Environmental Assessment for the Hart Prairie Fuels Reduction and Forest Health Restoration Project

Coconino National Forest
# Table of Contents

## CHAPTER 1 – PURPOSE AND NEED

- **Document Structure** ........................................................................................................................................................................... 1
- **Background** .......................................................................................................................................................................................... 1
- **Project Location** ..................................................................................................................................................................................... 4
- **Purpose and Need for Action** .................................................................................................................................................................. 4
  - Forest Health .......................................................................................................................................................................................... 5
  - Wildfire Hazard ...................................................................................................................................................................................... 8
  - Watershed Conditions .......................................................................................................................................................................... 10
- **Proposed Action** ................................................................................................................................................................................ 10
- **Forest Plan Consistency** ..................................................................................................................................................................... 11
- **Decision Framework** .......................................................................................................................................................................... 11
- **Public Involvement** ........................................................................................................................................................................... 11
- **Issues** .................................................................................................................................................................................................. 12

## CHAPTER 2 – ALTERNATIVES

- **Alternatives** ........................................................................................................................................................................................... 14
  - Alternative 1: No Action ........................................................................................................................................................................ 14
  - Alternative 2: Proposed Action ............................................................................................................................................................ 14
  - Design Features Specific to Alternative 2 ............................................................................................................................................... 18
  - Comparison of Alternatives .................................................................................................................................................................. 23

## CHAPTER 3 – AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

- **Silviculture** .................................................................................................................................................................................................. 29
  - Affected Environment ........................................................................................................................................................................... 29
  - Alternative 1 - No Action .................................................................................................................................................................... 37
    - Direct and Indirect Effects .................................................................................................................................................................. 37
    - Cumulative Effects ........................................................................................................................................................................... 44
  - Alternative 2 - Proposed Action ............................................................................................................................................................. 45
    - Direct and Indirect Effects ................................................................................................................................................................. 45
    - Cumulative Effects ........................................................................................................................................................................... 56
- **Fire and Fuels** ............................................................................................................................................................................................ 58
  - Affected Environment ........................................................................................................................................................................... 58
  - Alternative 1: No Action .................................................................................................................................................................... 60
    - Direct and Indirect Effects .................................................................................................................................................................. 60
    - Cumulative Effects ........................................................................................................................................................................... 60
  - Alternative 2: Proposed Action ............................................................................................................................................................. 61
    - Direct and Indirect Effects ................................................................................................................................................................. 61
    - Cumulative Effects ........................................................................................................................................................................... 62
- **Wildlife** ........................................................................................................................................................................................................... 63
  - Threatened, Endangered and Forest Service Sensitive (TES) Wildlife Species ......................................................................................... 63
    - Mexican Spotted Owl ........................................................................................................................................................................ 64
    - Black-footed Ferret ............................................................................................................................................................................. 69
    - Bald Eagle ......................................................................................................................................................................................... 70
    - Northern Goshawk ........................................................................................................................................................................... 72
    - American Peregrine Falcon .............................................................................................................................................................. 74
    - Western Burrowing Owl .................................................................................................................................................................... 75
    - Ferruginous Hawk ............................................................................................................................................................................ 76
Navajo Mogollon Vole ................................................................. 77
Long-tailed Vole ........................................................................ 78
Dwarf Shrew .............................................................................. 79
Merriam’s Shrew ...................................................................... 80
Allen’s Lappet-browed Bat ....................................................... 81
Pale Townsend’s Big-eared Bat ............................................... 82
Greater Western Mastiff Bat ...................................................... 84
Invertebrates ............................................................................. 85
Northern Leopard Frog ............................................................. 86
Management Indicator Species .................................................. 87
Abert Squirrel ........................................................................... 87
Red Squirrel .............................................................................. 89
Mexican Spotted Owl ............................................................... 90
Northern Goshawk ................................................................... 91
Pygmy Nuthatch ...................................................................... 92
Turkey ....................................................................................... 93
Elk ............................................................................................. 94
Hairy Woodpecker .................................................................... 95
Mule Deer ................................................................................ 96
Red-naped (Yellow-bellied) Sapsucker ..................................... 97
Pronghorn Antelope .................................................................. 98
Lincoln’s sparrow ..................................................................... 99
Macroinvertebrates ................................................................... 100
Migratory Birds ........................................................................ 101
SPECIAL STATUS PLANTS .......................................................... 105
Affected Environment ............................................................... 106
Alternative 1: No Action ......................................................... 106
Direct and Indirect Effects ........................................................ 106
Cumulative effects .................................................................. 106
Alternative 2: Proposed Action ................................................. 106
Direct and Indirect Effects ........................................................ 106
Cumulative Effects .................................................................. 107
NOXIOUS OR INVASIVE WEEDS .............................................. 109
Affected Environment ............................................................... 109
Alternative 1: No Action ......................................................... 110
Direct and Indirect Effects ........................................................ 110
Cumulative Effects .................................................................. 110
Alternative 2: Proposed Action ................................................. 111
Direct and Indirect Effects ........................................................ 111
Cumulative Effects .................................................................. 112
SOILS ......................................................................................... 113
Affected Environment ............................................................... 113
Alternative 1: No Action ......................................................... 114
Direct and Indirect Effects-SOILS .......................................... 114
Cumulative Effects .................................................................. 115
Alternative 2: Proposed Action ................................................. 116
Direct and Indirect Effects ........................................................ 116
Cumulative Effects .................................................................. 119
WATER RESOURCES ................................................................. 120
Affected Environment ............................................................... 120
Alternative 1: No Action ......................................................... 120
List of Tables

Table 1. Forest structure existing and desired values within northern goshawk habitat .................. 6
Table 2. Wildfire hazard existing and desired values ..................................................................... 9
Table 3. Summary of environmental consequences by alternative .............................................. 23
Table 4. Vegetative Structural Stage definitions ......................................................................... 30
Table 5. Basal area, trees per acre, and percent canopy cover by VSS and cover type within the project area (values are expressed in ranges, with averages in parentheses) .................. 30
Table 6. Basal area, trees per acre, and canopy cover within Mexican spotted owl habitat in the project area (values are expressed in ranges, with averages in parentheses) .................. 31
Table 7. Basal area and trees per acre within the aspen cover type (values are expressed as ranges, with averages in parentheses) ................................................................. 34
Table 8. Vegetative Structural Stage (VSS), basal area, trees per acre, and percent canopy cover under the No Action Alternative (values are expressed as ranges, with averages in parentheses) ....... 37
Table 9. Percent Vegetative Structural Stage distribution within northern goshawk habitat under the No Action Alternative ........................................................................................................... 39
Table 10. Average percent canopy cover across northern goshawk habitat under the No Action Alternative (values are expressed as ranges, with averages in parentheses) .................. 40
Table 11. Basal area, trees per acre, and percent canopy cover within Mexican spotted owl habitat under the No Action Alternative (values are expressed as ranges, with averages in parentheses) 41
Table 12. Basal area and trees per acre within the aspen cover type under the No Action Alternative (values are expressed as ranges, with averages in parentheses) ................................................................. 43
Table 13. Vegetative Structural Stage (VSS), basal area, trees per acre, and percent canopy cover under the Proposed Action (values are expressed as ranges, with averages in parentheses) ....... 47
Table 14. Percent of Vegetative Structural Stage distribution within northern goshawk habitat under the Proposed Action ........................................................................................................... 48
Table 15. Average percent canopy cover across northern goshawk habitat under the Proposed Action (values are expressed as ranges, with averages in parentheses) ................................................................. 50
Table 16. Basal area, trees per acre, and canopy cover within Mexican spotted owl habitat under the Proposed Action (values are expressed as ranges, with averages in parentheses) .................. 51
Table 17. Developing old-growth designated by cover type under the Proposed Action .................. 51
Table 18. Comparison of old-growth development after 40 years under the No Action Alternative and the Proposed Action .................................................................................................................. 52
Table 19. Developing old-growth designated by Ecosystem Management Area under the Proposed Action ................................................................................................................................. 52
Table 20. Basal area and trees per acre within the aspen cover type under the Proposed Action (values are expressed as ranges, with averages in parentheses) ................................................................. 54
Table 21. Fire regime and condition class within the project area ................................................... 59
Table 22. Fire hazard rating under the Proposed Action ................................................................. 61
Table 23. Cumulative change in fire hazard rating........................................................................... 63
Table 25. TES wildlife species that are present or have habitat within the project area .................. 63
Table 26. Existing acres of MSO habitat within the project area .................................................... 64
Table 27. Acres of treatments proposed in MSO habitat ................................................................. 67
Table 28. Management Indicator Species within the project area with their indicator habitats and 
forest trends ...................................................................................................................................... 87
Table 29. Noxious or invasive weeds detected in the project area .................................................. 109
Table 30. Soil erosion hazard rating in project area (acres are approximate) ................................. 113
Table 31. Natural revegetation data within the project area (acres are approximate) .................... 114
Table 32. Natural regeneration data within the project area (acres are approximate) ..................... 114
Table 33. Summary of direct soil effects for the No Action Alternative (acres are approximate) .... 115
Table 34. Acres of treatment type on severe erosion hazard soils (acres are approximate) .......... 116
Table 35. Summary of direct soil effects for the Proposed Action (acres are approximate) .............. 118
Table 36. Revegetation potential by treatment types (acres are approximate) ............................... 118
Table 37. Natural regeneration potential by treatment types (acres are approximate) ................... 119
Table 38. Summary of cumulative ground disturbance soil effects for Proposed Action (acres are 
approximate) ................................................................................................................................. 119
Table 39. Emissions comparison .................................................................................................... 124

