-SNFs Modeled PNVts	1	1	3	3	2	2	4	4	D, B, C, A	B, D, C, A
Interior chaparral PNVt	4	4	4	4	4	4	4	4	A/B/C/D	A/B/C/D
Wetland/cienega riparian areas PNVt	3	3	4	4	3	3	4	4	B/D, A/C	B/D, A/C
Mixed broadleaf deciduous riparian forest PNVt	3	3	4	4	3	3	4	4	B/D, A/C	B/D, A/C
Montane willow riparian forest PNVt	3	3	4	4	3	3	4	4	B/D, A/C	B/D, A/C
Cottonwood-willow riparian forest PNVt	3	3	4	4	3	3	4	4	B/D, A/C	B/D, A/C
All Riparian Areas/Forest PNVts	3	3	4	4	3	3	4	4	B/D, A/C	B/D, A/C
Overall Indicator Ranking - Vegetation Movement Toward DC and HRV	46/2.42	45/2.37	66/3.47	65/3.42	51/2.68	51/2.68	68/3.58	73/3.84	D, B, C, A	D, B, C, A
Indicator and Elements - Acres Of Old/Large Trees										
Ponderosa pine forest PNVt	3		2		1		4		D, A, B, C	
Wet mixed conifer forest PNVt	1		3		2		4		D, B, C, A	
Dry mixed conifer forest PNVt	1		4		2		3		B, D, C, A	
Spruce-fir forest PNVt	1		2		4		3		C, D, B, A	
Madrean pine-oak woodland PNVt	4		3		1		2		A, B, D, C	
Piñon-juniper woodland PNVt	1		2		3		4		D, C, B, A	
Overall Indicator Ranking - Acres of Old/Large Trees	11/1.83		16/2.67		13/2.17		20/3.33		D, B, C, A	
Indicator and Elements - Number Of Large Snags (> 18”) Per Acre										
Ponderosa pine forest PNVt	2		3		4		1		C, B, A, D	
Wet mixed conifer forest PNVt	4		2		3		1		A, C, B, D	
Dry mixed conifer forest PNVt	4		1		2		3		A, D, C, B	

Appendix G table 2. Continued

Indicator Variables and Elements	Alternative A (current)	Proposed High Acre Treatment Objectives			Alternative Ranking in Relation to Movement Toward Indicator Variables and Elements (from greatest to least)
		alternative B (preferred)	alternative C	alternative D	
Spruce-fir forest PNV	3	4	4	4	B/C/D, A
Madrean pine-oak woodland PNV	4	4	4	4	A/B/C/D
Piñon-juniper woodland PNV	4	4	4	4	A/B/C/D
Overall Indicator Ranking - Number of Snags per Acre	21/3.50	18/3.00	21/3.50	17/2.83	A/C, B, D
Indicator and Elements - Tons Of Coarse Woody Debris Per Acre					
Ponderosa pine forest PNV	2	3	4	1	C, B, A, D
Wet mixed conifer forest PNV	3	2	4	1	C, A, B, D
Dry mixed conifer forest PNV	2	3	4	1	C, B, A, D
Spruce-fir forest PNV	4	3	2	1	A, B, C, D
Madrean pine-oak woodland PNV	1	3	2	4	D, B, C, A
Piñon-juniper woodland PNV	2	4	3	4	B/D, C, A
Overall Indicator Ranking - Tons of Coarse Woody Debris per Acre	14/2.33	18/3.03	19/3.17	12/2.00	C, B, A, D
Indicator and Elements - Enhancement/Maintenance Of Aspen					
Enhancement/maintenance of aspen	4.00	4.00	3.00	2.00	A/B, C, D
Indicator and Elements - Woody Overstory Canopy Cover/Herbaceous Understory Vegetation Relationship					
Ponderosa pine forest PNV	1	3	4	2	C, B, D, A
Dry mixed conifer forest PNV	2	4	4	3	B/C, D, A
All A-SNFs Modeled Naturally Open Canopy Forest PNVs	1	2	4	3	C, D, B, A
Wet mixed conifer forest PNV	1	3	2	4	D, B, C, A
Spruce-fir forest PNV	1	4	3	2	B, C, D, A
All A-SNFs Modeled Naturally Closed Canopy Forest PNVs	2	4	1	3	B, D, A, C
Madrean pine-oak woodland PNV	1	3	2	4	D, B, C, A
Piñon-juniper woodland PNV	1	3	2	4	D, B, C, A
All A-SNFs Modeled Woodland PNVs	3	2	1	4	D, A, B, C
Great Basin grassland PNV	2	3	1	4	D, B, A, C
Semi-desert grassland PNV	3	4	2	4	B/D, A, C
All A-SNFs Modeled Grassland PNVs	2	3	2	4	D, B, A/C
Overall Indicator Ranking - Vegetation Overstory Canopy Cover/ Herbaceous understory vegetation Relationship	20/1.67	38/3.17	28/2.33	41/3.42	D, B, C, A
Overall Alternative Comparison Ranking For All Indicators					
Total Score/Average Score	161/2.33	225/3.26	186/2.70	233/3.38	D, B, C, A

¹ Based on the results of analyses, each alternative was assigned a numerical value (1, 2, 3, or 4) depending on its overall movement toward desired conditions when compared to the other alternatives for each assessed indicator; one point was assigned for the least movement and four points were assigned for the greatest movement. Values were summed and an average determined. Each alternative was then ranked against each other alternative; results of that ranking are displayed in the column(s) on the left. Comparisons Example 1): C, B, A, D would be interpreted to mean that alternative C is better than alternatives B, A, and D; alternative B is poorer than alternative C but better than alternatives A and D; alternative A is poorer than alternatives C and B but better than alternative D; and alternative D is poorer than alternatives C, B and A. Comparisons Example 2): A, B/D, C would be interpreted to mean that alternative A is better than alternatives B, D and C; alternative B is poorer than alternative A but is equal to alternative D but is better than alternative C; alternative D is poorer than alternative A but is equal to alternative B but is better than alternative C; and alternative C is poorer than alternatives A, B and D.

Overall, at the end of the 50-year planning period, when comparing the proposed high acre treatment objectives, **alternative D** provides the greatest composite movement towards all DCs; followed by alternatives B, C, and A, from greatest to least, respectively.

All PNVTs

15-Year Planning Period Proposed Average Acre Treatment Objectives

Appendix G table 3. Tabular summation and alternative ranking¹ of the 15-year planning period comparison² of the environmental consequences to the vegetation indicator variables and elements between the proposed average acre treatment objectives for alternatives B, C and D, and alternative A

Indicator Variables and Elements	Proposed Average Acre Treatment Objectives								Alternative Ranking in Relation to Movement Toward Indicator Variables and Elements (from greatest to least)	
	Alternative A (current)		alternative B (preferred)		alternative C		alternative D			
Indicator and Elements - Vegetation Movement Toward DC And HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV
Ponderosa pine forest PNVt	2	2	3	3	4	4	1	1	C, B, A, D	C, B, A, D
Wet mixed conifer forest PNVt	4	4	2	4	1	2	3	3	A, D, B, C	A/B, D, C
Dry mixed conifer forest PNVt	2	2	3	3	4	4	1	1	C, B, A, D	C, B, A, D
Spruce-fir forest PNVt	2	3	3	4	4	4	4	4	C/D, B, A	B/C/D, A
All A-SNFs Modeled Forest PNVts	2	3	3	3	4	4	1	2	C, B, A, D	C, A/B, D
Madrean pine-oak woodland PNVt	1	1	3	3	2	2	4	4	D, B, C, A	D, B, C, A
Piñon-juniper woodland PNVt	2	2	3	3	4	4	4	4	C/D, B, A	C/D, B, A
All A-SNFs Modeled Woodland PNVts	1	1	3	3	2	2	4	4	D, B, C, A	D, B, C, A
Great Basin grassland PNVt	2	2	4	4	2	2	3	3	B, D, A/C	B, D, A/C
Semi-desert grassland PNVt	3	3	4	4	3	3	4	4	B/D, A/C	B/D, A/C
Montane/subalpine grasslands PNVt	3	3	4	4	4	4	4	4	B/C/D, A	B/C/D, A
All A-SNFs Modeled Grassland PNVts	2	2	4	4	2	2	3	3	B, D, A/C	B, D, A/C
All A-SNFs Modeled PNVts	1	2	3	4	2	3	4	4	D, B, C, A	B/D, C, A
Interior chaparral PNVt	4	4	4	4	4	4	4	4	A/B/C/D	A/B/C/D
Wetland/cienega riparian areas PNVt	3	3	4	4	3	3	4	4	B/D, A/C	B/D, A/C
Mixed broadleaf deciduous riparian forest PNVt	3	3	4	4	3	3	4	4	B/D, A/C	B/D, A/C
Montane willow riparian forest PNVt	3	3	4	4	3	3	4	4	B/D, A/C	B/D, A/C
Cottonwood-willow riparian forest PNVt	3	3	4	4	3	3	4	4	B/D, A/C	B/D, A/C
All Riparian Areas/Forest PNVts	3	3	4	4	3	3	4	4	B/D, A/C	B/D, A/C
Overall Indicator Ranking - Vegetation Movement Toward DC and HRV	46/2.42	49/2.58	66/3.47	70/3.68	57/3.00	59/3.11	64/3.37	65/3.42	B, D, C, A	B, D, C, A
Indicator and Elements - Acres Of Old/Large Trees										
Ponderosa pine forest PNVt	3		2		1		4		D, A, B, C	
Wet mixed conifer forest PNVt	1		2		3		4		D, C, B, A	
Dry mixed conifer forest PNVt	1		4		3		2		B, C, D, A	
Spruce-fir forest PNVt	1		2		3		4		D, C, B, A	
Madrean pine-oak woodland PNVt	1		3		2		4		D, B, C, A	
Piñon-juniper woodland PNVt	2		1		3		4		D, C, A, B	
Overall Indicator Ranking - Acres of Old/Large Trees	9/1.50		14/2.33		15/2.50		22/3.67		D, C, B, A	
Indicator and Elements - Number Of Large Snags (> 18") Per Acre										
Ponderosa pine forest PNVt	2		4		3		1		B, C, A, D	
Wet mixed conifer forest PNVt	4		3		2		1		A, B, C, D	
Dry mixed conifer forest PNVt	3		2		3		4		D, A/C, B	

Appendix G table 3. Continued

Indicator Variables and Elements	Alternative A (current)	Proposed Average Acre Treatment Objectives			Alternative Ranking in Relation to Movement Toward Indicator Variables and Elements (from greatest to least)
		alternative B (preferred)	alternative C	alternative D	
Spruce-fir forest PNV	4	3	2	1	A, B, C, D
Madrean pine-oak woodland PNV	4	4	4	4	A/B/C/D
Piñon-juniper woodland PNV	4	4	4	4	A/B/C/D
Overall Indicator Ranking - Number of Snags per Acre	21/3.50	20/3.33	18/3.00	15/2.50	A, B, C, D
Indicator and Elements - Tons Of Coarse Woody Debris Per Acre					
Ponderosa pine forest PNV	2	3	4	1	C, B, A, D
Wet mixed conifer forest PNV	2	3	4	1	C, B, A, D
Dry mixed conifer forest PNV	2	3	4	1	C, B, A, D
Spruce-fir forest PNV	4	3	2	1	A, B, C, D
Madrean pine-oak woodland PNV	1	3	2	4	D, B, C, A
Piñon-juniper woodland PNV	4	4	4	4	A/B/C/D
Overall Indicator Ranking - Tons of Coarse Woody Debris per Acre	15/2.50	19/3.17	20/3.33	12/2.00	C, B, A, D
Indicator and Elements - Enhancement/Maintenance Of Aspen					
Enhancement/maintenance of aspen	4.00	4.00	4.00	4.00	A/B/C/D
Indicator and Elements - Woody Overstory Canopy Cover/Herbaceous Understory Vegetation Relationship					
Ponderosa pine forest PNV	2	3	4	1	C, B, A, D
Dry mixed conifer forest PNV	2	3	4	4	C/D, B, A
All A-SNFs Modeled Naturally Open Canopy Forest PNVs	2	3	4	1	C, B, A, D
Wet mixed conifer forest PNV	4	4	3	4	A/B/D, C
Spruce-fir forest PNV	4	4	2	3	A/B, D, C
All A-SNFs Modeled Naturally Closed Canopy Forest PNVs	4	4	3	4	A/B/D, C
Madrean pine-oak woodland PNV	1	3	2	4	D, B, C, A
Piñon-juniper woodland PNV	1	3	2	4	D, B, C, A
All A-SNFs Modeled Woodland PNVs	1	3	2	4	D, B, C, A
Great Basin grassland PNV	2	4	2	3	B, D, A/C
Semi-desert grassland PNV	3	4	3	4	B/D, A/C
All A-SNFs Modeled Grassland PNVs	2	4	2	3	B, D, A/C
Overall Indicator Ranking - Vegetation Overstory Canopy Cover/ Herbaceous understory vegetation Relationship	28/2.33	42/3.50	33/2.75	39/3.25	B, D, C, A
Overall Alternative Comparison Ranking For All Indicators					
Total Score/Average Score	172/2.49	235/3.41	206/3.99	221/3.20	B, D, C, A

¹ Based on the results of analyses, each alternative was assigned a numerical value (1, 2, 3, or 4) depending on its overall movement toward desired conditions when compared to the other alternatives for each assessed indicator; one point was assigned for the least movement and four points were assigned for the greatest movement. Values were summed and an average determined. Each alternative was then ranked against each other alternative; results of that ranking are displayed in the column(s) on the left.