List of Figures

Figure 1. Vicinity and project area map for the Hart Prairie Fuels Reduction and Forest Health 
Restoration Project ......................................................................................................................... 5
Figure 2. Map of Alternative B: Proposed Action ............................................................................ 17
Figure 3. Aspen decline in the project area, 1999-2007 ................................................................. 33
Figure 4. Changes in stand density in southwestern ponderosa pine, non-reserved forest lands, New 
Mexico and Arizona (source: USDA Forest Service, Southwestern Region 2004) ................. 45
Figure 5. Mexican spotted owl and northern goshawk habitat map ............................................. 65
Figure 6. Protected streamcourses, springs and wetlands in the project area ............................ 121
Figure 7. Recreation Opportunity Spectrum in the project area .................................................... 130
Chapter 1 – Purpose and Need

Document Structure
The Forest Service has prepared this Environmental Assessment in compliance with the National Environmental Policy Act (NEPA) and other relevant federal and state laws and regulations. This Environmental Assessment discloses the direct, indirect, and cumulative environmental impacts that would result from the proposed action and alternatives. The document is organized into the following chapters:

- Purpose and Need: includes information on the history of the project proposal, the purpose of and need for the project, and the agency’s proposal for achieving that purpose and need. This section also details how the Forest Service informed the public of the proposal and how the public responded.
- Alternatives: provides a more detailed description of the agency’s proposed action as well as the No Action alternative. This discussion also includes mitigation measures. Finally, this section provides a summary table of the environmental consequences associated with each alternative.
- Affected Environment and Environmental Consequences: describes the environmental effects of implementing the proposed action and other alternatives. This analysis is organized by resource area. Within each section, the affected environment is described first, followed by the effects of the No Action Alternative that provides a baseline for evaluation and comparison of the proposed action that follows.
- Consultation and Coordination: provides a list of agencies consulted and/or contacted during the development of the environmental assessment.
- References: provides the references for citations used throughout this document.
- List of Preparers: lists those persons who assisted in the preparation of this document.
- Appendices: provide more detailed information to support the analyses presented in the environmental assessment.

Background

Historical conditions

Ponderosa pine forests of northern Arizona were historically characterized by frequent, low-intensity surface fires occurring every 2 to 12 years. This historic fire regime maintained an open forest structure with variable, patchy tree distribution by thinning many of the smaller trees before they grew large enough to become fire-resistant (Moir et al. 1997, Covington et al. 1997). The forests were uneven-aged and consisted of few small diameter trees and a greater number of large, older trees arranged in groups and interspersed with grassy openings (Moore et al. 2004, White 1985). Trees were arranged in groups of 2-40 trees up to 0.7 acres in size (White 1985, Fule et al. 1993).

Aspens historically occurred as pure stands or “clones” interspersed within pine and mixed conifer forests at higher elevations and on moister sites. Aspen is a clonal organism that reproduces primarily by vegetative root suckering, which is usually stimulated by some form of disturbance (Strand et al. 2009). This disturbance frequently results in the death of overstory trees and a profusion of young aspen shoots which regenerate the stand.

Riparian vegetation, such as Bebb willow, were restricted to the few riparian habitats present, but historically experienced little browsing due to the absence of large populations of native ungulates.
Changes following Euro-American settlement

After Euro-American settlement, several conditions, including fire exclusion, livestock grazing, high-grade timber harvesting, and climatic events, favored dense ponderosa pine regeneration (Long and Smith 2000). High-grade timber harvesting was conducted in and around the project area around the turn of the 20th century to provide wood to supply local and regional economies. During this logging era, many of the older trees were removed. Livestock grazing removed fuels which previously carried ground fires and also reduced grass competition with pine seedlings. In 1919, an unprecedented regeneration event occurred, resulting in tremendous numbers of pine seedlings becoming established. In the absence of fire and with limited overstory shading, these seedlings continued to grow in dense stands, forming a closed-canopy forest across much of the landscape. These conditions inhibited further regeneration of shade-intolerant ponderosa pine in subsequent decades (as well as many herbaceous understory species). As a result of these events, ponderosa pine forests of the Southwest are now predominantly even-aged and consist of dense, crowded stands of ponderosa pine with closed canopies and few trees less than 5 inches diameter at breast height (dbh) or greater than 24 inches dbh. This dense, even-aged forest structure has resulted in increased fire hazard and severity and increased risk of mortality from insects and disease. Forests that are naturally even-aged are adapted to catastrophic, stand-replacing disturbances, such as moderate to high severity fire and insect epidemics, and tend to regenerate quickly following these events. However, ponderosa pine forests in the southwest are not adapted to such a disturbance regime and may take centuries to regenerate or simply convert to grassland.

Fire exclusion also resulted in reduced regeneration of aspen stands and allowed encroachment of conifers into aspen stands and meadows, gradually converting these areas to conifer forests. Historical photographs, accounts, and maps indicate that there has been a dramatic reduction in the extent of both aspen and meadows since the early 1900s (see Photo 1 and 2). Aspen communities across the Coconino National Forest have been in a gradual state of decline over the past 50 years. However, aerial and ground detection surveys have determined an alarming rate of decline in aspen across northern Arizona over the past decade since defoliation by a severe frost event that occurred in early June of 1999 (Fairweather et al. 2008). Many aspen clones are nearing 100% mortality. Increased mortality is caused by a variety of factors, including drought, canker fungi, bark beetles, wood borers, and root disease. Monitoring plots located in aspen clones across the forest exhibit a combination of symptoms including reduced canopies, branch dieback, increased mortality, and either non-existent aspen regeneration success or elk browsing damage approaching 100 percent (Fairweather et al. 2008). There is little evidence on the San Francisco Peaks of successful aspen recruitment over the last several decades due in large part to browsing by elk and deer, and livestock in some areas. Even in areas where large fires have occurred, such as the 1996 Hochderffer fire which burned areas within and adjacent to the project area, extensive acreages of aspen sprouts failed to result in successful regeneration of aspen stands, primarily due to heavy elk browsing. Some areas that were fenced after the fire to keep elk out produced dense stands of young aspen trees until fences were damaged by falling snags. Subsequent elk damage and browsing has converted many of these areas to grassland. The damage can be attributed to elk with certainty since there was no domestic livestock grazing in the area. Mortality of mature aspen coupled with a lack of successful regeneration is expected to result in an eventual type conversion from aspen to conifers or grassland at a landscape scale within the next 80-200 years (Strand et al. 2009). Loss of aspen clones at a landscape scale signifies a tremendous loss of biodiversity, with aspen decline cascading into losses of vertebrate species, vascular plants, and likely other groups of organisms (Strand et al. 2009).
Chapter 1 – Purpose and Need

Photo 1. Fern Mountain in the Hart Prairie project area taken 1880

Photo 2. Fern Mountain in the Hart Prairie project area taken 1980
The Rocky Mountain elk which are inhibiting successful regeneration of dying aspen stands are not native to the project area, and were another change introduced to the ecosystem in the early 1900s. Merriam’s elk (native to the Southwest) formerly inhabited the White Mountains in eastern Arizona but were extirpated by the 1920’s (Hoffmeister 1986). Notably, early explorers and trained naturalists who visited the area around the San Francisco Peaks and described the area in detail did not detect their presence (Davis 2001). Between 1913 and 1928, Rocky Mountain elk from Wyoming were released in the area with great success. Davis (2001) suggests that the tremendous increase in elk numbers and distribution in Arizona following Euro-American settlement was due to an increased availability of water. Prior to settlement, the area contained few live streams and wet meadows. During the twentieth century, thousands of stock tanks were constructed to support domestic livestock. This effort also provided elk with greatly improved and expanded habitat (Davis 2001).

Bebb willow and other riparian species found in wetlands also suffer from damage from elk, and to some extent deer. Bebb willow is a native wetland/riparian species of particular conservation concern because of its limited distribution and limited successful regeneration in recent decades. Natural springs are rare habitats in the project area that support a wide range of plant and animal species vulnerable to impacts of intense grazing and browsing by elk and deer, and livestock where present.