² Comparisons Example 1): C, B, A, D would be interpreted to mean that alternative C is better than alternatives B, A, and D; alternative B is poorer than alternative C but better than alternatives A and D; alternative A is poorer than alternatives C and B but better than alternative D; and alternative D is poorer than alternatives C, B and A. Comparisons Example 2): A, B/D, C would be interpreted to mean that alternative A is better than alternatives B, D and C; alternative B is poorer than alternative A but is equal to alternative D but is better than alternative C; alternative D is poorer than alternative A but is equal to alternative B but is better than alternative C; and alternative C is poorer than alternatives A, B and D.

Overall, by the end of the 15-year planning period, when comparing the proposed average acre treatment objectives, **alternative B** provides the greatest composite movement towards all DCs; followed by alternatives D, C, and A, from greatest to least, respectively.

All PNVTs

50-Year Modeling Period Proposed Average Acre Treatment Objectives

Appendix G table 4. Tabular summation and alternative ranking¹ of the 50-year modeling period comparisons² of the environmental consequences to the vegetation indicator variables and elements between the proposed average acre treatment objectives for alternatives B, C and D, and alternative A

Indicator Variables and Elements	Proposed Average Acre Treatment Objectives								Alternative Ranking in Relation to Movement Toward Indicator Variables and Elements (from greatest to least)	
	Alternative A (current)		alternative B (preferred)		alternative C		alternative D			
Indicator and Elements - Vegetation Movement Toward DC And HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV
Ponderosa pine forest PNVt	4	3	4	2	4	2	3	4	A/B/C, D	D, A, B/C
Wet mixed conifer forest PNVt	4	4	2	3	1	2	3	3	A, D, B, C	A, B/D, C
Dry mixed conifer forest PNVt	4	3	3	4	3	3	2	2	A, B, C, D	B, A/C, D
Spruce-fir forest PNVt	2	3	3	4	3	4	4	4	D, B/C, A	B/C/D, A
All A-SNFs Modeled Forest PNVts	4	3	3	2	2	2	1	4	A, B, C, D	D, A, B/C
Madrean pine-oak woodland PNVt	1	1	3	3	2	2	4	4	D, B, C, A	D, B, C, A
Piñon-juniper woodland PNVt	1	1	3	3	2	2	4	4	D, B, C, A	D, B, C, A
All A-SNFs Modeled Woodland PNVts	1	1	3	3	2	2	4	4	D, B, C, A	D, B, C, A
Great Basin grassland PNVt	2	2	3	3	2	2	4	4	D, B, A/C	D, B, A/C
Semi-desert grassland PNVt	3	3	4	4	3	3	4	4	B/D, A/C	B/D, A/C
Montane/subalpine grasslands PNVt	3	3	4	4	4	4	4	4	B/C/D, A	B/C/D, A
All A-SNFs Modeled Grassland PNVts	2	2	3	3	2	2	4	4	D, B, A/C	D, B, A/C
All A-SNFs Modeled PNVts	1	1	3	3	2	2	4	4	D, B, C, A	B, D, C, A
Interior chaparral PNVt	4	4	4	4	4	4	4	4	A/B/C/D	A/B/C/D
Wetland/cienega riparian areas PNVt	3	3	4	4	3	3	4	4	B/D, A/C	B/D, A/C
Mixed broadleaf deciduous riparian forest PNVt	3	3	4	4	3	3	4	4	B/D, A/C	B/D, A/C
Montane willow riparian forest PNVt	3	3	4	4	3	3	4	4	B/D, A/C	B/D, A/C
Cottonwood-willow riparian forest PNVt	3	3	4	4	3	3	4	4	B/D, A/C	B/D, A/C
All Riparian Areas/Forest PNVts	3	3	4	4	3	3	4	4	B/D, A/C	B/D, A/C
Overall Indicator Ranking - Vegetation Movement Toward DC and HRV	51/2.68	49/2.58	65/3.42	65/3.42	51/2.68	51/2.68	69/3.63	73/3.84	D, B, A/C	D, B, C, A
Indicator and Elements - Acres Of Old/Large Trees										
Ponderosa pine forest PNVt	3		2		1		4		D, A, B, C	
Wet mixed conifer forest PNVt	2		3		1		4		D, B, A, C	
Dry mixed conifer forest PNVt	1		4		2		3		B, D, C, A	
Spruce-fir forest PNVt	1		3		2		4		D, C, B, A	
Madrean pine-oak woodland PNVt	4		3		1		2		A, B, D, C	
Piñon-juniper woodland PNVt	1		2		3		4		D, C, B, A	
Overall Indicator Ranking - Acres of Old/Large Trees	12/2.00		17/2.83		10/1.67		21/3.50		D, B, A, C	
Indicator and Elements - Number Of Large Snags (> 18") Per Acre										
Ponderosa pine forest PNVt	2		3		4		1		C, B, A, D	
Wet mixed conifer forest PNVt	3		3		4		2		C, A/B, D	
Dry mixed conifer forest PNVt	3		2		3		4		D, A/C, B	

Appendix G table 4. Continued

Indicator Variables and Elements	Alternative A (current)	Proposed Average Acre Treatment Objectives			Alternative Ranking in Relation to Movement Toward Indicator Variables and Elements (from greatest to least)
		alternative B (preferred)	alternative C	alternative D	
Spruce-fir forest PNVt	4	3	2	1	A, B, C, D
Madrean pine-oak woodland PNVt	4	4	4	4	A/B/C/D
Piñon-juniper woodland PNVt	4	4	4	4	A/B/C/D
Overall Indicator Ranking - Number of Snags per Acre	20/3.33	19/3.17	21/3.50	16/2.67	A, C, B, D
Indicator and Elements - Tons Of Coarse Woody Debris Per Acre					
Ponderosa pine forest PNVt	2	3	4	1	C, B, A, D
Wet mixed conifer forest PNVt	2	3	4	1	C, B, A, D
Dry mixed conifer forest PNVt	4	3	2	1	A, B, C, D
Spruce-fir forest PNVt	4	3	2	1	A, B, C, D
Madrean pine-oak woodland PNVt	1	3	2	4	D, B, C, A
Piñon-juniper woodland PNVt	1	2	3	4	D, C, B, A
Overall Indicator Ranking - Tons of Coarse Woody Debris per Acre	14/2.33	17/2.83	17/2.83	12/2.00	B/C, A, D
Indicator and Elements - Enhancement/Maintenance Of Aspen					
Enhancement/maintenance of aspen	4.00	4.00	3.00	2.00	A/B, C, D
Indicator and Elements - Woody Overstory Canopy Cover/Herbaceous Understory Vegetation Relationship					
Ponderosa pine forest PNVt	1	2	4	3	C, D, B, A
Dry mixed conifer forest PNVt	2	3	2	4	D, B, A/C
All A-SNFs Modeled Naturally Open Canopy Forest PNVts	2	3	3	4	D, B/C, A
Wet mixed conifer forest PNVt	3	4	2	3	B, A/D, C
Spruce-fir forest PNVt	4	3	2	1	A, B, C, D
All A-SNFs Modeled Naturally Closed Canopy Forest PNVts	3	4	2	3	B, A/D, C
Madrean pine-oak woodland PNVt	1	3	2	4	D, B, C, A
Piñon-juniper woodland PNVt	1	3	2	4	D, B, C, A
All A-SNFs Modeled Woodland PNVts	3	2	1	4	D, A, B, C
Great Basin grassland PNVt	2	3	2	4	D, B, A/C
Semi-desert grassland PNVt	3	4	3	4	B/D, A/C
All A-SNFs Modeled Grassland PNVts	2	3	2	4	D, B, A/C
Overall Indicator Ranking - Vegetation Overstory Canopy Cover/ Herbaceous understory vegetation Relationship	27/2.25	37/3.08	27/2.25	42/3.50	D, B, A/C
Overall Alternative Comparison Ranking For All Indicators					
Total Score/Average Score	177/2.57	224/3.25	180/2.61	235/3.41	D, B, C, A

¹ Based on the results of analyses, each alternative was assigned a numerical value (1, 2, 3, or 4) depending on its overall movement toward desired conditions when compared to the other alternatives for each assessed indicator; one point was assigned for the least movement and four points were assigned for the greatest movement. Values were summed and an average determined. Each alternative was then ranked against each other alternative; results of that ranking are displayed in the column(s) on the left.

² Comparisons Example 1): C, B, A, D would be interpreted to mean that alternative C is better than alternatives B, A, and D; alternative B is poorer than alternative C but better than alternatives A and D; alternative A is poorer than alternatives C and B but better than alternative D; and alternative D is poorer than alternatives C, B and A. Comparisons Example 2): A, B/D, C would be interpreted to mean that alternative A is better than alternatives B, D and C; alternative B is poorer than alternative A but is equal to alternative D but is better than alternative C; alternative D is poorer than alternative A but is equal to alternative B but is better than alternative C; and alternative C is poorer than alternatives A, B and D.

Overall, at the end of the 50-year modeling period, when comparing the proposed average acre treatment objectives, **alternative D** provides the greatest composite movement towards all DCs; followed by alternatives B, C, and A, from greatest to least, respectively.

All PNVTs

15-Year Planning Period Proposed Low Acre Treatment Objectives

Appendix G table 5. Tabular summation and alternative ranking¹ of the 15-year planning period comparisons² of the environmental consequences to the vegetation indicator variables and elements between the proposed low acre treatment objectives for alternatives B, C and D, and alternative A

Indicator Variables and Elements	Alternative A (current)		Proposed Low Acre Treatment Objectives						Alternative Ranking in Relation to Movement Toward Indicator Variables and Elements (from greatest to least)	
			alternative B (preferred)		alternative C		alternative D			
	DC	HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV
Indicator and Elements - Vegetation Movement Toward DC And HRV										
Ponderosa pine forest PNVt	4	4	3	2	3	3	1	1	A, B/C, D	A, C, B, D
Wet mixed conifer forest PNVt	4	4	3	3	2	3	3	4	A, B/D, C	A/D, B/C
Dry mixed conifer forest PNVt	4	4	2	2	3	1	3	3	A, C/D, B	A, D, B, C
Spruce-fir forest PNVt	3	2	3	4	4	3	4	4	C/D, A, B	B/D, C, A
All A-SNFs Modeled Forest PNVts	2	3	3	3	4	4	1	2	C, B, A, D	C, A/B, D
Madrean pine-oak woodland PNVt	3	3	4	4	3	3	4	4	B/D, A/C	B/D, A/C
Piñon-juniper woodland PNVt	3	3	4	4	3	3	4	4	B/D, A/C	B/D, A/C
All A-SNFs Modeled Woodland PNVts	3	3	4	4	3	3	4	4	B/D, A/C	B/D, A/C
Great Basin grassland PNVt	2	2	4	4	2	2	3	3	B, D, A/C	B, D, A/C
Semi-desert grassland PNVt	3	3	4	4	3	3	4	4	B/D, A/C	B/D, A/C
Montane/subalpine grasslands PNVt	3	3	4	4	4	4	4	4	B/C/D, A	B/C/D, A
All A-SNFs Modeled Grassland PNVts	2	2	4	4	2	2	3	3	B, D, A/C	B, D, A/C
All A-SNFs Modeled PNVts	1	2	4	4	2	3	3	4	B, D, C, A	B/D, C, A
Interior chaparral PNVt	4	4	4	4	4	4	4	4	A/B/C/D	A/B/C/D
Wetland/cienega riparian areas PNVt	3	3	4	4	3	3	4	4	B/D, A/C	B/D, A/C
Mixed broadleaf deciduous riparian forest PNVt	3	3	4	4	3	3	4	4	B/D, A/C	B/D, A/C
Montane willow riparian forest PNVt	3	3	4	4	3	3	4	4	B/D, A/C	B/D, A/C
Cottonwood-willow riparian forest PNVt	3	3	4	4	3	3	4	4	B/D, A/C	B/D, A/C
All Riparian Areas/Forest PNVts	3	3	4	4	3	3	4	4	B/D, A/C	B/D, A/C
Overall Indicator Ranking - Vegetation Movement Toward DC and HRV	56/2.95	57/3.05	70/3.68	70/3.68	57/3.00	56/2.95	65/3.42	68/3.58	B, D, C, A	B, D, A, C
Indicator and Elements - Acres Of Old/Large Trees										
Ponderosa pine forest PNVt	4		1		2		3		A, D, C, B	
Wet mixed conifer forest PNVt	4		1		3		2		A, C, D, B	
Dry mixed conifer forest PNVt	4		3		2		1		A, B, C, D	
Spruce-fir forest PNVt	4		2		1		3		A, D, B, C	
Madrean pine-oak woodland PNVt	3		1		2		4		D, B, C, A	
Piñon-juniper woodland PNVt	3		1		3		4		D, A, C, B	
Overall Indicator Ranking - Acres of Old/Large Trees	22/3.67		9/1.50		13/2.17		17/2.83		A, D, C, B	
Indicator and Elements - Number Of Large Snags (> 18”) Per Acre										
Ponderosa pine forest PNVt	2		4		4		3		B/C, D, A	
Wet mixed conifer forest PNVt	3		4		4		2		B/C, A, D	
Dry mixed conifer forest PNVt	1		2		3		4		D, C, B, A	