Changes in historic fire regimes over the past century have resulted in increased conifer densities, surface fuel accumulation, increased fuel continuity, changes in age and size class diversity, changes in successional dynamics, altered insect and disease dynamics, decreased understory productivity and diversity, decreased tree health, growth and vigor, increased crown fire potential, increased fire size and intensity and pine encroachment in meadows and drainage bottoms (Long 2003). Most of the project area shows a significant departure from natural conditions, and a wildfire occurring under existing conditions would result in more severe effects than would occur under the natural fire regime. In addition to the ecological impacts of these changes, there is an increased risk to firefighter and public safety with the potential for extreme fire behavior. The communities within the Hart Prairie project area are currently at risk from a wildfire and were included in the Community Wildfire Protection Plan for Flagstaff and Surrounding Communities (GFFP and PFAC 2005).

**Project Location**

The Hart Prairie project area is located just north of Flagstaff to the west of the Kachina Peaks Wilderness boundary and east of Highway 180 (see Figure 1). The project boundary comprises approximately 12,775 acres, of which there are approximately 11,331 acres of National Forest System lands and approximately 1,444 acres of private land (treatments and actions are only proposed on National Forest System lands). In this document, the “project area” refers to National Forest System lands within this boundary. It is located on the Peaks Ranger District of the Coconino National Forest and is within all or portions of T22N, R6E, Sections 3, 4, 5; T23N, R6E, Sections 3, 9, 10, 12-30, 32-36; T23N, R7E, Sections 7 and 18 of the Gila and Salt River Meridian.

**Purpose and Need for Action**

The purpose of and need for this project is to improve overall forest health and reduce the threat of severe wildfire in and around the Hart Prairie project area. There is a need to move toward conditions that support natural and desirable fire behavior with healthy and sustainable forests, meadows, and wetlands.

The purpose of and need for this project is focused on the following topics: Forest Health, Wildfire Hazard, and Watershed Conditions. For each of these topics, *Existing Conditions* describe the current ecological conditions, *Desired Conditions* describes the goals and vision for the area, and *Need for*
Chapter 1 – Purpose and Need

*Change* describes the difference between existing and desired conditions that necessitate the need for changed conditions.

![Figure 1. Vicinity and project area map for the Hart Prairie Fuels Reduction and Forest Health Restoration Project](image)

**Forest Health**

*Existing and Desired Conditions*  

Vegetative structural stage (VSS) is a six-class vegetation scheme used to describe the developmental stages of a forest ecosystem, from seedlings (VSS 1) to old-growth forest (VSS 6). In northern goshawk habitat within the project area, forested stands currently are primarily comprised of young to mid-aged ponderosa pine (VSS 3 and 4). Seedlings (VSS 1), saplings (VSS 2), and old-growth forest (VSS 6) are lacking. Current tree arrangement consists of dense, homogeneous conifer stands, with few openings and a limited “groupy” structure. Stand basal areas (BA) range from 44-326 ft² per acre, with tree densities ranging from 84-1817 trees per acre. Canopy cover ranges from 39-90%. Much of the project area is at
the higher ends of these ranges. Approximately 1/3 of the area contains some level of dwarf mistletoe infection.

Desired conditions in northern goshawk habitat include a more open, variable, patchy forest structure that is sustainable, uneven-aged, and within the historic range of natural variability. Trees would be arranged primarily in groups of varying shape, size, and number of trees, with a mosaic pattern of individual and clustered trees interspersed among openings. The area would exhibit an increase in age class diversity, decreased canopy cover, decreased conifer densities, improved successional dynamics, increased and unsuppressed regeneration, increased old-growth forest, increased vertical and horizontal heterogeneity, and a decrease in the level and extent of dwarf mistletoe infection. These desired conditions would be consistent with goals for management of northern goshawk habitat.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Existing Condition</th>
<th>Desired Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forest structure</td>
<td>Predominantly even-aged:</td>
<td>Uneven-aged: VSS 1= 0% VSS 2= 0% VSS 3= 43% VSS 4= 38% VSS 5= 19% VSS 6= 0%</td>
</tr>
<tr>
<td>Tree arrangement</td>
<td>Dense and homogeneous with few,</td>
<td>More open, variable, and patchy; Groups of 2-40 trees, up to 0.7 acres in size, interspersed with grassy openings</td>
</tr>
<tr>
<td></td>
<td>small openings and limited ‘groupy’</td>
<td></td>
</tr>
<tr>
<td></td>
<td>structure</td>
<td></td>
</tr>
<tr>
<td>Tree density</td>
<td>19-1817 trees per acre</td>
<td>Generally less than 100 trees per acre</td>
</tr>
<tr>
<td>Canopy cover</td>
<td>39-90%</td>
<td>40-70%</td>
</tr>
<tr>
<td>Basal area</td>
<td>44-326 ft² per acre</td>
<td>50 ft² per acre or greater (60-120 ft² per acre at the group level)</td>
</tr>
<tr>
<td>Logs (greater than 12” diameter)</td>
<td>Ponderosa pine – 4.4/acre</td>
<td>Ponderosa pine – 3 logs/acre</td>
</tr>
<tr>
<td></td>
<td>Mixed conifer- 9.1/acre</td>
<td>Mixed conifer- 5 logs/acre</td>
</tr>
<tr>
<td>Snags (greater than 18” diameter)</td>
<td>Ponderosa pine – 5.2/acre</td>
<td>Ponderosa pine – 2 snags/acre</td>
</tr>
<tr>
<td></td>
<td>Mixed conifer- 4.0/acre</td>
<td>Mixed conifer – 3 snags/acre</td>
</tr>
</tbody>
</table>

Within the known northern goshawk nest area in the project area, basal areas currently exceed 200 ft² per acre. The nest area is dominated by mid-aged forest (VSS 4) with “closed” canopies and canopy cover values of 80%. Desired conditions include mature and old-growth forest (VSS 5 and 6) with basal areas which average 70-150 ft² per acre and canopy cover values that average 50-70% across the nest area. Tree arrangement would consist of non-uniform tree spacing.

Within the northern goshawk post-fledgling family area (PFA) surrounding the nest area, basal areas also currently exceed 200 ft² per acre. The PFA is dominated by “closed” canopies, with canopy cover values averaging 80%. Desired conditions include basal areas ranging from 70-100 ft² per acre at the stand level. Canopy cover values would average 50-60% across the PFA. Tree arrangement would be less “groupy” in appearance than in other areas due to higher residual densities.

Mexican spotted owls are a threatened species with special management emphasis areas, including protected habitat, protected activity centers, and restricted habitat. Protected habitat for Mexican spotted owls (MSO) include 161 acres of mixed conifer with slopes greater than 40% within the project.
boundary. Additionally, two Mexican spotted owl Protected Activity Centers (PACs) are located within the project boundary (Little Springs #040227 and Hochderffer #040232). There are approximately 1,442 acres in MSO PACs within the project boundary. PACs include 639 acres of ponderosa pine, 384 acres of aspen, 351 acres of mixed conifer and 68 acres of grassland. Current conditions include basal areas that range from 44-326 ft² per acre. Crown canopies are closed, with canopy cover values ranging from 39-90% (average 65%) and few openings one-quarter acre or larger. Fire hazard rating for the PACs within the project area varies from low to extreme, with 13% low to moderate, 61% high to very high and 26% extreme. Fire hazard ratings in protected habitat on slopes greater than 40 percent are moderate to very high, with 11% moderate and 85% very high. Desired conditions include 20 or more trees per acre greater than 18” dbh and basal areas ranging from 150-170 ft² per acre at the stand level.

Within Mexican spotted owl restricted habitat (i.e., mixed conifer with slopes less than 40%), which consists of 270 acres of mixed-conifer and 22 acres of riparian habitat, current conditions include basal areas that range from 165-297 ft² per acre. Nearly all stands consist of young to mid-aged forest. Crown canopies are closed, with canopy cover values ranging from 73-88% (average 81%). Desired conditions for restricted habitat include the creation of replacement nesting and roosting habitat, while providing a diversity of stand conditions (USDI 1995). Nesting and roosting habitat contain 20 or more trees per acre greater than 18” dbh and basal areas ranging from 150-170 ft² per acre at the stand level. In order to grow large trees and develop the young to mid-aged restricted stands into mature and old forest, basal areas and stand densities would initially have to be reduced significantly to decrease competition between trees, increase tree health, growth, and vigor, reduce the potential for stand-replacing wildfire, and increase insect and disease resistance. Emphasis would be placed on retaining trees greater than 18” dbh, and trees greater than 24” dbh would not be harvested.

Current forest understory productivity is low in areas with closed and moderately closed canopies. Additionally, meadows have been experiencing pine encroachment for over 100 years due to fire exclusion. Desired conditions for understory vegetation include increased diversity, productivity, and abundance of understory species (i.e., grasses, forbs, and shrubs). Desired conditions for meadows include increased grassland productivity and diversity and a decrease in pine density to historic levels prior to fire suppression.