Appendix G table 5. Continued

Indicator Variables and Elements	Alternative A (current)	Proposed Low Acre Treatment Objectives			Alternative Ranking in Relation to Movement Toward Indicator Variables and Elements (from greatest to least)
		alternative B (preferred)	alternative C	alternative D	
Spruce-fir forest PNVT	2	4	3	2	B, C, A/D
Madrean pine-oak woodland PNVT	4	4	4	4	A/B/C/D
Piñon-juniper woodland PNVT	4	4	4	4	A/B/C/D
Overall Indicator Ranking - Number of Snags per Acre	16/2.67	22/3.67	22/3.67	19/3.17	B/C, D, A
Indicator and Elements - Tons Of Coarse Woody Debris Per Acre					
Ponderosa pine forest PNVT	2	4	3	1	B, C, A, D
Wet mixed conifer forest PNVT	1	3	4	2	C, B, D, A
Dry mixed conifer forest PNVT	4	3	2	2	A, B, C/D
Spruce-fir forest PNVT	1	3	4	2	C, B, D, A
Madrean pine-oak woodland PNVT	2	3	2	4	D, B, A/C
Piñon-juniper woodland PNVT	4	4	4	4	A/B/C/D
Overall Indicator Ranking - Tons of Coarse Woody Debris per Acre	14/2.33	20/3.33	19/3.17	15/2.50	B, C, D, A
Indicator and Elements - Enhancement/Maintenance Of Aspen					
Enhancement/maintenance of aspen	4.00	4.00	4.00	4.00	A/B/C/D
Indicator and Elements - Woody Overstory Canopy Cover/Herbaceous Understory Vegetation Relationship					
Ponderosa pine forest PNVT	4	3	3	2	A, B/C, D
Dry mixed conifer forest PNVT	4	3	2	2	A, B, C/D
All A-SNFs Modeled Naturally Open Canopy Forest PNVTS	2	4	4	3	B/C, D, A
Wet mixed conifer forest PNVT	2	4	3	4	B/D, C, A
Spruce-fir forest PNVT	3	4	4	4	B/C/D, A
All A-SNFs Modeled Naturally Closed Canopy Forest PNVTS	2	4	3	4	B/D, C, A
Madrean pine-oak woodland PNVT	3	4	2	4	B/D, A, C
Piñon-juniper woodland PNVT	1	3	2	4	D, B, C, A
All A-SNFs Modeled Woodland PNVTS	2	4	3	4	B/D, C, A
Great Basin grassland PNVT	2	4	1	3	B, D, A, C
Semi-desert grassland PNVT	1	4	2	3	B, D, C, A
All A-SNFs Modeled Grassland PNVTS	2	4	2	3	B, D, A/C
Overall Indicator Ranking - Vegetation Overstory Canopy Cover/ Herbaceous understory vegetation Relationship	28/2.33	45/3.75	31/2.58	40/3.33	B, D, C, A
Overall Alternative Comparison Ranking For All Indicators					
Total Score/Average Score	197/2.86	240/3.48	202/2.93	228/3.30	B, D, C, A

¹ Based on the results of analyses, each alternative was assigned a numerical value (1, 2, 3, or 4) depending on its overall movement toward desired conditions when compared to the other alternatives for each assessed indicator; one point was assigned for the least movement and four points were assigned for the greatest movement. Values were summed and an average determined. Each alternative was then ranked against each other alternative; results of that ranking are displayed in the column(s) on the left.

² Comparisons Example 1): C, B, A, D would be interpreted to mean that alternative C is better than alternatives B, A, and D; alternative B is poorer than alternative C but better than alternatives A and D; alternative A is poorer than alternatives C and B but better than alternative D; and alternative D is poorer than alternatives C, B and A. Comparisons Example 2): A, B/D, C would be interpreted to mean that alternative A is better than alternatives B, D and C; alternative B is poorer than alternative A but is equal to alternative D but is better than alternative C; alternative D is poorer than alternative A but is equal to alternative B but is better than alternative C; and alternative C is poorer than alternatives A, B and D.

Overall, by the end of the 15-year planning period, when comparing the proposed low acre treatment objectives, **alternative B** provides the greatest composite movement towards all DCs; followed by alternatives D, C, and A, from greatest to least, respectively.

All PNVTs

50-Year Modeling Period Proposed Low Acre Treatment Objectives

Appendix G table 6. Tabular summation and alternative ranking¹ of the 50-year modeling period comparisons² of the environmental consequences to the vegetation indicator variables and elements between the proposed low acre treatment objectives for alternatives B, C and D, and alternative A

Indicator Variables and Elements	Proposed Low Acre Treatment Objectives								Alternative Ranking in Relation to Movement Toward the Indicator Variables and Elements (from greatest to least)	
	Alternative A (current)		alternative B (preferred)		alternative C		alternative D			
	DC	HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV
Indicator and Elements - Vegetation Movement Toward DC And HRV										
Ponderosa pine forest PNVt	4	4	1	1	3	3	2	3	A, C, D, B	A, C/D, B
Wet mixed conifer forest PNVt	4	4	2	2	1	2	3	3	A, D, B, C	A, D, B/C
Dry mixed conifer forest PNVt	4	4	3	3	2	2	1	1	A, B, C, D	A, B, C, D
Spruce-fir forest PNVt	3	3	3	4	2	4	4	3	D, A/B, C	B/C, A/D
All A-SNFs Modeled Forest PNVts	4	3	3	2	2	2	1	4	A, B, C, D	D, A, B/C
Madrean pine-oak woodland PNVt	2	2	4	4	3	3	4	4	B/D, C, A	B/D, C, A
Piñon-juniper woodland PNVt	1	1	3	3	2	2	4	4	D, B, C, A	D, B, C, A
All A-SNFs Modeled Woodland PNVts	1	2	3	4	2	3	4	4	D, B, C, A	B/D, C, A
Great Basin grassland PNVt	2	2	4	4	2	2	3	3	B, D, A/C	B, D, A/C
Semi-desert grassland PNVt	3	3	4	4	3	3	4	4	B/D, A/C	B/D, A/C
Montane/subalpine grasslands PNVt	3	3	4	4	4	4	4	4	B/C/D, A	B/C/D, A
All A-SNFs Modeled Grassland PNVts	2	2	4	4	2	2	3	3	B, D, A/C	B, D, A/C
All A-SNFs Modeled PNVts	2	2	4	4	3	3	4	4	B/D, C, A	B/D, C, A
Interior chaparral PNVt	4	4	4	4	4	4	4	4	A/B/C/D	A/B/C/D
Wetland/cienega riparian areas PNVt	3	3	4	4	3	3	4	4	B/D, A/C	B/D, A/C
Mixed broadleaf deciduous riparian forest PNVt	3	3	4	4	3	3	4	4	B/D, A/C	B/D, A/C
Montane willow riparian forest PNVt	3	3	4	4	3	3	4	4	B/D, A/C	B/D, A/C
Cottonwood-willow riparian forest PNVt	3	3	4	4	3	3	4	4	B/D, A/C	B/D, A/C
All Riparian Areas/Forest PNVts	3	3	4	4	3	3	4	4	B/D, A/C	B/D, A/C
Overall Indicator Ranking - Vegetation Movement Toward DC and HRV	54/2.84	54/2.84	66/3.47	67/3.53	50/2.63	54/2.84	65/3.42	68/3.58	B, D, A, C	D, B, A/C
Indicator and Elements - Acres Of Old/Large Trees										
Ponderosa pine forest PNVt	4		1		2		3		A, D, C, B	
Wet mixed conifer forest PNVt	4		2		1		3		A, D, B, C	
Dry mixed conifer forest PNVt	3		4		2		1		B, A, C, D	
Spruce-fir forest PNVt	2		1		3		4		D, C, A, B	
Madrean pine-oak woodland PNVt	1		2		4		3		C, D, B, A	
Piñon-juniper woodland PNVt	2		3		1		4		D, B, A, C	
Overall Indicator Ranking - Acres of Old/Large Trees	16/2.67		13/2.17		13/2.17		18/3.00		D, A, B/C	
Indicator and Elements - Number Of Snags (> 18”) Per Acre										
Ponderosa pine forest PNVt	1		4		3		2		B, C, D, A	
Wet mixed conifer forest PNVt	2		4		4		3		B/C, D, A	
Dry mixed conifer forest PNVt	2		1		3		4		D, C, A, B	

Appendix G table 6. Continued

Indicator Variables and Elements	Alternative A (current)	Proposed Low Acre Treatment Objectives			Alternative Ranking in Relation to Movement Toward the Indicator Variables and Elements (from greatest to least)
		alternative B (preferred)	alternative C	alternative D	
Spruce-fir forest PNV	4	4	3	2	A/B, C, D
Madrean pine-oak woodland PNV	4	4	4	4	A/B/C/D
Piñon-juniper woodland PNV	4	4	4	4	A/B/C/D
Overall Indicator Ranking - Number of Snags per Acre	17/2.83	21/3.50	21/3.50	19/3.17	B/C, D, A
Indicator and Elements - Tons Of Coarse Woody Debris Per Acre					
Ponderosa pine forest PNV	3	4	4	2	B/C, A, D
Wet mixed conifer forest PNV	1	3	4	2	C, B, D, A
Dry mixed conifer forest PNV	4	3	2	1	A, B, C, D
Spruce-fir forest PNV	3	4	3	2	B, A/C, D
Madrean pine-oak woodland PNV	2	4	3	4	B/D, C, A
Piñon-juniper woodland PNV	1	3	2	4	D, B, C, A
Overall Indicator Ranking - Tons of Coarse Woody Debris per Acre	14/2.33	21/3.50	18/3.00	15/2.50	B, C, D, A
Indicator and Elements - Enhancement/Maintenance Of Aspen					
Enhancement/maintenance of aspen	4.00	4.00	4.00	4.00	A/B/C/D
Indicator and Elements - Woody Overstory Canopy Cover/Herbaceous Understory Vegetation Relationship					
Ponderosa pine forest PNV	4	2	3	1	A, C, B, D
Dry mixed conifer forest PNV	4	3	2	1	A, B, C, D
All A-SNFs Modeled Naturally Open Canopy Forest PNVs	4	3	3	2	A, B/C, D
Wet mixed conifer forest PNV	2	4	3	4	B/D, C, A
Spruce-fir forest PNV	2	4	4	3	B/C, D, A
All A-SNFs Modeled Naturally Closed Canopy Forest PNVs	3	4	4	4	B/C/D, A
Madrean pine-oak woodland PNV	1	3	2	4	D, B, C, A
Piñon-juniper woodland PNV	1	3	2	4	D, B, C, A
All A-SNFs Modeled Woodland PNVs	3	2	1	4	D, A, B, C
Great Basin grassland PNV	2	4	1	3	B, D, A, C
Semi-desert grassland PNV	3	4	2	4	B/D, A, C
All A-SNFs Modeled Grassland PNVs	2	4	2	3	B, D, A/C
Overall Indicator Ranking - Vegetation Overstory Canopy Cover/ Herbaceous understory vegetation Relationship	31/2.58	40/3.33	29/2.42	37/3.08	B, D, A, C
Overall Alternative Comparison Ranking For All Indicators					
Total Score/Average Score	190/2.75	232/3.36	188/2.72	224/3.25	B, D, A, C

¹ Based on the results of analyses, each alternative was assigned a numerical value (1, 2, 3, or 4) depending on its overall movement toward desired conditions when compared to the other alternatives for each assessed indicator; one point was assigned for the least movement and four points were assigned for the greatest movement. Values were summed and an average determined. Each alternative was then ranked against each other alternative; results of that ranking are displayed in the column(s) on the left.

² Comparisons Example 1): C, B, A, D would be interpreted to mean that alternative C is better than alternatives B, A, and D; alternative B is poorer than alternative C but better than alternatives A and D; alternative A is poorer than alternatives C and B but better than alternative D; and alternative D is poorer than alternatives C, B and A. Comparisons Example 2): A, B/D, C would be interpreted to mean that alternative A is better than alternatives B, D and C; alternative B is poorer than alternative A but is equal to alternative D but is better than alternative C; alternative D is poorer than alternative A but is equal to alternative B but is better than alternative C; and alternative C is poorer than alternatives A, B and D.

Overall, at the end of the 50-year modeling period, when comparing the proposed low acre treatment objectives, **alternative B** provides the greatest composite movement towards all DCs; followed by alternatives D, A, and C, from greatest to least, respectively.