The Fern Mountain Botanical Area, located within the project area, covers 186 acres of National Forest System lands adjacent to The Nature Conservancy Hart Prairie Preserve and south of Fern Mountain. It contains a high elevation riparian scrub community which is dominated by Bebb willow (Salix bebbiana) and represents a unique riparian community. The presence of Bebb willow strongly enhances the diversity of understory plants and animals in the community. Bebb willow is a widespread species across its entire range, however plant communities where Bebb willow is the dominant species are very rare, and the community within the Fern Mountain Botanical Area and adjacent Nature Conservancy property is one of the largest existing examples of the community type. The species is relatively rare in the Southwest, and Bebb willow was added to the Region 3 Sensitive Species list for the Coconino National Forest in 2007. During past prescribed burning, a few of the Bebb willow plants were damaged and/or killed by fire. Desired conditions for the Bebb willow are to maintain or increase population size and potential habitat, and to ensure there is no additional damage or mortality to Bebb willow as a result of prescribed fire operations. Conservation of Bebb willow is the main focus of the Fern Mountain Botanical Area and is a species of major interest on the adjacent Nature Conservancy Hart Prairie Preserve.

Within the aspen cover type, the majority of sites have sustained greater than 60% mortality over the past 10 years (Fairweather et. al. 2008). Aerial detection survey data over this time period show most of the aspen type in the project area has been impacted. Ground surveys revealed aspen decline is due to a range of stressors including frost, drought, defoliation by western tent caterpillar, cankers, wood borers, and
bark beetles. Residual aspen trees are in generally poor health with reduced crown canopies and increased mortality. Approximately 40% of the aspen cover type contains 5-10 snags per acre greater than 12” dbh. Approximately 36% of the aspen cover type contains greater than 10 snags per acre greater than 12” dbh. Desired conditions within the aspen cover type include: maintenance of aspen across the landscape, successful regeneration, decreased conifer density and competition within aspen clones, and improved health, vigor, longevity, and sustainability of aspen clones.

Need for Change
There is a need to decrease conifer (predominantly ponderosa pine) densities and canopy cover on approximately 80% of the project area to decrease inter-tree competition, increase individual tree health, growth, and vigor, increase understory productivity and diversity, increase regeneration, decrease fire hazard, and increase insect and disease resistance. There is a need to create a more variable and patchy tree distribution that would more closely mimic the historic forest structure that existed prior to fire suppression. There is a need to create openings of adequate size to promote regeneration (VSS 1 and 2 groups), increase age/size class diversity, and promote a more sustainable, uneven-aged forest structure.

Within northern goshawk habitat, there is a need to improve age class distribution, create more variable and patchy habitat, to reduce tree densities, and to decrease canopy cover and basal area in some locations. Within the northern goshawk nest area, there is a need to create more open canopy conditions, reduce tree densities and increase the amount of mature and old-growth forest. There is a need to create non-uniform tree spacing.

Within Mexican spotted owl habitat, there is a need to develop nesting structure in restricted habitat and protect existing nesting structure where it exists by reducing the potential for stand-replacing wildfire. There is a need to reduce stand densities in order to promote development of larger trees and mature and old-growth forest. Within the Little Springs MSO PAC, there is a need to reduce the risk of potential stand-replacing wildfire.

There is a need to maintain or increase populations and habitat of Bebb willow and maintain associated biological diversity.

There is a need to restore approximately 80% of aspen sites. Aspen restoration would consist of a variety of different treatments to promote successful regeneration of young trees in dying stands. There is a need to maintain or increase biological diversity and scenic quality associated with aspen stands.

Within stands infected with dwarf mistletoe, there is a need to decrease the extent, or isolate the incidence, of infection. Creating a more “groupy” tree arrangement and decreasing tree densities will decrease the spread of dwarf mistletoe infection and decrease susceptibility to disease and successful insect attack and mortality.

There is a need to restore understory vegetation on approximately 90% of the project area, and a need to decrease pine encroachment within approximately 99% of the grassland cover type.

Wildfire Hazard
Existing and Desired Conditions
The area’s natural fire regime is predominantly Fire Regime 1, which indicates a fire recurrence of less than 35 years with a low percentage of overstory replacement expected under historical conditions. Most of the project is currently in Condition Class 3, indicating a significant departure from natural conditions,
due to a lack of fire occurrence. High canopy closure values and low crown heights (branches close to the ground), combined with an increasing number of trees per acre elevate the fire hazard beyond desirable levels for many portions of the project area. The existing fire hazard makes it very difficult for initial attack operations to control a wildfire starting under severe weather conditions that occur in April, May, June, and sometimes during September and October.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Existing Condition</th>
<th>Desired Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fire hazard rating</td>
<td>Extreme 2,089 acres</td>
<td>Low or moderate in most of the project area (some areas unsuitable for treatment will remain at higher ratings)</td>
</tr>
<tr>
<td></td>
<td>Very High 2,937 acres</td>
<td></td>
</tr>
<tr>
<td></td>
<td>High 3,329 acres</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Moderate 3,346 acres</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low 1,085 acres</td>
<td></td>
</tr>
</tbody>
</table>

Across the entire project area, the current fuel conditions would likely generate dangerous fire behavior and undesirable fire effects if and when a wildfire occurs. Although it would be difficult to initiate a crown fire within portions of the project area, once a crown fire is initiated or is carried in from a neighboring area, many sites have sufficient crown bulk density coupled with sufficient canopy cover to sustain a crown fire and spread it across the area. Initial emergency response personnel would have great difficulty in controlling a wildfire occurring in the area under severe weather conditions.

One method to evaluate the risk of wildfire to an area is to determine a fire hazard rating. Fire hazard rating is a relative measure of how virulently a wildfire could burn under the 90th percentile weather conditions that occur from April through July. Fire hazard rating is a relative measure to demonstrate fire resilience between stands and is a good indicator of how effectively and safely fire suppression crews can manage a wildfire.

Fire hazard rating criteria include: height to live crown (distance between ground and lowest branches), dead and down fuel, canopy cover, aspect, slope, and trees per acre. Aspect and slope cannot be changed with treatments. Current values across the project area that can be changed are:

- **Height to live crown**: 1-25 feet
- **Dead and down fuel**: 2-28 tons per acre
- **Canopy cover**: 10-90 percent
- **Trees per acre (ponderosa pine)**: 19-799
- **(mixed conifer)**: 32-850
- **(aspen)**: 799+

It is important to note that much of the project area is currently at the upper end of the ranges provided above. To reach the desired condition of low to moderate fire hazard ratings, it would be necessary to achieve some combination of increased height to live crown, reduced dead and down fuel load, decreased percent canopy cover, and decreased number of stems per acre that would minimize the chance of severe fire behavior occurring during the worst fire weather.

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1 Fuel moisture and weather characteristics used to model fire effects include:
- 1-Hour fuel Moisture: 2%
- 10-Hour fuel Moisture: 3%
- 100-Hour fuel Moisture: 4%
- 20-Foot Wind Speed: 20mph
- Air Temperature: 85 degrees F
Chapter 1 – Purpose and Need

Need for Change

There is a need to reduce the fire regime Condition Class from a 3 to at least a 2 to reduce the departure from natural conditions. Fire hazard ratings need to be reduced from high and extreme to low or moderate across much of the project area. However, some stands might remain at higher hazard ratings due to lack of access or to accommodate other resource needs such as providing habitat necessary for particular wildlife species. Most areas within a mile of private property need to be reduced to a low fire hazard rating, especially areas which would carry fire into private property with the prevailing winds.

There is a need to reduce dead and down fuel loading enough to allow safe, periodic prescribed burning, while also retaining enough woody debris to support wildlife habitat needs. There is a need to increase the average height to live crown to approximately 15 feet and decrease expected flame lengths to less than 4 feet to reduce the likelihood of crown fire initiation. There is a need to decrease canopy continuity to increase resistance to crown fire spread.

Watershed Conditions

Existing and Desired Conditions

No unsatisfactory soils occur in the project area by total soil mapping units, however, there are sections of the Hochderffer Hills that have severe erosion occurring with rills and gullies forming due to lack of effective ground cover that resulted from the Hochderffer Fire in 1996. Roads throughout the analysis area produce areas of unsatisfactory soil conditions. The desired condition is to maintain current satisfactory watershed conditions and improve unsatisfactory conditions to satisfactory where possible. Three springs exist in the project area (Little, Wilson, and Otto) that are all non-functional riparian areas due to grazing and browsing by wild ungulates. All three springs occur within the Peaks Range Allotment, and the pastures containing the springs have not been grazed for over 15 years. A portion of Volunteer Wash near The Nature Conservancy Preserve contains Bebb willow and is considered riparian (approximately 0.6 miles). The stream channel is stable, but Bebb willows are not regenerating and are being heavily browsed.

Need for Change

There is a need to improve soil conditions on the Hochderffer Hills by reducing severe erosion in a localized area of concern. There is a need to manage the road system in a manner that minimizes soil impacts and still provides for access to the area. There is a need to protect Bebb willow and springs from browsing and to regenerate Bebb willow in the project area.

Proposed Action

To best meet the purpose and need, the Peaks/Mormon Lake Ranger District is proposing to use a variety of fuel reduction and forest restoration treatments within the project area, including mechanical- and hand-thinning (a.k.a. “thin from below”), prescribed burning, slope stabilization, and fencing of sensitive plants and springs. In order to accomplish these activities, the Forest Service is proposing to provide maintenance on existing roads and create temporary roads as needed. Because road maintenance would require material, the Forest Service is also proposing to establish a material source borrow pit just north of the project area. In response to public comments, a gate located on FSR 418B would be relocated to prevent recreationists from getting their vehicles stuck during wet soil conditions, and improve parking accessibility. Chapter 2 provides more detailed information on the Proposed Action and accompanying mitigation measures.
Forest Plan Consistency

This action responds to the goals and objectives outlined in the Coconino National Forest Land and Resource Management Plan (Forest Plan), as amended, and helps move the project area towards desired conditions described in that plan (Coconino National Forest Plan, 1987 as amended).

Forest-wide standards and guidelines are used in directing management activities for the project area, as well as Management Area standards and guidelines. A Management Area (MA) is defined as “an area that has common direction throughout and that differs from neighboring areas” (Coconino National Forest Plan 1987). The Hart Prairie project area falls within MA 3, Ponderosa Pine and Mixed-conifer less than 40% Slope; MA 4, Ponderosa Pine and Mixed-conifer Greater than 40% Slope; MA 5, Aspen; MA 6 Unproductive Timber Land; MA 9 Mountain Meadows and Wet Grasslands, MA 12, Riparian and Open Water; MA 15, Developed Recreation Sites (Flagstaff Nordic Center); MA 17 Special Areas (Fern Mountain Botanical Area); MA 20 Highway 180 Travel Corridor. See Appendix A for a map and approximate acres within each MA.

Decision Framework

Based on the analysis in this Environmental Assessment, the Coconino National Forest Supervisor will decide how to best reduce fuel loading and restore forest health in the project area in accordance with the Coconino National Forest Plan direction and the desired future conditions. The deciding official may choose the No Action Alternative, the Proposed Action, or a modified version of it. The decision will include:

- The location, design, and scheduling of the proposed mechanical treatment, burning, and other forest restoration activities;
- Access management measures; and
- Mitigation measures and monitoring activities.

Public Involvement

The proposal was listed in the Schedule of Proposed Actions from October 2007 through December 2009. On May 28, 2009, the proposal was mailed to members of the public and other agencies for comment via letters and email. This was the official start of the 30-day scoping period; however, comments were accepted through July 2009. A mailing list was compiled of local agencies, businesses, individuals, and organizations interested in or determined to be potentially impacted by the proposed action. Emphasis was placed on contacting people affected or concerned about the project because of ownership or land-use interests. Scoping documents including a discussion of the proposed action and a map were sent to more than 340 individuals, organizations, agencies, and tribes on the mailing list. Announcements soliciting public input on the Proposed Action were posted on the Coconino National Forest website and published in the Arizona Daily Sun on June 3, 2009. Twelve tribes were notified of the project. The Coconino National Forest elected to not hold official public meetings because of this extensive mailing effort and limited response indicating a need for meetings.

In addition on June 30, 2009, the Forest Service hosted an all-day Hart Prairie Field Trip that was open to other agencies and organizations. Representatives from the U.S. Fish and Wildlife Service, Arizona Game and Fish Department, Ecological Restoration Institute, the Nature Conservancy, the Nordic Center, Arizona Snowbowl, Greater Flagstaff Forests Partnership, and Coconino Natural Resource Conservation District attended. The field trip focused on visiting points of interest within the project area with productive discussion regarding the proposed action. As a response to a public request, Forest Service
Chapter 1 – Purpose and Need

representatives met with members of the public who live within the project area on August 26, 2009 to discuss the proposed action and to listen to their concerns. The Forest Service also met with staff from The Nature Conservancy’s Hart Prairie Preserve several times to discuss opportunities for collaboration at the time of implementation in order to minimize impacts to private land owners within the project area.

A total of 13 comment submittals were received by the CNF by mail as a result of mailing the scoping documents and publishing the public notice. The submittals were reviewed, organized, and analyzed; the analysis identified 32 specific comments within the 13 submittals. Public comments included, but were not limited to, concerns for wildlife as a result of the proposed naturalization and fencing of water structures, forest management activities (specifically prescribed burning and thinning) and associated construction of temporary roads, and impacts of these activities on viewshed, air quality, and recreational experiences. The Forest Service team working on the project reviewed all comments received and considered them in the development of the final Proposed Action to carry forward through the EA. For example, due to public concern over the naturalization of water tanks, the Forest Service decided to drop this activity from the project. The relocation of a gate on FSR418B to help protect resources was included in the Proposed Action due to comments received. Some forest treatments were changed due to input from other agencies and organizations in regards to resources that could be impacted by the implementation of these treatments. On the basis of the comments received, the interdisciplinary team developed a list of issues to address.

Issues

Issues serve to highlight effects or unintended consequences that may occur from the proposed action and alternatives, giving opportunities during the analysis to reduce adverse effects and compare trade-offs for the decision maker and public to understand.

1. Vegetation Issue: The Proposed Action includes over 3000 acres of treatment for aspen restoration. In addition, the largest Bebb willow population in Arizona occurs in the Fern Mountain Botanical Area and adjacent Hart Prairie Preserve, which are in the project area. Fern Mountain Botanical Area is a high elevation riparian shrub community dominated by Bebb willow and represents a unique riparian community. The Proposed Action includes management actions to restore and enhance the Bebb willow community – a Forest Service Sensitive species. The impacts of the proposed forest management practices on Bebb willow and aspen population should be included in the EA.

2. Wildlife Issues: Some areas proposed for treatment include areas that are identified as Mexican Spotted Owl Protected Activity Centers and northern Goshawk Post-fledgling Family Areas. The impacts of the proposed forest treatments on these special status species should be included in the EA. The Proposed Action includes installing and maintaining elk-deterring fencing around three springs, four water tanks and two wildlife catchments, as well as the relocation of one steel water tank. The impacts of the proposed fencing and relocation of water infrastructure on wildlife species, including special status species, should be included in the EA.

3. Recreation Issue: The proposed forest treatment along popular hiking trails, including the Arizona Trail and within the vicinity of Bismarck Lake could result in disturbance to recreationists. These trails are popular for hiking, mountain biking, and horseback riding. Although we received no comments during the scoping period, the forest treatments, which include logging and hauling timber has the potential to be an issue with the public users and user groups and is a recreation management concern. In addition, smoke from burning treatments could potentially impact users on the surrounding trails or in the Snowbowl area. The impacts of forest treatments on the recreation experience should be included in the EA document.
4. **Visual Quality Issue:** The proposed forest treatments along roads and popular trails, including Highway 180, Forest Road (FR) 418, FR 151, FR 794, Arizona Trail, and Bismarck Trail could result in impacts to the scenic quality for recreationists and residents who frequent the roads. The impacts of forest treatments on visual quality and consistency with Visual Quality Objectives outlined in the Coconino Forest Plan should be included in the EA document.
Chapter 2 – Alternatives

This chapter describes and compares the alternatives considered for the Hart Prairie Fuel Reduction and Forest Health Restoration Project. This section also presents the mitigation measures associated with the Proposed Action. In addition, it provides a summary of the issues and environmental consequences of both alternatives and allows the public and the decision-maker to easily compare the two options.

Alternatives

Alternative 1: No Action
Under the No Action alternative, current management plans would continue to guide management of the project area. No forest treatment activities, including harvesting conifers, restoring aspen, reducing dead and down fuels, or installing fencing around water sources would be implemented to accomplish project goals.

Alternative 2: Proposed Action
The Forest Service proposes to implement the following forest management activities to reduce the fire hazard and restore forest health within the project area:

**Restoration using uneven-aged management, thinning and prescribed burning treatments**
Dense stands of ponderosa pine and mixed conifer would be treated using uneven-aged management via mechanical methods (with mechanical equipment) or by hand-thinning (using chainsaws). Aspens would be treated through clear-felling or hand-thinning. Within ponderosa pine or mixed-conifer stands treated with mechanical thinning, emphasis would be placed on leaving trees in variable groups to mimic the spatial arrangement that existed prior to European settlement. Pre-settlement evidences (e.g. stumps, stump holes, and downed logs) may be used to guide placement of tree “groups,” interspaces, and openings. Mechanical thinning would also emphasize retaining and enhancing existing groups of older, larger trees (18” dbh or greater). Figure 2 shows the location of these treatments within the project area.

Areas to be treated with hand thinning are not typically accessible to mechanical logging equipment and therefore only trees up to 9” dbh would be removed. For this project, hand thinning is referred to as “thin from below”, and is proposed to occur on approximately 30 acres on steep slopes and along the Arizona Trail within the project area (see Figure 2). Due to the inability to remove larger diameter trees in these areas, the remaining tree arrangement would be less “groupy”, with fewer grassy interspaces and openings for regeneration. However, compared to no thinning, these thin from below areas would exhibit decreased stand densities, resulting in decreased inter-tree competition, increased growth and vigor, and increased understory production. In response to public concern, the Forest Service would coordinate with The Nature Conservancy to hand-thin areas surrounding private property adjacent to the Hart Prairie Preserve in order to minimize noise and visual impacts to residents.