**Appendix H - Comparisons of the Percent Departures from DC and HRV by
Alternative Proposed High, Average, and Low Acre Treatment Objectives and
Alternative A, by the end of the 15-Year Planning Period and the 50-Year Modeling
Period**

All A-SNFs Modeled PNVTs

15-Year Planning Period Proposed High Acre Treatment Objectives

Appendix H table 1. Comparisons of the percent departures from DC and HRV at the end of the 15-year planning period, by alternative proposed high acre treatment objectives and alternative A (the lower the departure¹ value the closer to DC and HRV)

Alternative	Forested PNVt Group								Woodland PNVt Group								Grassland PNVt Group								All A-SNFs Modeled PNVts
	ponderosa pine forest		wet mixed conifer forest		dry mixed conifer forest		spruce-fir forest		all A-SNFs modeled forested PNVts		Madrean pine-oak woodland		piñon-juniper woodland		all A-SNFs modeled woodland PNVts		Great Basin grassland		semi-desert grassland		all A-SNFs modeled grassland PNVts				
	DC	HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV	
Current Condition	77 ^H	94 ^S	54 ^M	61 ^H	67 ^H	77 ^H	59 ^M	62 ^H	71 ^H	85 ^S	61 ^H	72 ^H	28 ^L	28 ^L	49 ^M	56 ^M	67 ^H	67 ^H	79 ^H	79 ^H	71 ^H	71 ^H	64 ^H	73 ^H	
A	65 ^H	84 ^S	49 ^M	46 ^M	57 ^M	54 ^M	68 ^H	58 ^M	61 ^H	71 ^H	59 ^M	70 ^H	21 ^L	21 ^L	45 ^M	52 ^M	63 ^H	63 ^H	84 ^S	84 ^S	71 ^H	71 ^H	57 ^M	65 ^H	
B High	58 ^M	80 ^H	52 ^M	44 ^M	53 ^M	48 ^M	64 ^H	54 ^M	56 ^M	68 ^H	41 ^M	52 ^M	19 ^N	19 ^N	33 ^L	40 ^L	9 ^N	9 ^N	66 ^H	66 ^H	30 ^L	30 ^L	44 ^M	52 ^M	
C High	52 ^M	75 ^H	56 ^M	51 ^M	49 ^M	44 ^M	63 ^H	54 ^M	52 ^M	65 ^H	50 ^M	61 ^H	18 ^N	18 ^N	38 ^L	45 ^M	63 ^H	63 ^H	84 ^S	84 ^S	71 ^H	71 ^H	51 ^M	60 ^H	
D High	61 ^H	82 ^S	50 ^M	47 ^M	56 ^M	52 ^M	64 ^H	53 ^M	58 ^M	70 ^H	28 ^L	38 ^L	19 ^N	19 ^N	25 ^L	31 ^L	8 ^N	8 ^N	66 ^H	66 ^H	29 ^L	29 ^L	43 ^M	51 ^M	

¹ Departure Ratings: (0-20% = no departure^N); (21-40% = low departure^L); (41-60% = moderate departure^M); (61-80% = high departure^H); and (81-100% = severe departure^S)

Appendix H table 1, overall summary at the end of the 15-year planning period for the proposed high acre treatments for alternatives B, C and D, and alternative A; from greatest movement toward DC and HRV to the least movement toward DC and HRV:

- Ponderosa pine forest PNVt
Greatest movement toward DC: alternatives C, then B, D, and lastly A
Greatest movement toward HRV: alternatives C, then B, D, and lastly A
- Wet mixed conifer forest PNVt
Greatest movement toward DC: alternatives A, then D, B, and lastly C
Greatest movement toward HRV: alternatives B, then A, D, and lastly C

- Dry mixed conifer forest PNVT
Greatest movement toward DC: alternatives **C**, then B, D, and lastly A
Greatest movement toward HRV: alternatives **C**, then B, D, and lastly A
- Spruce-fir forest PNVT
Greatest movement toward DC: alternatives **C**, then equally B and D, and lastly A
Greatest movement toward HRV: alternatives **D**, then equally B and C, and lastly A
- All A-SNFs Modeled Forested PNVTs combined
Greatest movement toward DC: alternatives **C**, then B, D, and lastly A
Greatest movement toward HRV: alternatives **C**, then B, D, and lastly A
- Madrean pine-oak woodland PNVT
Greatest movement toward DC: alternatives **D**, then B, C, and lastly A
Greatest movement toward HRV: alternatives **D**, then B, C, and lastly A
- Piñon-juniper woodland PNVT
Greatest movement toward DC: alternatives **C**, then equally B and D, and lastly A
Greatest movement toward HRV: alternatives **C**, then equally B and D, and lastly A
- All A-SNFs Modeled Woodland PNVTs combined
Greatest movement toward DC: alternatives **D**, then B, C, and lastly A
Greatest movement toward HRV: alternatives **D**, then B, C, and lastly A
- Great Basin grassland PNVT
Greatest movement toward DC: alternatives **D**, then B, C, and lastly A
Greatest movement toward HRV: alternatives **D**, then B, C, and lastly A
- Semi-desert grassland PNVT
Greatest movement toward DC: alternatives equally **B and D**, and then equally C and A
Greatest movement toward HRV: alternatives equally **B and D**, then C, and lastly A
- All A-SNFs Modeled Grassland PNVTs combined
Greatest movement toward DC: alternatives **D**, then B, and lastly equally C and A
Greatest movement toward HRV: alternatives **D**, then B, and lastly equally C and A
- All A-SNFs Modeled PNVTs combined
Greatest movement toward DC: alternatives **D**, then B, C, and lastly A
Greatest movement toward HRV: alternatives **D**, then B, C, and lastly A

All A-SNFs Modeled PNTVs

50-year Modeling Period Proposed High Acre Treatment Objectives

Appendix H table 2. Comparisons of the percent departures from DC and HRV at the end of the 50-year modeling period, by alternative proposed high acre treatment objectives and alternative A (the lower the departure¹ value the closer to DC and HRV)

Alternative	Forested PNVT Group										Woodland PNVT Group						Grassland PNVT Group						All A-SNFs Modeled PNVTs	
	ponderosa pine forest		wet mixed conifer forest		dry mixed conifer forest		spruce-fir forest		all A-SNFs modeled forested PNVTs		Madrean pine-oak woodland		piñon-juniper woodland		all A-SNFs modeled woodland PNVTs		Great Basin grassland		semi-desert grassland		all A-SNFs modeled grassland PNVTs			
	DC	HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV
Current Condition	77 ^H	94 ^S	54 ^M	61 ^H	67 ^H	77 ^H	59 ^M	62 ^H	71 ^H	85 ^S	61 ^H	72 ^H	28 ^L	28 ^L	49 ^M	56 ^M	67 ^H	67 ^H	79 ^H	79 ^H	71 ^H	71 ^H	64 ^H	73 ^H
A	54 ^M	71 ^M	45 ^M	43 ^M	47 ^M	47 ^M	65 ^H	54 ^M	51 ^M	62 ^H	56 ^M	67 ^H	41 ^M	41 ^M	51 ^M	57 ^M	68 ^H	68 ^H	94 ^S	94 ^S	78 ^H	78 ^H	55 ^M	63 ^H
B High	46 ^M	69 ^H	51 ^M	45 ^M	43 ^M	39 ^L	61 ^H	53 ^M	49 ^M	60 ^M	30 ^L	40 ^L	15 ^N	15 ^N	25 ^L	31 ^L	22 ^L	22 ^L	52 ^M	52 ^M	33 ^L	33 ^L	38 ^M	46 ^M
C High	48 ^M	70 ^H	59 ^M	51 ^M	44 ^M	40 ^L	60 ^M	52 ^M	50 ^M	62 ^H	40 ^L	51 ^M	25 ^L	25 ^L	35 ^L	41 ^M	68 ^H	68 ^H	94 ^S	94 ^S	78 ^H	78 ^H	49 ^M	57 ^M
D High	54 ^M	55 ^M	49 ^M	45 ^M	45 ^M	44 ^M	60 ^M	53 ^M	52 ^M	51 ^M	19 ^N	29 ^L	10 ^N	10 ^N	16 ^N	22 ^L	16 ^N	16 ^N	52 ^M	52 ^M	29 ^L	29 ^L	36 ^L	38 ^M

¹Departure Ratings: (0-20% = no departure^N); (21-40% = low departure^L); (41-60% = moderate departure^M); (61-80% = high departure^H); and (81-100% = severe departure^S)

Appendix H table 2, overall summary at the end of the 50-year modeling period for the proposed high acre treatments for alternatives B, C and D, and alternative A; from greatest movement toward DC and HRV to the least movement toward DC and HRV:

- Ponderosa pine forest PNTV
Greatest movement toward DC: alternatives **B**, then C, and lastly equally D and A
Greatest movement toward HRV: alternatives **D**, then B, C, and lastly A
- Wet mixed conifer forest PNTV
Greatest movement toward DC: alternatives **A**, then D, B, and lastly C
Greatest movement toward HRV: alternatives **A**, then equally B and D, and lastly C

- Dry mixed conifer forest PNVT
Greatest movement toward DC: alternatives **B**, then C, D, and lastly A
Greatest movement toward HRV: alternatives **B**, then C, D, and lastly A
- Spruce-fir forest PNVT
Greatest movement toward DC: alternatives equally **C and D**, then B, and lastly A
Greatest movement toward HRV: alternatives **C**, then equally B and D, and lastly A
- All A-SNFs Modeled Forested PNVTs combined
Greatest movement toward DC: alternatives **B**, then C, A, and lastly D
Greatest movement toward HRV: alternatives **D**, B, and then equally A and C
- Madrean pine-oak woodland PNVT
Greatest movement toward DC: alternatives **D**, then B, C, and lastly A
Greatest movement toward HRV: alternatives **D**, then B, C, and lastly A
- Piñon-juniper woodland PNVT
Greatest movement toward DC: alternatives **D**, then B, C, and lastly A
Greatest movement toward HRV: alternatives **D**, then B, C, and lastly A
- All A-SNFs Modeled Woodland PNVTs combined
Greatest movement toward DC: alternatives **D**, B then, C, and lastly A
Greatest movement toward HRV: alternatives **D**, then B, C, and A
- Great Basin grassland PNVT
Greatest movement toward DC: alternatives **D**, then B, and equally C and A
Greatest movement toward HRV: alternatives **D**, then B, and equally C and A
- Semi-desert grassland PNVT
Greatest movement toward DC: alternatives equally **B** and D, and then equally A and C;
Greatest movement toward HRV: alternatives equally **B and D**, and then equally A and C.
- All A-SNFs Modeled Grassland PNVTs combined
Greatest movement toward DC: alternatives **D**, then B, and lastly equally A and C;
Greatest movement toward HRV: alternatives **D**, then B, and lastly equally A and C.
- All A-SNFs Modeled PNVTs combined
Greatest movement toward DC: alternatives **D**, then B, C, and lastly A
Greatest movement toward HRV: alternatives **D**, then B, C, and lastly A

All A-SNFs Modeled PNTVs

15-Year Planning Period Proposed Average Acre Treatment Objectives

Appendix H table 3. Comparisons of the percent departures from DC and HRV at the end of the 15-year planning period, by alternative proposed average acre treatment objectives and alternative A (the lower the departure¹ value the closer to DC and HRV)

Alternative	Forested PNVT Group								Woodland PNVT Group								Grassland PNVT Group								All A-SNFs Modeled PNVTs	
	ponderosa pine forest		wet mixed conifer forest		dry mixed conifer forest		spruce-fir forest		all A-SNFs modeled forested PNVTs		Madrean pine-oak woodland		piñon-juniper woodland		all A-SNFs modeled woodland PNVTs		Great Basin grassland		semi-desert grassland		all A-SNFs modeled grassland PNVTs					
	DC	HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV		
Current Condition	77 ^H	94 ^S	54 ^M	61 ^H	67 ^H	77 ^H	59 ^M	62 ^H	71 ^H	85 ^S	61 ^H	72 ^H	28 ^L	28 ^L	49 ^M	56 ^M	67 ^H	67 ^H	79 ^H	79 ^H	71 ^H	71 ^H	64 ^H	73 ^H		
A	65 ^H	84 ^S	49 ^M	46 ^M	57 ^M	54 ^M	68 ^H	58 ^M	61 ^H	71 ^H	59 ^M	70 ^H	21 ^L	21 ^L	45 ^M	52 ^M	63 ^H	63 ^H	84 ^S	84 ^S	71 ^H	71 ^H	57 ^M	65 ^H		
B Average	63 ^H	83 ^S	53 ^M	46 ^M	56 ^M	52 ^M	66 ^H	55 ^M	60 ^M	71 ^H	47 ^M	58 ^M	20 ^N	20 ^N	37 ^L	44 ^M	17 ^N	17 ^N	68 ^H	68 ^H	36 ^L	36 ^L	49 ^M	56 ^M		
C Average	60 ^M	81 ^S	56 ^M	49 ^M	54 ^M	51 ^M	65 ^H	55 ^M	58 ^M	70 ^H	55 ^M	66 ^H	19 ^N	19 ^N	42 ^M	49 ^M	63 ^H	63 ^H	84 ^S	84 ^S	71 ^H	71 ^H	55 ^M	63 ^H		
D Average	66 ^H	85 ^S	52 ^M	47 ^M	59 ^M	56 ^M	65 ^H	55 ^M	62 ^H	73 ^H	41 ^M	51 ^M	19 ^N	19 ^N	33 ^L	39 ^L	19 ^N	19 ^N	68 ^H	68 ^H	37 ^L	37 ^L	48 ^M	56 ^M		

¹Departure Ratings: (0-20% = no departure^N); (21-40% = low departure^L); (41-60% = moderate departure^M); (61-80% = high departure^H); and (81-100% = severe departure^S)

Appendix H table 3, overall summary at the end of the 15-year planning period for the proposed average acre treatments for alternatives B, C and D, and alternative A; from greatest movement toward DC and HRV to the least movement toward DC and HRV:

- Ponderosa pine forest PNTV
Greatest movement toward DC: alternatives C, then B, A, and lastly D
Greatest movement toward HRV: alternatives C, then B, A, and lastly D
- Wet mixed conifer forest PNTV
Greatest movement toward DC: alternatives A, then D, B, and lastly C
Greatest movement toward HRV: alternatives equally A and B, then D, and lastly C