A variety of prescribed burning would be used depending on the stand receiving treatment. Burn treatments include initial, maintenance, and pile burns and would be implemented over the course of several years. Thinned areas would be burned after trees are harvested in order to remove slash, duff, and needle-cast caused by harvesting activity. Slash would be gathered into piles, which could be burned soon after they dry out. Some of the project area would receive “burn-only” treatment, which means that there would be no mechanical or hand thinning of trees. Figure 2 shows the location of these burn-only...
treatments within the project area. Maintenance burns would be conducted as needed to maintain low and moderate fire hazard conditions for up to 20 years without additional thinning.

Burning would be planned for times when weather and other environmental factors such as wind, fuel moisture and humidity are most suitable. This would be primarily during the fall and early spring. Any prescribed burn would be approved in advance by the Arizona Department of Environmental Quality to ensure air quality standards are maintained. Public notification of burning would take place prior to the ignition of any prescribed fire.

- **Ponderosa Pine Restoration – approximately 3790 acres**
  Remaining tree groups would vary in shape, size, density, and number of trees (approximately 2-40 trees per group, up to 0.7 acres in size, basal area of 50 ft² per acre or greater in VSS 4-6). These areas would receive both initial and maintenance prescribed burning.

- **Mixed Conifer Restoration – approximately 250 acres**
  The desired remaining tree arrangement would mimic natural disturbance patterns that historically resulted in variable stand/patch sizes (groups of trees up to 4 acres in size, basal area of approximately 50-120 ft² per acre or greater). These areas would receive pile burning only; broadcast burning would not occur in predominantly mixed conifer stands because the return interval is substantially longer than ponderosa pine stands. Prescribed burning is also difficult as mixed conifer sites typically have a higher degree of mortality and severity.

- **Aspen Restoration – approximately 3215 acres**
  A variety of different treatments would be used to promote aspen regeneration, including removal of conifer encroachment, prescribed fire, ripping, planting, and/or clearfelling. In addition, some stands would use jackstrawing felled conifers and/or aspen and fencing as methods to protect aspen regeneration from severe browsing. There are currently 25 aspen monitoring plots located within the project area, and ongoing monitoring of these plots would help measure and evaluate health, mortality and regeneration of aspen clones. Additional monitoring plots would also be added.

- **Thin from below – approximately 30 acres**
  These areas occur on steep slopes where thinning with mechanical equipment is not feasible, and in areas along the Arizona Trail, to avoid impact from logging equipment to recreationists is not desired. To reduce ladder fuels, trees less than 9”dbh would be hand-thinned using chainsaws. These areas would receive pile burning only.

- **Meadow Restoration – approximately 1515 acres**
  Treatments would include mechanical thinning to remove conifer that have encroached into meadows. Prescribed burning would be used to stimulate growth and regeneration of herbaceous species.

- **Burn only – approximately 965 acres**
  Figure 2 shows the location of burn only areas within the project area. These areas include the Hochderffer Hills (outside the Hochderffer MSO PAC) and stands with very low tree densities. Burn only treatments would also be implemented in the MSO protected habitat of the Hochderffer Hill portion of the project. Broadcast burning would only be implemented when weather conditions are optimal for burning. Fire hazard ratings in burn only areas would be reduced.
• **Slope Stabilization – approximately 25 acres**  
  The area proposed for slope stabilization currently is experiencing erosion and is located on the east side of the Hochderffer Hills. Treatment would include non-mechanical thinning of trees less than 9” dbh. Erosion mats would be placed on the slope and the thinned trees would be placed across erosion mats to prevent disturbance. The entire area would be revegetated using native species.

**Other proposed forest treatments**

**Bebb Willow Restoration – approximately 25 acres**  
Bebb willow stands would be enhanced by using cuttings, planting locally cultivated plants, and fencing existing or newly planted willows. Manual grubbing of grasses would be used to increase the likelihood of planting success. During prescribed burning in adjacent areas, fire lines would be placed around Bebb willows, and downed woody debris would be removed before prescribed burning to reduce the risk of fire impacting willows. See Figure 2 for Bebb willow restoration location.

**Spring Exclosures**  
To protect spring habitats and reduce trampling and browsing pressure, elk-deterrent fences would be restored, constructed and maintained around Little Spring, Wilson Spring, and Otto Spring. See Figure 2 for locations of springs.

**Water Tank/Catchment Relocation/Exclosures**  
To reduce browsing pressure by elk on adjacent aspen and willow stands, existing fencing would be restored and maintained, and where no fencing currently exists, new fencing would be constructed and maintained to Domingo Tank, Windmill Tanks #1, #2, #3, Basecamp catchment and Springer catchment. Turkey Tank is currently located in an area proposed for aspen restoration, so this tank would be relocated to the southwest outside of restoration treatments. Fence design would allow access to water by wildlife other than elk.

**Road Improvements and Temporary Roads**  
There is a large network of existing roads within the project area (see Figure 2). These existing roads would be used to the extent possible for hauling harvested trees. Where possible, FSR 151, 418 and 794 would be used as haul routes. It is possible that not all treatment blocks could be accessed by these three roads. As a result, temporary roads may need to be constructed to facilitate the harvest and removal of trees. Temporary roads would be rehabilitated after harvesting has been completed. The project has been designed to limit impacts to resources and forest activities. Deferred maintenance items, including road re-alignment, relating to health and safety and resource protection on existing system roads would be addressed, as funding allows. Applicable Coconino National Forest Plan direction, BMPs, Forest Service Manual and Handbook direction, as well as mitigation measures outlined in the next section would be implemented.

**Establish Borrow Pit**  
Curly Pit is located approximately five miles north of the Hart Prairie project area and would be developed to provide material to improve system and haul roads.

**No Treatment – approximately 1535 acres**  
Figure 2 shows the areas that would not receive any treatment, which includes all of the Hochderffer and Little Spring MSO PAC’s, and a portion of Fern Mountain.
Figure 2. Map of Alternative B: Proposed Action
**Relocate Gate on FSR 418B**

FSR 418B is approximately ¼ mile long with a gate at the end to prohibit further motorized access. Alternative 2 would relocate the gate to the intersection between FR 418B and FR 151 and create parking space at the junction of the two roads by slightly widening the road onto Forest Service land. A small parking area near the junction of FR 418B and FR 151 would allow recreationists to continue to access Little Spring and the surrounding area via FR 418B by non-motorized travel (foot, horse, and/or mountain biking). Moving the gate to the junction of FR 418B and FR 151 would prevent recreationists from getting their vehicles stuck during wet soil conditions, and would improve parking accessibility.

Design features and mitigation measures, including BMPs, developed by the Interdisciplinary Team to reduce or mitigate any adverse impacts are detailed in the following section, Design Features.

Implementation is expected to begin in 2010 and carry into following years as funding becomes available to implement the various pieces of the Proposed Action.

**Design Features Specific to Alternative 2**

In response to public comments on the proposal, mitigation measures were developed to ease some of the potential impacts the proposed action may cause. Applicable Forest Plan standards and guidelines, Best Management Practices, and Forest Service Manual and Handbook direction will be incorporated in project design and implementation. The following features are design elements that further detail management actions, mitigate environmental consequences, and establish priorities for implementation.

*Harvesting Operations*

- No old, “yellow bark” ponderosa pine would be cut except under rare circumstances when a yellow bark pine may need to be cut for a landing to avoid skidding long distances.
- Thin smaller trees around “yellow bark” ponderosa pine as needed to limit mortality from fire.

*Broadcast Burning*

- Design prescribed burns to cover large areas and be of short duration (2 to 7 days). Burning would occur when weather and other prescription criteria are met.
- Minimize loss of snags, logs, and roost trees during broadcast burning activities.
- Minimize residual tree scorch through fire prescriptions.
- Seedlings and saplings (VSS 1 and 2 groups) would be protected as needed during both initial and maintenance burns. Mortality would be mitigated in burn plans.
- No prescribed burning or preparation for burning would occur within occupied goshawk nest stands during the breeding season (March 1 – September 30).
- No prescribed burning would occur within active prairie dog colonies.
- No prescribed burning would occur within the Little Springs and Hochderffer MSO PAC’s.
- Broadcast burning would generally avoid aspen clones with existing elk exclosure fencing and other healthy aspen clones.
- Fire lines would be placed around Bebb willows and dead branches within the clumps would be removed before prescribed burning adjacent areas to reduce the risk of fire negatively impacting willows. The Forest Botanist would be contacted prior to implementation of prescribed burning.
Burning near the Bebb willow stands would only occur under low to moderate fire conditions and not during times of high fire risk.