- Dry mixed conifer forest PNVT
Greatest movement toward DC: alternatives **C**, then B, A, and lastly D
Greatest movement toward HRV: alternatives **C**, then B, A, and lastly D
- Spruce-fir forest PNVT
Greatest movement toward DC: alternatives equally **C and D**, then B, and lastly A
Greatest movement toward HRV: alternatives equally **B, C and D**, and lastly A
- All A-SNFs Modeled Forested PNVTs combined
Greatest movement toward DC: alternatives **C**, then B, A, and lastly D
Greatest movement toward HRV: alternatives **C**, then equally A and B, and lastly D
- Madrean pine-oak woodland PNVT
Greatest movement toward DC: alternatives **D**, then B, C, and lastly A
Greatest movement toward HRV: alternatives **D**, then B, C, and lastly A
- Piñon-juniper woodland PNVT
Greatest movement toward DC: alternatives equally **C and D**, then B, and lastly A
Greatest movement toward HRV: alternatives equally **C and D**, then B, and lastly A
- All A-SNFs Modeled Woodland PNVTs combined
Greatest movement toward DC: alternatives **D**, then B, C, and lastly A
Greatest movement toward HRV: alternatives **D**, then B, C, and lastly A
- Great Basin grassland PNVT
Greatest movement toward DC: alternatives **B**, then D, and lastly equally A and C
Greatest movement toward HRV: alternatives **B**, then D, and lastly equally A and C
- Semi-desert grassland PNVT
Greatest movement toward DC: alternatives equally **B and D**, and then equally A and C
Greatest movement toward HRV: alternatives equally **B and D**, and then equally A and C
- All A-SNFs Modeled Grassland PNVTs combined
Greatest movement toward DC: alternatives **B**, then C, and lastly equally A and C
Greatest movement toward HRV: alternatives **B**, then C, and lastly equally A and C
- All A-SNFs Modeled PNVTs combined
Greatest movement toward DC: alternatives **D**, then B, C, and lastly A
Greatest movement toward HRV: alternatives equally **B and D**, then C, and lastly A

All A-SNFs Modeled PNTVs

50-year Modeling Period Proposed Average Acre Treatment Objectives

Appendix H table 4. Comparisons of the percent departures from DC and HRV at the end of the 50-year modeling period, by alternative proposed average acre treatment objectives and alternative A (the lower the departure¹ value the closer to DC and HRV)

Alternative	Forested PNVT Group									Woodland PNVT Group						Grassland PNVT Group						All A-SNFs Modeled PNVTs		
	ponderosa pine forest		wet mixed conifer forest		dry mixed conifer forest		spruce-fir forest		all A-SNFs modeled forested PNVTs		Madrean pine-oak woodland		piñon-juniper woodland		all A-SNFs modeled woodland PNVTs		Great Basin grassland		semi-desert grassland		all A-SNFs modeled grassland PNVTs			
	DC	HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV
Current Condition	77 ^H	94 ^S	54 ^M	61 ^H	67 ^H	77 ^H	59 ^M	62 ^H	71 ^H	85 ^S	61 ^H	72 ^H	28 ^L	28 ^L	49 ^M	56 ^M	67 ^H	67 ^H	79 ^H	79 ^H	71 ^H	71 ^H	64 ^H	73 ^H
A	54 ^M	71 ^H	45 ^M	43 ^M	47 ^M	47 ^M	65 ^H	54 ^M	51 ^M	62 ^H	56 ^M	67 ^H	41 ^M	41 ^M	51 ^M	57 ^M	68 ^H	68 ^H	94 ^S	94 ^S	78 ^H	78 ^H	55 ^M	63 ^H
B Average	54 ^M	74 ^H	53 ^M	45 ^M	48 ^M	46 ^M	63 ^H	53 ^M	53 ^M	64 ^H	38 ^L	48 ^M	22 ^L	22 ^L	32 ^L	38 ^L	20 ^N	20 ^N	58 ^M	58 ^M	34 ^L	34 ^L	43 ^M	51 ^M
C Average	54 ^M	74 ^H	57 ^M	48 ^M	48 ^M	47 ^M	63 ^H	53 ^M	54 ^M	64 ^H	47 ^M	57 ^M	30 ^L	30 ^L	41 ^M	47 ^M	68 ^H	68 ^H	94 ^S	94 ^S	78 ^H	78 ^H	53 ^M	61 ^H
D Average	57 ^M	66 ^H	51 ^M	45 ^M	49 ^M	49 ^M	62 ^H	53 ^M	55 ^M	59 ^M	32 ^L	42 ^M	19 ^N	19 ^N	27 ^L	34 ^L	18 ^N	18 ^N	58 ^M	58 ^M	33 ^L	33 ^L	42 ^M	46 ^M

¹Departure Ratings: (0-20% = no departure^N); (21-40% = low departure^L); (41-60% = moderate departure^M); (61-80% = high departure^H); and (81-100% = severe departure^S)

Appendix H table 4, overall summary at the end of the 50-year modeling period for the proposed average acre treatments for alternatives B, C and D, and alternative A; from greatest movement toward DC and HRV to the least movement toward DC and HRV:

- Ponderosa pine forest PNTV
Greatest movement toward DC: alternatives equally **A**, then **B and C**, and lastly D
Greatest movement toward HRV: alternatives **D**, A, and then equally B and C
- Wet mixed conifer forest PNTV
Greatest movement toward DC: alternatives **A**, then D, B, and lastly C
Greatest movement toward HRV: alternatives **A**, then equally B and D, and lastly C

- Dry mixed conifer forest PNVT
Greatest movement toward DC: alternatives **A**, then equally B and C, and lastly A
Greatest movement toward HRV: alternatives **B**, then equally A and C, and lastly D
- Spruce-fir forest PNVT
Greatest movement toward DC: alternatives **D**, then equally B and C, and lastly A
Greatest movement toward HRV: alternatives equally **B, C and D**, and lastly A
- All A-SNFs Modeled Forested PNVTs
Greatest movement toward DC: alternatives **A**, then B, C, and lastly D
Greatest movement toward HRV: alternatives **D**, then A and lastly equally B and C
- Madrean pine-oak woodland PNVT
Greatest movement toward DC: alternatives **D**, then B, C, and lastly A
Greatest movement toward HRV: alternatives **D**, then B, C, and lastly A
- Piñon-juniper woodland PNVT
Greatest movement toward DC: alternatives **D**, then B, C and lastly A
Greatest movement toward HRV: alternatives **D**, then B, C and lastly A
- All A-SNFs Modeled Woodland PNVTs
Greatest movement toward DC: alternatives **D**, then B, C, and lastly A
Greatest movement toward HRV: alternatives **D**, then B, C, and lastly A
- Great Basin grassland PNVT
Greatest movement toward DC: alternatives **D**, B then, and lastly equally A and C
Greatest movement toward HRV: alternatives **D**, then B, and lastly equally A and C
- Semi-desert grassland PNVT
Greatest movement toward DC: alternatives equally **B and D**, and then equally A and C
Greatest movement toward HRV: alternatives equally **B and D**, and then equally A and C
- All A-SNFs Modeled Grassland PNVTs
Greatest movement toward DC: alternatives **D**, then B, and lastly equally A and C
Greatest movement toward HRV: alternatives **D**, then B, and lastly equally A and C
- All A-SNFs Modeled PNVTs
Greatest movement toward DC: alternatives **D**, then B, C, and lastly A
Greatest movement toward HRV: alternatives **D**, then B, C, and lastly A

All A-SNFs Modeled PNTVs

15-Year Planning Period Proposed Low Acre Treatment Objectives

Appendix H table 5. Comparisons of the percent departures from DC and HRV at the end of the 15-year planning period, by alternative proposed low acre treatment objectives and alternative A (the lower the departure¹ value the closer to DC and HRV)

Alternative	Forested PNVT Group										Woodland PNVT Group						Grassland PNVT Group						All A-SNFs Modeled PNVTs	
	ponderosa pine forest		wet mixed conifer forest		dry mixed conifer forest		spruce-fir forest		all A-SNFs modeled forested PNVTs		Madrean pine-oak woodland		piñon-juniper woodland		all A-SNFs modeled woodland PNVTs		Great Basin grassland		semi-desert grassland		all A-SNFs modeled grassland PNVTs			
	DC	HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV
Current Condition	77 ^H	94 ^S	54 ^M	61 ^H	67 ^H	77 ^H	59 ^M	62 ^H	71 ^H	85 ^S	61 ^H	72 ^H	28 ^L	28 ^L	49 ^M	56 ^M	67 ^H	67 ^H	79 ^H	79 ^H	71 ^H	71 ^H	64 ^H	73 ^H
A	65 ^H	84 ^S	49 ^M	46 ^M	57 ^M	54 ^M	68 ^H	58 ^M	61 ^H	71 ^H	59 ^M	70 ^H	21 ^L	21 ^L	45 ^M	52 ^M	63 ^H	63 ^H	84 ^S	84 ^S	71 ^H	71 ^H	57 ^M	65 ^H
B Low	69 ^H	87 ^S	54 ^M	47 ^M	60 ^M	57 ^M	68 ^H	56 ^M	64 ^H	74 ^H	54 ^M	65 ^H	20 ^N	20 ^N	42 ^M	49 ^M	24 ^L	24 ^L	70 ^H	70 ^H	41 ^M	41 ^L	53 ^M	61 ^H
C Low	69 ^M	86 ^S	55 ^M	47 ^M	59 ^M	58 ^M	67 ^H	57 ^M	64 ^H	74 ^H	59 ^M	70 ^H	21 ^L	21 ^L	45 ^M	52 ^M	63 ^H	63 ^H	84 ^S	84 ^S	71 ^H	71 ^H	59 ^M	66 ^H
D Low	70 ^H	87 ^S	54 ^M	46 ^M	62 ^H	59 ^M	67 ^H	56 ^M	66 ^H	74 ^H	54 ^M	65 ^H	20 ^N	20 ^N	42 ^M	49 ^M	29 ^L	29 ^L	70 ^H	70 ^H	44 ^M	44 ^L	54 ^M	61 ^H

¹Departure Ratings: (0-20% = no departure^N); (21-40% = low departure^L); (41-60% = moderate departure^M); (61-80% = high departure^H); and (81-100% = severe departure^S)

Appendix H table 5, overall summary at the end of the 15-year planning period for the proposed low acre treatments for alternatives B, C and D, and alternative A; from greatest movement toward DC and HRV to the least movement toward DC and HRV:

- Ponderosa pine forest PNTV
Greatest movement toward DC: alternatives **A**, then equally B and C, and lastly D
Greatest movement toward HRV: alternatives **A**, then equally B and D, and lastly C
- Wet mixed conifer forest PNTV
Greatest movement toward DC: alternatives **A**, then equally B and D, and lastly C
Greatest movement toward HRV: alternatives equally **A and D**, and then equally B and C

- Dry mixed conifer forest PNVT
Greatest movement toward DC: alternatives **A**, then C, B, and lastly D
Greatest movement toward HRV: alternatives **A**, then B, C, and lastly D
- Spruce-fir forest PNVT
Greatest movement toward DC: alternatives equally **C and D**, and then equally A and B
Greatest movement toward HRV: alternatives equally **B and D**, then C, and lastly A
- All A-SNFs Modeled Forested PNVTs
Greatest movement toward DC: alternatives A, then equally B and C, and lastly D
Greatest movement toward HRV: alternatives **A**, and then equally B, C and D
- Madrean pine-oak woodland PNVT
Greatest movement toward DC: alternatives equally **B and D**, and then equally A and C
Greatest movement toward HRV: alternatives equally **B and D**, and then equally A and C
- Piñon-juniper woodland PNVT
Greatest movement toward DC: alternatives equally **C and D**, then B, and lastly A
Greatest movement toward HRV: alternatives equally **C and D**, then B, and lastly A
- All A-SNFs Modeled Woodland PNVTs
Greatest movement toward DC: alternatives equally **B and D**, and then equally A and C
Greatest movement toward HRV: alternatives equally **B and D**, and then equally A and C
- Great Basin grassland PNVT
Greatest movement toward DC: alternatives **B**, then D, and lastly equally A and C
Greatest movement toward HRV: alternatives **B**, then D, and lastly equally A and C
- Semi-desert grassland PNVT
Greatest movement toward DC: alternatives equally **B and D**, and then equally A and C
Greatest movement toward HRV: alternatives equally **B and D**, and then equally A and C
- All A-SNFs Modeled Grassland PNVTs
Greatest movement toward DC: alternatives B, then D, and lastly equally A and C
Greatest movement toward HRV: alternatives **B**, then C, and lastly equally A and C
- All A-SNFs Modeled PNVTs
Greatest movement toward DC: alternatives **B**, then D, A, and lastly C
Greatest movement toward HRV: alternatives equally **B and D**, then C, and lastly A

All A-SNFs Modeled PNTVs

50-Year Modeling Period Proposed Low Acre Treatment Objectives

Appendix H table 6. Comparisons of the departures from DC and HRV at the end of the 50-year modeling period, by alternative proposed low acre treatment objectives and alternative A (the lower the departure¹ value the closer to DC and HRV)

Alternative	Forested PNVT Group								Woodland PNVT Group								Grassland PNVT Group								All A-SNFs Modeled PNVTs
	ponderosa pine forest		wet mixed conifer forest		dry mixed conifer forest		spruce-fir forest		all A-SNFs modeled forested PNVTs		Madrean pine- oak woodland		piñon-juniper woodland		all A-SNFs modeled woodland PNVTs		Great Basin grassland		semi-desert grassland		all A-SNFs modeled grassland PNVTs				
	DC	HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV	DC	HRV	
Current Condition	77 ^H	94 ^S	54 ^M	61 ^H	67 ^H	77 ^H	59 ^M	62 ^H	71 ^H	85 ^S	61 ^H	72 ^H	28 ^L	28 ^L	49 ^M	56 ^M	67 ^H	67 ^H	79 ^H	79 ^H	71 ^H	71 ^H	64 ^H	73 ^H	
A	54 ^M	71 ^H	45 ^M	43 ^M	47 ^M	47 ^M	65 ^H	54 ^M	51 ^M	62 ^H	56 ^M	67 ^H	41 ^M	41 ^M	51 ^M	57 ^M	68 ^H	68 ^H	94 ^S	94 ^S	78 ^H	78 ^H	55 ^M	63 ^H	
B Low	62 ^H	80 ^H	54 ^M	45 ^M	51 ^M	50 ^M	65 ^H	53 ^M	58 ^M	67 ^H	45 ^M	56 ^M	30 ^L	30 ^L	40 ^L	46 ^M	19 ^N	19 ^N	63 ^H	63 ^H	35 ^L	35 ^L	48 ^M	55 ^M	
C Low	59 ^M	77 ^H	55 ^M	45 ^M	52 ^M	53 ^M	65 ^H	53 ^M	57 ^M	67 ^H	53 ^M	64 ^H	36 ^L	36 ^L	47 ^M	54 ^M	68 ^H	68 ^H	94 ^S	94 ^S	78 ^H	78 ^H	57 ^M	64 ^H	
D Low	60 ^M	77 ^H	53 ^M	44 ^M	54 ^M	55 ^M	64 ^H	54 ^M	58 ^M	67 ^H	45 ^M	56 ^M	28 ^L	28 ^L	39 ^L	46 ^M	20 ^N	20 ^N	63 ^H	63 ^H	36 ^L	36 ^L	48 ^M	55 ^M	