**Slash Treatment**

- Pile and burn logging slash resulting from harvesting operations.
- Remove slash from within 500 feet of private property.
- In designated areas, use slash for jackstrawing.
- Piles would be located so that burning would minimize damage to standing live trees, snags, down logs, sensitive plants or physical improvements such as fences, poles, signs, and cattle guards.
- Large logs (greater than 12 inches) that exist on the landscape prior to treatment would not be piled during slash treatment.
- Chipping and removal of biomass would be used as an alternative to pile burning, where access allows, if biomass material can be effectively utilized at the time of implementation.
- In designated areas, slash would be made available for fuelwood gathering.

**Sensitive Plant Protection**

- Avoid piling slash or creating fire control lines within sensitive and rare plant populations.
- Avoid sensitive plant populations when constructing temporary roads.
- Provide opportunities for additional research and monitoring of treatment effects on sensitive plants.

**Noxious or Invasive Weeds**

Best Management Practices as outlined in Appendix B of the “Final Environmental Impact Statement for Integrated Treatment of Noxious or Invasive Weeds” (USDA 2005) would be followed to incorporate weed prevention and control into the project. The following features would be incorporated into project implementation and monitoring:

- Equipment would be inspected and cleaned before entering treatment areas to prevent introduction of invasive weeds.
- Soil disturbance would be avoided to the extent practicable.
- Landing and burn pile sites would be located away from noxious or invasive weed populations to avoid spread.
- Monitor and treat noxious or invasive weed populations following project implementation if infestations expand or if new noxious or invasive weeds are detected in the project area.

**Recreation and Social Considerations**

- For public safety, camping would be prohibited within active harvesting and burning areas.
- Harvesting activities would be avoided (cutting and hauling) on the following holiday weekends: Memorial Day, Fourth of July, and Labor Day.
- Coordinate the timing of harvesting and burning activities with grazing permittees.
• Develop and install interpretation signage at Little Springs about spring habitat and spring protection.

• Establish mitigation measures to minimize ground disturbing impacts on existing Forest Service trails in the project area, which include the Arizona Trail, Bismarck Lake Trail and Little Springs area. Mitigation measures may include:
  (a) crossing trails on a 90 degree angle with mechanized logging equipment (i.e. skidders)
  (b) minimizing the number of trail crossings and locating the crossings at areas that are more sustainable or would limit ground disturbance on the trail
  (c) requiring that timber contractors rehabilitate any trails impacted by their operations to Forest Service trail specifications

• Establish mitigation measures to retain scenic quality at trail heads and along trails in the project area which include the Bismarck Lake Trail Head and Little Springs parking area, as well as Arizona Trail and Bismarck Lake Trail. Mitigation measures may include:
  (a) greater tree retention and vegetative diversity to retain or enhance scenic quality at the trail heads or parking areas
  (b) greater tree retention along the roads into trail heads and parking areas to restrict / minimize off-road vehicular cross-country travel in these areas
  (c) greater tree retention along trail corridors to retain or enhance scenic quality
  (d) greater tree retention at trail junctions, switchbacks and climbing turns on trails to reduce "cutting" or creating new trails in those areas

Cultural and Historical Resource Protection

• Historic and pre-historic cultural resources that are fire sensitive would be excluded and protected from burning activities and ground disturbing activities. An archaeologist would flag sites prior to implementation. Sites would be lined and monitored during prescribed burning operations.

• Areas where temporary roads would be constructed would be inventoried prior to implementation.

• Any ground disturbing road re-alignments proposed within the Hart Prairie project area will comply with the existing Region 3 Programmatic Agreement with the Arizona State Historic Preservation Officer, dated December 24, 2003, and shall constitute an additional undertaking for Section 106 compliance outside Hart Prairie Fuels Reduction and Forest Health Restoration Project Report.

Wildlife Protection

Mexican Spotted Owl

• Within MSO restricted and protected habitat, trees greater than 24” dbh would not be harvested.

• MSO restricted and protected habitat would be surveyed in the project area the year of implementation or one year prior to implementation to determine if any new areas have become occupied by owls.

• In restricted and protected habitat where treatments are planned, pre- and post-treatment micro-habitat monitoring would occur as specified in the MSO recovery plan.

• Spring fencing construction would not occur within the Little Spring MSO PAC during the breeding season (March 1 to August 31).
• No treatments would occur in known PACs within the project area (Hochderffer and Little Springs), or within a half mile of nests and roosts during the breeding season.

Northern Goshawk
• Harvesting and hauling within occupied northern goshawk PFAs would not occur during the breeding season (March 1 to September 30).
• No prescribed burning or preparation would occur within occupied nest stands during the breeding season.
• Prescribed burn plans for nest areas within PFAs would minimize smoke impacts to nesting birds and avoid loss of nest trees.

Turkey
• As needed, turkey roost trees would be prepped prior to broadcast burning (Roost trees have been identified with a metal “Wildlife Tree” tag).
• Timber harvesting and slash treatment activities would not occur in turkey nesting areas from April 15 to June 30.
• Scattered patches of untreated slash within ½ mile of dependable water would be retained in known or potential turkey nesting areas.

Deer Fawning and Elk Calving Areas
• Logging activities would be deferred from May 15 to June 30 in known fawning and calving areas.

Wildlife Cover and Highway Crossings
• Maintain hiding cover at least 200 feet around known dependable waters in the area.
• Work with Arizona Game and Fish Department to identify the best treatments to facilitate safer wildlife crossings along Highway 180.

Snags and Logs
• Snags and downed logs that are necessary to meet wildlife management objectives for the area would be identified and fire lined to protect them.
• Within MSO restricted habitat and northern goshawk habitat, snags greater than 18” dbh, and 3 logs per acre greater than 12 inches in diameter at midpoint would be fire lined before broadcast burning.
• Recruitment snags would be identified and a minimum of two 18”+ trees/acre would be retained across the landscape for future snags where available. Recruitment snags are retained from live trees that exhibit defects ideal for wildlife to work toward and/or meet Forest Plan Standards and Guidelines requirements. For example, trees with spiked tops, lightning strikes, mistletoe brooms, or fading crowns are good candidates.

Soil and Watershed Protection
Best management practices (BMPs) are designed to prevent or reduce the amount of water pollution generated by non-point sources to a level compatible with water quality goals. BMPs would be incorporated into applicable harvesting, burning, and road activities. Authority and guidance to prescribe and implement BMPs is defined in FSM 2501, 2530, FSH 2509.22 and the Forest Plan.
• Minimize erosion and sedimentation by designing skidding patterns that best fit the terrain.
Chapter 2 – Alternatives

- Locate landings so creation of unsatisfactory watershed conditions which lead to water quality degradation is avoided.
- Erosion control work would be kept current immediately preceding expected seasonal periods of precipitation or runoff.
- Protected stream courses would be designated on the sale area map. Disturbance from mechanical equipment would be minimal within 50 feet on either side of the protected stream course.

**Scenery Management Considerations along Roads and Trails**

- Consideration would be given to scenery management when harvesting is done along National Forest System trails and roads and along Scenic Highway corridors such as Hwy 180 and FR 151. Treatment areas (including slash) would be treated or rehabilitated promptly for the protection of scenic values. Curly Pit would be located to minimize visual impacts.
Comparison of Alternatives

This section provides a summary of the effects of implementing each alternative.

Table 3. Summary of environmental consequences by alternative

<table>
<thead>
<tr>
<th>Resource</th>
<th>Alternative 1: No Action</th>
<th>Alternative 2: Proposed Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silviculture</td>
<td><strong>Forest Structure</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>VSS</strong></td>
<td>Increases in size class diversity in northern goshawk habitat, creating VSS 1, 2, and eventually 6</td>
</tr>
<tr>
<td></td>
<td>Within 40 years, northern goshawk habitat would be dominated by mid-aged or mature forest, without VSS 1, 2 or 6, and very little VSS 3</td>
<td>More heterogenous and uneven-aged</td>
</tr>
<tr>
<td></td>
<td>Homogenous and predominantly even-aged over next 40 years</td>
<td>Moves toward the desired VSS distribution outlined in the Coconino National Forest Plan</td>
</tr>
<tr>
<td></td>
<td>Desired VSS distribution outlined in the Coconino National Forest Plan would not be attainable</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Canopy cover</strong></td>
<td>Decreased canopy cover immediately after treatment. Average percent canopy covers remain lower than the No Action for 20-40 years</td>
</tr>
<tr>
<td></td>
<td>Northern goshawk habitat dominated by closed canopies over next 40 years.</td>
<td>More “open” canopy which resembles that recommended by Coconino National Forest Plan</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Old-growth</strong></td>
<td>2540 acres designated; minimum of 20% in each cover type (consistent with Coconino National Forest Plan requirements)</td>
</tr>
<tr>
<td></td>
<td>0 acres designated (not consistent with Coconino National Forest Plan requirement)</td>
<td>Stands would more quickly develop into old-growth</td>
</tr>
<tr>
<td></td>
<td>Stands would be slower to develop into old-growth, with some stands stagnating and never reaching old-growth conditions.</td>
<td></td>
</tr>
<tr>
<td>Stand density</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Basal area</td>
<td>Nearly 90% of conifer stands &gt; 150 ft$^2$/acre within 40 years</td>
<td>Majority of conifer stands &lt; 150 ft$^2$/acre after 40 years</td>
</tr>
</tbody>
</table>
### Chapter 2 – Alternatives