¹Departure Ratings: (0-20% = no departure^N); (21-40% = low departure^L); (41-60% = moderate departure^M); (61-80% = high departure^H); and (81-100% = severe departure^S)

Appendix H table 6, overall summary at the end of the 50-year modeling period for the proposed low acre treatments for alternatives B, C and D, and alternative A; from greatest movement toward DC and HRV to the least movement toward DC and HRV:

- Ponderosa pine forest PNTV
Greatest movement toward DC: alternatives **A**, then C, D, and lastly B
Greatest movement toward HRV: alternatives **A**, then equally C and D, and lastly B
- Wet mixed conifer forest PNTV
Greatest movement toward DC: alternatives **A**, then D, B, and lastly C
Greatest movement toward HRV: alternatives **A**, then D, and lastly equally B and C

- Dry mixed conifer forest PNVT
Greatest movement toward DC: alternatives **A**, then B, C, and lastly D
Greatest movement toward HRV: alternatives **A**, then B, C, and lastly D
- Spruce-fir forest PNVT
Greatest movement toward DC: alternatives **D**, and then equally A, B and C
Greatest movement toward HRV: alternatives equally **B and C**, and then equally A and D
- All A-SNFs Modeled Forested PNVTs
Greatest movement toward DC: alternatives **A**, then C and lastly equally B and D
Greatest movement toward HRV: alternatives **A**, and then equally B, C and D
- Madrean pine-oak woodland PNVT
Greatest movement toward DC: alternatives equally **B and D**, then C and lastly A
Greatest movement toward HRV: alternatives equally **B and D**, then C and lastly A
- Piñon-juniper woodland PNVT
Greatest movement toward DC: alternatives **D**, then B, C, and lastly A
Greatest movement toward HRV: alternatives **D**, then B, C, and lastly A
- All A-SNFs Modeled Woodland PNVTs
Greatest movement toward DC: alternatives **D**, then B, C, and lastly A
Greatest movement toward HRV: alternatives equally **B and D**, then C, and lastly A
- Great Basin grassland PNVT
Greatest movement toward DC: alternatives **B**, then D, and lastly equally A and C
Greatest movement toward HRV: alternatives **B**, then D, and lastly equally A and C
- Semi-desert grassland PNVT
Greatest movement toward DC: alternatives equally **B and D**, and then equally A and C
Greatest movement toward HRV: alternatives equally **B and D**, and then equally A and C
- All A-SNFs Modeled Grassland PNVTs
Greatest movement toward DC: alternatives **B**, then D, and lastly equally A and C
Greatest movement toward HRV: alternatives **B**, then C, and lastly equally A and C
- All A-SNFs Modeled PNVTs
Greatest movement toward DC: alternatives equally **B and D**, then A, and lastly C
Greatest movement toward HRV: alternatives equally **B and D**, and C, then lastly A

Appendix I - Comparisons, Based on the Proposed High, Average, and Low Acre Treatment Objectives for Alternatives B, C and D, and Alternative A, by the end of the 15-Year Planning Period and the 50-Year Modeling Period, of the Percentage and Acreage Changes in Closed Woody Canopy Cover

All A-SNFs Modeled Forested PNVTs

15-Year Planning Period and the 50-Year Modeling Period Proposed High Acre Treatment Objectives

Appendix I table 1. Comparisons, based on the proposed high acre treatment objectives for alternatives B, C and D, and alternative A, by the end of the 15-year planning period and the 50-year modeling period, of the percentage and acreage changes in closed woody canopy cover¹ within the historically open forest (ponderosa pine forest (PPF) and dry mixed conifer forest (DMCF)) PNVTs, and the historically closed forest (wet mixed conifer forest (WMCF) and spruce-fir forest (SFF)) PNVTs on the A-SNFs

Percent and Acreage Display the Amount of Change within Each PNVT that has Closed Woody Canopy Cover Greater than 30 Percent (arrows indicate direction of change in woody canopy cover; ↑ increase, ↓ decrease, or ↔ no change)				
Years	alternative A percent and (acreage)	alternative B percent and (acreage)	alternative C percent and (acreage)	alternative D percent and (acreage)
proposed high treatment objectives				
Ponderosa pine forest PNVT current conditions: 602,206 acres of which 68% or 410,912 acres with woody canopy cover > 30%				
15	10%↓ (370,119 acres)	21%↓ (324,218 acres)	38%↓ (254,139 acres)	14%↓ (351,946 acres)
50	16%↓ (343,281 acres)	29%↓ (291,511 acres)	40%↓ (245,091 acres)	37%↓ (258,284 acres)
Dry mixed conifer forest PNVT current conditions: 147,885 acres of which 61% or 90,210 acres with woody canopy cover > 30%				
15	23%↑ (110,914 acres)	11%↑ (100,562 acres)	7%↑ (96,125 acres)	18%↑ (106,477 acres)
50	21%↑ (109,435 acres)	10%↑ (99,083 acres)	10%↑ (99,083 acres)	16%↑ (104,998 acres)
All A-SNFs Modeled Open canopy forest types (PPF+DMCF): 750,091 acres of which 67% or 501,122 acres with woody canopy cover > 30%				
15	4%↓ (481,033 acres)	15%↓ (424,779 acres)	30%↓ (350,264 acres)	9%↓ (458,423 acres)
50	10%↓ (452,716 acres)	22%↓ (390,594 acres)	31%↓ (344,174 acres)	28%↓ (363,282 acres)
Wet mixed conifer forest PNVT current conditions: 177,995 acres of which 61% or 101,457 acres with woody canopy cover > 30%				
15	12%↑ (113,917 acres)	11%↑ (112,137 acres)	2%↓ (99,677 acres)	11%↑ (112,137 acres)
50	18%↑ (119,257 acres)	18%↑ (119,257 acres)	9%↑ (110,357 acres)	16%↑ (117,477 acres)
Spruce-fir forest PNVT current conditions: 17,667 acres of which 61% or 10,777 acres with woody canopy cover > 30%				
15	11%↑ (12,014 acres)	8%↑ (11,660 acres)	5%↑ (11,307 acres)	7%↑ (11,484 acres)
50	2%↑ (10,954 acres)	10%↓ (9,717 acres)	11%↓ (9,540 acres)	15%↓ (9,187 acres)
All A-SNFs Modeled Closed canopy forest types (WMCF+SFF): 195,662 acres of which 57% or 112,234 acres with woody canopy cover > 30%				
15	12%↑ (125,930 acres)	10%↑ (123,797 acres)	1%↓ (110,984 acres)	10%↑ (123,620 acres)
50	16%↑ (130,210 acres)	15%↑ 128,974 acres)	7%↑ (119,897 acres)	15%↑ (126,664 acres)

¹Woody canopy closure classes are: 0 to < 10% is defined as very open canopy; ≥ 10 to ≤ 30% is defined as open canopy; and > 30% is defined as closed canopy. Under HRV and for DC ponderosa pine and dry mixed conifer forests should exhibit open canopies (≥ 10 to ≤ 30% woody canopy cover). Therefore, the lower the amounts of closed woody canopy cover, the closer these two PNVTs are to their HRV and forest plan DCs. Under HRV and for DC wet mixed conifer and spruce-fir forests should exhibit closed canopies (> 30% woody canopy cover). Therefore, the higher the amount of closed woody canopy cover, the closer these two PNVTs are to their HRV and forest plan DCs

Appendix I table 1, overall summary of the proposed high acre treatment objectives for alternatives B, C and D, and alternative A, by the end of the 15-year planning period and the 50-year modeling period for most open canopy for ponderosa pine and dry mixed conifer forest PNVTs (greatest to least); and most closed canopy for wet mixed conifer and spruce-fir forest PNVTs (greatest to least):

- Ponderosa pine forest PNVT
Most open canopy at the end of the 15-year planning period: alternatives **C**, then B, D, and lastly A
Most open canopy at the end of the 50-year modeling period: alternatives **C**, then D, B, and lastly A
- Dry mixed conifer forest PNVT
Most open canopy at the end of the 15-year planning period: alternatives **C**, then B, D, and lastly A
Most open canopy at the end of the 50-year modeling period: alternatives equally **B and C**, then D, and lastly A
- All A-SNFs Modeled Open (Ponderosa pine and Dry mixed conifer) Forested PNVTs
Most open canopy at the end of the 15-year planning period: alternatives **C**, then B, D, and lastly A
Most open canopy at the end of the 50-year modeling period: alternatives **C**, then D, B, and lastly A
- Wet mixed conifer forest PNVT
Most closed canopy at the end of the 15-year planning period: alternatives **A**, then equally B and D, and lastly C
Most closed canopy at the end of the 50-year modeling period: alternatives equally **A and B**, then D, and lastly C
- Spruce-fir forest PNVT
Most closed canopy at the end of the 15-year planning period: alternatives **A**, then B, D, and lastly C
Most closed canopy at the end of the 50-year modeling period: alternatives **A**, then B, C, and lastly D
- All A-SNFs Modeled Closed (Wet mixed conifer and Spruce-fir) Forested PNVTs
Most closed canopy at the end of the 15-year planning period: alternatives **A**, then equally B and D, and lastly C
Most closed canopy at the end of the 50-year modeling period: alternatives **A**, then equally B and D, and lastly C

All A-SNFs Modeled Forested PNVTs

15-Year Planning Period and the 50-Year Modeling Period Proposed Average Acre Treatment Objectives

Appendix I table 2. Comparisons, based on the proposed average acre treatment objectives for alternatives B, C and D, and alternative A, by the end of the 15-year planning period and the 50-year modeling period, of the percentage and acreage changes in closed woody canopy cover¹ within the historically open forest (ponderosa pine forest (PPF) and dry mixed conifer forest (DMCF)) PNVTs, and the historically closed forest (wet mixed conifer forest (WMCF) and spruce-fir forest (SFF)) PNVTs on the A-SNFs

Percent and Acreage Display the Amount of Change within Each PNVT that has Closed Woody Canopy Cover Greater than 30 Percent (arrows indicate direction of change in woody canopy cover; ↑ increase, ↓ decrease, or ↔ no change)				
Years	alternative A percent and (acreage)	proposed average treatment objectives		
		alternative B percent and (acreage)	alternative C percent and (acreage)	alternative D percent and (acreage)
Ponderosa pine forest PNVT current conditions: 602,206 acres of which 68% or 410,912 acres with woody canopy cover > 30%				
15	10%↓ (370,119 acres)	13%↓ (359,445 acres)	21%↓ (324,765 acres)	8%↓ (378,270 acres)
50	16%↓ (343,281 acres)	18%↓ (338,631 acres)	24%↓ (312,530 acres)	21%↓ (324,026 acres)
Dry mixed conifer forest PNVT current conditions: 147,885 acres of which 61% or 90,210 acres with woody canopy cover > 30%				
15	23%↑ (110,914 acres)	20%↑ (107,956 acres)	19%↑ (107,217 acres)	25%↑ (112,393 acres)
50	21%↑ (109,435 acres)	20%↑ (107,695 acres)	22%↑ (110,174 acres)	26%↑ (113,871 acres)
All A-SNFs Modeled Open canopy forest types (PPF+DMCF): 750,091 acres of which 67% or 501,122 acres with woody canopy cover > 30%				
15	4%↓ (481,033 acres)	7%↓ (467,401 acres)	14%↓ (431,982 acres)	2%↓ (490,662 acres)
50	10%↓ (452,716 acres)	11%↓ (447,327 acres)	16%↓ (422,704 acres)	13%↓ (437,897 acres)
Wet mixed conifer forest PNVT current conditions: 177,995 acres of which 61% or 101,457 acres with woody canopy cover > 30%				
15	12%↑ (113,917 acres)	12%↑ (113,917 acres)	5%↑ (106,797 acres)	12%↑ (113,917 acres)
50	18%↑ (119,257 acres)	19%↑ (121,037 acres)	14%↑ (115,697 acres)	18%↑ (120,147 acres)
Spruce-fir forest PNVT current conditions: 17,667 acres of which 61% or 10,777 acres with woody canopy cover > 30%				
15	11%↑ (12,014 acres)	11%↑ (11,925 acres)	9%↑ (11,749 acres)	10%↑ (11,837 acres)
50	2%↑ (10,954 acres)	3%↓ (10,424 acres)	4%↓ (10,335 acres)	7%↓ (9,982 acres)
All A-SNFs Modeled Closed canopy forest types (WMCF+SFF): 195,662 acres of which 57% or 112,234 acres with woody canopy cover > 30%				
15	12%↑ (125,930 acres)	12%↑ (125,842 acres)	6%↑ (118,546 acres)	12%↑ (125,754 acres)
50	16%↑ (130,210 acres)	17%↑ (131,460 acres)	12%↑ (126,032 acres)	16%↑ (130,128 acres)

¹Woody canopy closure classes are: 0 to < 10% is defined as very open canopy; ≥ 10 to ≤ 30% is defined as open canopy; and > 30% is defined as closed canopy. Under HRV and for DC ponderosa pine and dry mixed conifer forests should exhibit open canopies (≥ 10 to ≤ 30% woody canopy cover). Therefore, the lower the amounts of closed woody canopy cover, the closer these two PNVTs are to their HRV and forest plan DCs. Under HRV and for DC wet mixed conifer and spruce-fir forests should exhibit closed canopies (> 30% woody canopy cover). Therefore, the higher the amount of closed woody canopy cover, the closer these two PNVTs are to their HRV and forest plan DCs

Appendix I table 2, overall summary of the proposed average acre treatment objectives for alternatives B, C and D, and alternative A, by the end of the 15-year planning period and the 50-year modeling period for most open canopy for ponderosa pine and dry mixed conifer forest PNVTs (greatest to least); and most closed canopy for wet mixed conifer and spruce-fir forest PNVTs (greatest to least):

- Ponderosa pine forest PNVT
Most open canopy at the end of the 15-year planning period: alternatives **C**, then B, A and lastly D
Most open canopy at the end of the 50-year modeling period: alternatives **C**, then D, B, and lastly A
- Dry mixed conifer forest PNVT
Most open canopy at the end of the 15-year planning period: alternatives **C**, then B, A and lastly D
Most open canopy at the end of the 50-year modeling period: alternatives **B**, then A, C, and lastly D
- All A-SNFs Modeled Open (Ponderosa pine and Dry mixed conifer) Forested PNVTs
Most open canopy at the end of the 15-year planning period: alternatives **C**, then B, and lastly equally A and D
Most open canopy at the end of the 50-year modeling period: alternatives **C**, then D, B, and lastly A
- Wet mixed conifer forest PNVT
Most closed canopy at the end of the 15-year planning period: alternatives equally **A, B and D**, and lastly C
Most closed canopy at the end of the 50-year modeling period: alternatives **B**, then equally A and D, and lastly C
- Spruce-fir forest PNVT
Most closed canopy at the end of the 15-year planning period: alternatives equally **A and B**, then D, and lastly C
Most closed canopy at the end of the 50-year modeling period: alternatives **A**, then B, C, and lastly D
- All A-SNFs Modeled Closed (Wet mixed conifer and Spruce-fir) Forested PNVTs
Most closed canopy at the end of the 15-year planning period: alternatives equally **A, B and D**, and lastly C
Most closed canopy at the end of the 50-year modeling period: alternatives **B**, equally A and D, and lastly C

All A-SNFs Modeled Forested PNVTs

15-Year Planning Period and the 50-Year Modeling Period Proposed Low Acre Treatment Objectives

Appendix I table 3. Comparisons, based on the proposed low acre treatment objectives for alternatives B, C and D, and alternative A, by the end of the 15-year planning period and the 50-year modeling period, of the percentage and acreage changes in closed woody canopy cover¹ within the historically open forest (ponderosa pine forest (PPF) and dry mixed conifer forest (DMCF)) PNVTs, and the historically closed forest (wet mixed conifer forest (WMCF) and spruce-fir forest (SFF)) PNVTs on the A-SNFs

Percent and Acreage Display the Amount of Change within Each PNVT that has Closed Woody Canopy Cover Greater than 30 Percent (arrows indicate direction of change in woody canopy cover; ↑ increase, ↓ decrease, or ↔ no change)				
Years	alternative A percent and (acreage)	proposed low treatment objectives		
		alternative B percent and (acreage)	alternative C percent and (acreage)	alternative D percent and (acreage)
Ponderosa pine forest PNVT current conditions: 602,206 acres of which 68% or 410,912 acres with woody canopy cover > 30%				
15	10%↓ (370,119 acres)	4%↓ (394,673 acres)	4%↓ (395,392 acres)	2%↓ (404,593 acres)
50	16%↓ (343,281 acres)	6%↓ (385,752 acres)	8%↓ (379,968 acres)	5%↓ (389,767 acres)
Dry mixed conifer forest PNVT current conditions: 147,885 acres of which 61% or 90,210 acres with woody canopy cover > 30%				
15	23%↑ (110,914 acres)	28%↑ (115,350 acres)	31%↑ (118,308 acres)	31%↑ (118,308 acres)
50	21%↑ (109,435 acres)	31%↑ (118,308 acres)	34%↑ (121,266 acres)	36%↑ (122,745 acres)
All A-SNFs Modeled Open canopy forest types (PPF+DMCF): 750,091 acres of which 67% or 501,122 acres with woody canopy cover > 30%				
15	4%↓ (481,033 acres)	2%↑ (510,023 acres)	3%↑ (513,700 acres)	4%↑ (522,901 acres)
50	10%↓ (452,716 acres)	1%↑ (504,060 acres)	0%↔ (501,234 acres)	2%↑ (512,512 acres)
Wet mixed conifer forest PNVT current conditions: 177,995 acres of which 61% or 101,457 acres with woody canopy cover > 30%				
15	12%↑ (113,917 acres)	14%↑ (115,697 acres)	12%↑ (113,917 acres)	14%↑ (115,697 acres)
50	18%↑ (119,257 acres)	21%↑ (122,817 acres)	19%↑ (121,037 acres)	21%↑ (122,817 acres)
Spruce-fir forest PNVT current conditions: 17,667 acres of which 61% or 10,777 acres with woody canopy cover > 30%				
15	11%↑ (12,014 acres)	13%↑ (12,190 acres)	13%↑ (12,190 acres)	13%↑ (12,190 acres)
50	2%↑ (10,954 acres)	3%↑ (11,130 acres)	3%↑ (11,130 acres)	0%↔ (10,777 acres)
All A-SNFs Modeled Closed canopy forest types (WMCF+SFF): 195,662 acres of which 57% or 112,234 acres with woody canopy cover > 30%				
15	12%↑ (125,930 acres)	14%↑ (127,887 acres)	12%↑ (126,107 acres)	14%↑ (127,887 acres)
50	16%↑ (130,210 acres)	19%↑ (133,947 acres)	18%↑ (132,167 acres)	19%↑ (133,593 acres)

¹Woody canopy closure classes are: 0 to < 10% is defined as very open canopy; ≥ 10 to ≤ 30% is defined as open canopy; and > 30% is defined as closed canopy. Under HRV and for DC ponderosa pine and dry mixed conifer forests should exhibit open canopies (≥ 10 to ≤ 30% woody canopy cover). Therefore, the lower the amounts of closed woody canopy cover, the closer these two PNVTs are to their HRV and forest plan DCs. Under HRV and for DC wet mixed conifer and spruce-fir forests should exhibit closed canopies (> 30% woody canopy cover). Therefore, the higher the amount of closed woody canopy cover, the closer these two PNVTs are to their HRV and forest plan DCs

Appendix I table 3, overall summary of the proposed low acre treatment objectives for alternatives B, C and D, and alternative A, by the end of the 15-year planning period and the 50-year modeling period for most open canopy for ponderosa pine and dry mixed conifer forest PNVTs (greatest to least); and most closed canopy for wet mixed conifer and spruce-fir forest PNVTs (greatest to least):

- Ponderosa pine forest PNVT
Most open canopy at the end of the 15-year planning period: alternatives **A**, then equally B and D, and lastly C
Most open canopy at the end of the 50-year modeling period: alternatives **A**, then C, B, and lastly D
- Dry mixed conifer forest PNVT
Most open canopy at the end of the 15-year planning period: alternatives **A**, then B, and lastly equally C and D
Most open canopy at the end of the 50-year modeling period: alternatives **A**, then B, C, and lastly D
- All A-SNFs Modeled Open (Ponderosa pine and Dry mixed conifer) Forested PNVTs
Most open canopy at the end of the 15-year planning period: alternatives **A**, then B, C, and lastly D
Most open canopy at the end of the 50-year modeling period: alternatives **A**, then C, B, and lastly D
- Wet mixed conifer forest PNVT
Most closed canopy at the end of the 15-year planning period: alternatives equally **B and D**, then A and lastly C
Most closed canopy at the end of the 50-year modeling period: alternatives equally **B and D**, then A, and lastly C
- Spruce-fir forest PNVT
Most closed canopy at the end of the 15-year planning period: alternatives equally **B, C and D**, and then A
Most closed canopy at the end of the 50-year modeling period: alternatives equally **B and D**, then A, and lastly C
- All A-SNFs Modeled Closed (Wet mixed conifer and Spruce-fir) Forested PNVTs
Most closed canopy at the end of the 15-year planning period: alternatives equally **B and D**, and then equally A and C
Most closed canopy at the end of the 50-year modeling period: alternatives equally **B and D**, then C, and lastly A

All A-SNFs Modeled Woodland and Grassland PNVTs

15-Year Planning Period and the 50-Year Modeling Period Proposed High Acre Treatment Objectives

Appendix I table 4. Comparisons, based on the proposed high acre treatment objectives for alternatives B, C and D, and alternative A, by the end of the 15-year planning period and the 50-year modeling period, of the percentage and acreage changes in closed woody canopy cover¹ within the historically open woodland (Madrean pine-oak woodland (MPOW) and piñon-juniper woodland (PJW)) PNVTs, and very open grassland (Great Basin grassland (GBG) and semi-desert grassland (SDG)) PNVTs on the A-SNFs

Percent and Acreage Display Amount of Change Within Each PNVT that has Closed Woody Canopy Cover Greater than 30 Percent in Woodland PNVTs and Greater than 10 Percent in Grassland PNVTs (arrows indicate direction of change in woody canopy cover; ↑ increase, ↓ decrease, or ↔ no change)				
Years	proposed high treatment objectives			
	alternative A percent and (acreage)	alternative B percent and (acreage)	alternative C percent and (acreage)	alternative D percent and (acreage)
Madrean pine-oak woodland PNVT current conditions: 394,927 acres of which 78% or 308,043 acres with woody canopy cover > 30%				
15	3%↓ (300,145 acres)	24%↓ (233,007 acres)	17%↓ (256,703 acres)	44%↓ (173,768 acres)
50	6%↓ (288,297 acres)	45%↓ (169,819 acres)	38%↓ (189,565 acres)	63%↓ (114,529 acres)
Piñon-juniper woodland PNVT current conditions: 222,166 acres of which 22% or 48,877 acres with woody canopy cover > 30%				
15	82%↑ (88,866 acres)	36%↑ (66,650 acres)	45%↑ (71,093 acres)	0%↔ (48,877 acres)
50	191%↑ (142,186 acres)	82%↑ (88,866 acres)	118%↑ (106,640 acres)	5%↑ (51,098 acres)
All A-SNFs Modeled Open Woodland types total current conditions (MPOW+PJW): 617,093 acres of which 58% or 356,920 acres with woody canopy cover > 30%				
15	9%↑ (389,011 acres)	16%↓ (299,657 acres)	8%↑ (327,796 acres)	38%↓ (222,644 acres)
50	21%↑ (430,483 acres)	28%↓ (258,685 acres)	17%↓ (296,205 acres)	54%↓ (165,627 acres)
Great Basin grassland PNVT current conditions: 185,523 acres of which 89% or 165,190 acres with woody canopy cover > 10%				
15	5%↓ (157,757 acres)	75%↓ (40,815 acres)	7%↓ (153,984 acres)	70%↓ (50,091 acres)
50	2%↓ (162,647 acres)	55%↓ (74,209 acres)	8%↓ (152,129 acres)	61%↓ (64,933 acres)
Semi-desert grassland PNVT current conditions: 106,952 acres of which 79% or 84,492 acres with woody canopy cover > 10%				
15	6%↑ (89,840 acres)	19%↓ (68,449 acres)	4%↑ (87,701 acres)	19%↓ (68,449 acres)
50	19%↑ (100,535 acres)	37%↓ (53,476 acres)	16%↑ (98,396 acres)	37%↓ (53,476 acres)
All A-SNFs Modeled Very Open Grassland types total current conditions (GBG+SDG): 292,475 acres of which 85% or 249,682 acres with woody canopy cover > 10%				
15	1%↓ (246,597 acres)	56%↓ (109,264 acres)	3%↓ (241,685 acres)	53%↓ (118,540 acres)
50	5%↑ (263,182 acres)	49%↓ (127,685 acres)	0%↔ (250,525 acres)	53%↓ (118,409 acres)

¹ Woody canopy closure classes are: 0 to < 10% is defined as very open canopy; ≥ 10 to ≤ 30% is defined as open canopy; and > 30% is defined as closed canopy. Under HRV and for DC Madrean pine-oak and piñon-juniper woodlands should exhibit open canopies (≥ 10 to ≤ 30% woody canopy cover). Under HRV and for DC Great Basin and semi-desert grasslands should exhibit very open canopies (0 to ≤ 10% woody canopy cover); grasslands, by definition, should not be dominated by woody species canopy cover. Therefore, the lower the amounts of closed woody canopy cover, the closer these four PNVTs are to their HRV and forest plan DCs

Appendix I table 4, overall summary of the proposed high acre treatment objectives for alternatives B, C and D, and alternative A, by the end of the 15-year planning period and the 50-year modeling period most open canopy for Madrean pine-oak and piñon-juniper woodland PNVTs, and Great Basin and semi-desert grassland PNVTs (greatest to least):

- Madrean pine-oak woodland PNVT
Most open canopy at the end of the 15-year planning period: alternatives **D**, then B, C, and lastly A
Most open canopy at the end of the 50-year modeling period: alternatives **D**, then B, C, and lastly A
- Piñon-juniper woodland PNVT
Most open canopy at the end of the 15-year planning period: alternatives **D**, then B, C, and lastly A
Most open canopy at the end of the 50-year modeling period: alternatives **D**, then B, C, and lastly A
- All A-SNFs Modeled Open Woodland PNVTs
Most open canopy at the end of the 15-year planning period: alternatives **D**, then B, A, and lastly C
Most open canopy at the end of the 50-year modeling period: alternatives **D**, then B, C, and lastly A
- Great Basin grassland PNVT
Most open canopy at the end of the 15-year planning period: alternatives **D**, then B, C, and lastly A
Most open canopy at the end of the 50-year modeling period: alternatives **D**, then B, C, and lastly A
- Semi-desert grassland PNVT
Most open canopy at the end of the 15-year planning period: alternatives equally **B and D**, then C, and lastly A
Most open canopy at the end of the 50-year modeling period: alternatives equally **B and D**, then C, and lastly A
- All A-SNFs Modeled Very Open Grassland PNVTs
Most open canopy at the end of the 15-year planning period: alternatives **B** then D, C, and lastly A
Most open canopy at the end of the 50-year modeling period: alternatives **D**, then B, C, and lastly A

All A-SNFs Modeled Woodland and Grassland PNVTs

15-Year Planning Period and the 50-Year Modeling Period Proposed Average Acre Treatment Objectives

Appendix I table 5. Comparisons, based on the proposed average acre treatment objectives for alternatives B, C and D, and alternative A, by the end of the 15-year planning period and the 50-year modeling period, of the percentage and acreage changes in closed woody canopy cover¹ within the historically open woodland (Madrean pine-oak woodland (MPOW) and piñon-juniper woodland (PJW)) PNVTs, and very open grassland (Great Basin grassland (GBG) and semi-desert grassland (SDG)) PNVTs on the A-SNFs

Percent and Acreage Display Amount of Change Within Each PNVT that has Closed Woody Canopy Cover Greater than 30 Percent in Woodland PNVTs and Greater than 10 Percent in Grassland PNVTs (arrows indicate direction of change in woody canopy cover; ↑ increase, ↓ decrease, or ↔ no change)				
Years	proposed average treatment objectives			
	alternative A percent and (acreage)	alternative B percent and (acreage)	alternative C percent and (acreage)	alternative D percent and (acreage)
Madrean pine-oak woodland PNVT current conditions: 394,927 acres of which 78% or 308,043 acres with woody canopy cover > 30%				
15	3%↓ (300,145 acres)	15%↓ (260,652 acres)	8%↓ (282,373 acres)	25%↓ (231,032 acres)
50	6%↓ (288,297 acres)	33%↓ (207,337 acres)	24%↓ (233,007 acres)	42%↓ (177,717 acres)
Piñon-juniper woodland PNVT current conditions: 222,166 acres of which 22% or 48,877 acres with woody canopy cover > 30%				
15	82%↑ (88,866 acres)	52%↑ (74,426 acres)	61%↑ (78,869 acres)	32%↑ (64,428 acres)
50	191%↑ (142,186 acres)	116%↑ (105,529 acres)	145%↑ (119,970 acres)	70%↑ (83,312 acres)
All A-SNFs Modeled Open Woodland types total current conditions (MPOW+PJW): 617,093 acres of which 58% or 356,920 acres with woody canopy cover > 30%				
15	9%↑ (389,011 acres)	6%↓ (335,077 acres)	1%↑ (361,242 acres)	17%↓ (295,460 acres)
50	21%↑ (430,483 acres)	12%↓ (312,866 acres)	1%↓ (352,977 acres)	27%↓ (261,029 acres)
Great Basin grassland PNVT current conditions: 185,523 acres of which 89% or 165,190 acres with woody canopy cover > 10%				
15	5%↓ (157,757 acres)	63%↓ (61,223 acres)	7%↓ (153,984 acres)	57%↓ (70,499 acres)
50	2%↓ (162,647 acres)	56%↓ (73,282 acres)	8%↓ (152,129 acres)	58%↓ (69,571 acres)
Semi-desert grassland PNVT current conditions: 106,952 acres of which 79% or 84,492 acres with woody canopy cover > 10%				
15	6%↑ (89,840 acres)	16%↓ (70,588 acres)	4%↑ (87,701 acres)	16%↓ (70,588 acres)
50	19%↑ (100,535 acres)	30%↓ (59,358 acres)	16%↑ (98,398 acres)	30%↓ (59,358 acres)
All A-SNFs Modeled Very Open Grassland types total current conditions (GBG+SDG): 292,475 acres of which 85% or 249,682 acres with woody canopy cover > 10%				
15	1%↓ (246,597 acres)	47%↓ (131,811 acres)	3%↓ (241,685 acres)	43%↓ (141,087 acres)
50	5%↑ (263,182 acres)	47%↓ (132,640 acres)	0%↔ (250,525 acres)	48%↓ (128,929 acres)

¹ Woody canopy closure classes are: 0 to < 10% is defined as very open canopy; ≥ 10 to ≤ 30% is defined as open canopy; and > 30% is defined as closed canopy. Under HRV and for DC Madrean pine-oak and piñon-juniper woodlands should exhibit open canopies (≥ 10 to ≤ 30% woody canopy cover). Under HRV and for DC Great Basin and semi-desert grasslands should exhibit very open canopies (0 to ≤ 10% woody canopy cover); grasslands, by definition, should not be dominated by woody species canopy cover. Therefore, the lower the amounts of closed woody canopy cover, the closer these four PNVTs are to their HRV and forest plan DCs

Appendix I table 5, overall summary of the proposed average acre treatment objectives for alternatives B, C and D, and alternative A, by the end of the 15-year planning period and the 50-year modeling period most open canopy for Madrean pine-oak and piñon-juniper woodland PNVTs, and Great Basin and semi-desert grassland PNVTs (greatest to least):

- Madrean pine-oak woodland PNVT
Most open canopy at the end of the 15-year planning period: alternatives **D**, then B, C, and lastly A
Most open canopy at the end of the 50-year modeling period: alternatives **D**, then B, C, and lastly A
- Piñon-juniper woodland PNVT
Most open canopy at the end of the 15-year planning period: alternatives **D**, then B, C, and lastly A
Most open canopy at the end of the 50-year modeling period: alternatives **D**, then B, C, and lastly A
- All A-SNFs Modeled Open Woodland PNVTs
Most open canopy at the end of the 15-year planning period: alternatives **D**, then B, C, and lastly A
Most open canopy at the end of the 50-year modeling period: alternatives **D**, then B, C, and lastly A
- Great Basin grassland PNVT
Most open canopy at the end of the 15-year planning period: alternatives **B**, then D, C, and lastly A
Most open canopy at the end of the 50-year modeling period: alternatives **D**, then B, C, and lastly A
- Semi-desert grassland PNVT
Most open canopy at the end of the 15-year planning period: alternatives **B**, then D, C, and lastly A
Most open canopy at the end of the 50-year modeling period: alternatives **D**, then B, C, and lastly A
- All A-SNFs Modeled Very Open Grassland PNVTs
Most open canopy at the end of the 15-year planning period: alternatives **B**, then D, C, and lastly A
Most open canopy at the end of the 50-year modeling period: alternatives **D**, then B, C, and lastly A

Modeled Woodland and Grassland PNVTs

15-Year Planning Period and the 50-Year Modeling Period Proposed Low Acre Treatment Objectives

Appendix I table 6. Comparisons, based on the proposed low acre treatment objectives for alternatives B, C and D, and alternative A, by the end of the 15-year planning period and the 50-year modeling period, of the percentage and acreage changes in closed woody canopy cover¹ within the historically open woodland (Madrean pine-oak woodland (MPOW) and piñon-juniper woodland (PJW)) PNVTs, and very open grassland (Great Basin grassland (GBG) and semi-desert grassland (SDG)) PNVTs on the A-SNFs

Percent and Acreage Display Amount of Change Within Each PNVT that has Closed Woody Canopy Cover Greater than 30 Percent in Woodland PNVTs and Greater than 10 Percent in Grassland PNVTs (arrows indicate direction of change in woody canopy cover; ↑ increase, ↓ decrease, or ↔ no change)				
Years	proposed low treatment objectives			
	alternative A percent and (acreage)	alternative B percent and (acreage)	alternative C percent and (acreage)	alternative D percent and (acreage)
Madrean pine-oak woodland PNVT current conditions: 394,927 acres of which 78% or 308,043 acres with woody canopy cover > 30%				
15	3%↓ (300,145 acres)	6%↓ 288,297 acres)	0%↓ (308,043 acres)	6%↓ (288,297 acres)
50	6%↓ (288,297 acres)	21%↓ (244,855 acres)	10%↓ (276,449 acres)	22%↓ (240,905 acres)
Piñon-juniper woodland PNVT current conditions: 222,166 acres of which 22% or 48,877 acres with woody canopy cover > 30%				
15	82%↑ (88,866 acres)	68%↑ 82,201 acres)	77%↑ (86,645 acres)	64%↑ (79,980 acres)
50	191%↑ (142,186 acres)	150%↑ (122,191 acres)	173%↑ (133,300 acres)	136%↑ (115,526 acres)
All A-SNFs Modeled Open Woodland types total current conditions (MPOW+PJW): 617,093 acres of which 58% or 356,920 acres with woody canopy cover > 30%				
15	9%↑ (389,011 acres)	4%↑ (370,498 acres)	11%↑ (394,688 acres)	3%↑ (368,276 acres)
50	21%↑ (430,483 acres)	3%↑ (367,046 acres)	15%↑ (409,749 acres)	0%↔ (356,432 acres)
Great Basin grassland PNVT current conditions: 185,523 acres of which 89% or 165,190 acres with woody canopy cover > 10%				
15	5%↓ (157,757 acres)	51%↓ (81,630 acres)	7%↓ (153,984 acres)	45%↓ (90,906 acres)
50	2%↓ (162,647 acres)	56%↓ (72,354 acres)	8%↓ (152,129 acres)	55%↓ (74,209 acres)
Semi-desert grassland PNVT current conditions: 106,952 acres of which 79% or 84,492 acres with woody canopy cover > 10%				
15	6%↑ (89,840 acres)	14%↓ (72,727 acres)	4%↑ (87,701 acres)	14%↓ (72,727 acres)
50	19%↑ (100,535 acres)	23%↓ (65,241 acres)	16%↑ (98,396 acres)	23%↓ (65,241 acres)
All A-SNFs Modeled Very Open Grassland types total current conditions (GBG+SDG): 292,475 acres of which 85% or 249,682 acres with woody canopy cover > 10%				
15	1%↓ (246,597 acres)	38%↓ (154,357 acres)	3%↓ (241,685 acres)	34%↓ (163,634 acres)
50	5%↑ (263,182 acres)	45%↓ (137,595 acres)	0%↔ (250,525 acres)	44%↓ (139,450 acres)

¹ Woody canopy closure classes are: 0 to < 10% is defined as very open canopy; ≥ 10 to ≤ 30% is defined as open canopy; and > 30% is defined as closed canopy. Under HRV and for DC Madrean pine-oak and piñon-juniper woodlands should exhibit open canopies (≥ 10 to ≤ 30% woody canopy cover). Under HRV and for DC Great Basin and semi-desert grasslands should exhibit very open canopies (0 to ≤ 10% woody canopy cover); grasslands, by definition, should not be dominated by woody species canopy cover. Therefore, the lower the amounts of closed woody canopy cover, the closer these four PNVTs are to their HRV and forest plan DCs

Appendix I table 6, overall summary of the proposed low acre treatment objectives for alternatives B, C and D, and alternative A, by the end of the 15-year planning period and the 50-year modeling period most open canopy for Madrean pine-oak and piñon-juniper woodland PNVTs, and Great Basin and semi-desert grassland PNVTs (greatest to least):

- Madrean pine-oak woodland PNVT
Most open canopy at the end of the 15-year planning period: alternatives equally **B and D**, then A, and lastly C
Most open canopy at the end of the 50-year modeling period: alternatives **D**, then B, C, and lastly A
- Piñon-juniper woodland PNVT
Most open canopy at the end of the 15-year planning period: alternatives **D**, then B, C, and lastly A
Most open canopy at the end of the 50-year modeling period: alternatives **D**, then B, C, and lastly A
- All A-SNFs Modeled Open Woodland PNVTs
Most open canopy at the end of the 15-year planning period: alternatives **D**, then B, C, and lastly A
Most open canopy at the end of the 50-year modeling period: alternatives **D**, then B, C, and lastly A
- Great Basin grassland PNVT
Most open canopy at the end of the 15-year planning period: alternatives **B**, then D, C, and lastly A
Most open canopy at the end of the 50-year modeling period: alternatives **B**, then D, C, and lastly A
- Semi-desert grassland PNVT
Most open canopy at the end of the 15-year planning period: alternatives equally **B and D**, then C, and lastly A
Most open canopy at the end of the 50-year modeling period: alternatives equally **B and D**, then C, and lastly A
- All A-SNFs Modeled Very Open Grassland PNVTs
Most open canopy at the end of the 15-year planning period: alternatives **B**, then D, C, and lastly A
Most open canopy at the end of the 50-year modeling period: alternatives **D**, then B, C, and lastly A

“The land ethic simply enlarges the boundaries of the community to include soils, waters, plants, and animals, or collectively: the land... ...We abuse land because we regard it as a commodity belonging to us. When we see land as a community to which we belong, we may begin to use it with love and respect.”

ALDO LEOPOLD

– The End –

A-SNFs’ Vegetation Specialist’s Report for Forest Plan Revision