#### Environmental Assessment for the Hart Prairie Fuels Reduction and Forest Health Restoration Project

**Coconino National Forest**

**Resource** | **Alternative 1: No Action** | **Alternative 2: Proposed Action**
---|---|---
**Trees per acre** | Would decrease over next 40 years within nearly all conifer stands due to competition based mortality and lack of regeneration but would still remain > 100 in most stands | Would decrease post-treatment, but would increase over next 40 years due to regeneration (VSS 1 and 2)

**Forest Health and Species Diversity**

**Aspen** | After 40 years average basal area of aspen 77ft²/acre, 57 aspens per acre; loss of biodiversity | After 40 years average basal area of aspen 112ft²/acre, 423 aspens per acre (due to regeneration); increase in biodiversity

**Dwarf mistletoe** | Increased level of infection over next 40 years | Decreases level of infection over next 40 years

**Bark beetle** | At extreme risk of attack in 20 years | Reduced risk of attack in 20 years

**Understory vegetation** | Decrease in vegetation biomass and diversity over next 40 years | Increase in vegetation biomass and diversity over next 40 years

**Meadows** | Decrease in productivity, diversity, and functionality | Increase in productivity, diversity, and functionality

**Fuels**

<table>
<thead>
<tr>
<th>Resource</th>
<th>Alternative 1: No Action</th>
<th>Alternative 2: Proposed Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;65% of project area has high-extreme fire hazard conditions</td>
<td>&lt;21% of project area at high-extreme fire hazard Reduced fuel on ground Move towards Condition Class 1 within 20 years In the event of a wildfire: &lt;25% mortality of ponderosa pine trees 8-14” dbh, and &lt;9% mortality of ponderosa pine trees &gt;16” dbh Fuels would accumulate High risk of canopy ignition Flame lengths: &gt;4 feet</td>
<td></td>
</tr>
<tr>
<td>52% of project area at risk for active crown fires In the event of a wildfire: 99% mortality of ponderosa pine trees 8-14” dbh, and 65% mortality of ponderosa pine trees &gt;16” dbh Fuels would accumulate High risk of canopy ignition Flame lengths: &gt;4 feet</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Wildlife**

<table>
<thead>
<tr>
<th>Resource</th>
<th>Alternative 1: No Action</th>
<th>Alternative 2: Proposed Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Threatened,</td>
<td>Disturbance from smoke or noise may cause</td>
<td></td>
</tr>
</tbody>
</table>

---

Environmental Assessment for the Hart Prairie Fuels Reduction and Forest Health Restoration Project

Coconino National Forest

24
<table>
<thead>
<tr>
<th>Resource</th>
<th>Alternative 1: No Action</th>
<th>Alternative 2: Proposed Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Endangered, Forest Service Sensitive</td>
<td>No direct effects&lt;br&gt;Indirect adverse effects from risk of high intensity wildfire, and loss of prey and habitat from continued increased tree density and encroachment&lt;br&gt;VSS distributions outlined in Coconino Forest Plan would not be attained</td>
<td>short-term direct effects; mitigation measures would reduce impacts&lt;br&gt;Restoration of forest health and meadows would reduce wildfire risk and provide higher quality foraging habitat over the long-term, resulting in indirect beneficial effects&lt;br&gt;Voles &amp; shrews: short-term direct adverse effects from fuel treatments, with long-term indirect beneficial effects. Fencing would result in improved riparian vegetation resulting in indirect beneficial effects&lt;br&gt;VSS distributions outlined in Coconino Forest Plan would be attained</td>
</tr>
<tr>
<td>Management Indicator Species</td>
<td>No direct effect&lt;br&gt;Indirect adverse effects to habitat and population trends from risk of high-intensity wildfire and continued limited foraging habitat</td>
<td>Overall: direct beneficial effects to habitat trend from forest treatments; some short-term adverse effects to snag-dependent species, however beneficial to population trend over the long-term&lt;br&gt;Long-term indirect beneficial effects to population trend from improved quality habitat (see Chapter 3 for species-specific analysis)</td>
</tr>
<tr>
<td>Migratory Birds</td>
<td>No direct effect&lt;br&gt;Indirect adverse effects from risk of high-intensity wildfire and continued limited foraging habitat</td>
<td>Disturbance from smoke or noise may cause short-term direct adverse effects; mitigation measures would reduce impacts&lt;br&gt;Direct and indirect beneficial effects from forest treatments resulting in improved quality habitat</td>
</tr>
<tr>
<td>Snags and Logs(^2)</td>
<td>No direct effect&lt;br&gt;Indirect adverse effect as high tree densities would</td>
<td>Direct effect from loss of snags and logs during broadcast burning; however, mitigation would</td>
</tr>
</tbody>
</table>

\(^2\) Detailed analysis can be found in the Wildlife Specialist Report located in the project record
<table>
<thead>
<tr>
<th>Resource</th>
<th>Alternative 1: No Action</th>
<th>Alternative 2: Proposed Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wildlife Cover</td>
<td>remain limiting growth of large diameter trees and thereby limiting replacement snags and logs</td>
<td>minimize effects and meet wildlife management objectives</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Stands would more quickly develop recruitment snags and logs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Indirect beneficial effect from reduced risk of high intensity wildfire</td>
</tr>
<tr>
<td>Special Status Plants</td>
<td>No direct effect</td>
<td>Reduction of combination, thermal and hiding cover across 990 acres (10%) of mixed conifer and ponderosa pine. Meets recommendation of Coconino Forest Plan.</td>
</tr>
<tr>
<td></td>
<td>Indirect adverse effects from risk of high intensity wildfire. Continued dense forest conditions with surplus hiding and thermal cover would limit foraging.</td>
<td></td>
</tr>
<tr>
<td>Noxious Weeds</td>
<td>No direct effects</td>
<td>Fencing of Bebb willows and springs would have direct beneficial effects to regeneration and population viability</td>
</tr>
<tr>
<td></td>
<td>Indirect adverse effects from potential high intensity wildfire causing death to individuals and reducing populations</td>
<td>Fuel treatments may result in short-term direct adverse effects, however improved forest health would have long-term indirect beneficial effects</td>
</tr>
<tr>
<td></td>
<td>Indirect adverse effects from continued canopy closure and tree density reducing resources</td>
<td>Indirect beneficial effect from reduced risk of high intensity wildfire</td>
</tr>
<tr>
<td></td>
<td>No direct effects</td>
<td>Noxious or invasive weed treatments would result in direct beneficial effects</td>
</tr>
<tr>
<td></td>
<td>Indirect adverse effects from potential wildfire creating suitable conditions for invasions</td>
<td>Forest treatments would increase plant vigor, providing better competition resulting in indirect beneficial effects</td>
</tr>
<tr>
<td></td>
<td>No noxious or invasive weed treatments would occur</td>
<td></td>
</tr>
</tbody>
</table>

3 Detailed analysis can be found in the Wildlife Specialist Report located in the project record.
<table>
<thead>
<tr>
<th>Resource</th>
<th>Alternative 1: No Action</th>
<th>Alternative 2: Proposed Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soils</td>
<td>Higher Intensity Burn effects 0 acres</td>
<td>80-478 acres (1-3% of project area)</td>
</tr>
<tr>
<td></td>
<td>Disturbance from non-burning activities 0 acres</td>
<td>1,590-2,790 acres (12-22% of project area)</td>
</tr>
<tr>
<td>Water</td>
<td>Untreated fuel would increase potential risk for high intensity fire with unquantifiable indirect adverse impact</td>
<td>Limited direct impact from sediments produced from ground disturbance (ca. 1,670-3,270 acres). Fencing of springs would result in direct and indirect beneficial effects to water quality and function</td>
</tr>
<tr>
<td>Air Quality</td>
<td>No direct effects</td>
<td>Short-term direct effects of smoke (1-3 days at a time), however would not exceed air quality standards</td>
</tr>
<tr>
<td></td>
<td>Potential wildfire would exceed air quality standards</td>
<td>Potential wildfire would likely not exceed air quality standards after completed treatments</td>
</tr>
<tr>
<td>Cultural Resources</td>
<td>No direct effects</td>
<td>Direct effects from treatments would be negligible. Treatments would reduce fuel loading and the risk of high intensity wildfires, resulting in indirect beneficial effects</td>
</tr>
<tr>
<td></td>
<td>Indirect adverse effect from risk of high intensity fires and subsequent fire suppression actions</td>
<td>Prescribed burning and other forest health treatments may enhance viability of plants used by tribes</td>
</tr>
<tr>
<td>Recreation</td>
<td>No direct effects</td>
<td>Direct beneficial effects from gate relocation and fencing of springs</td>
</tr>
<tr>
<td></td>
<td>Indirect adverse effects from risk of stand replacing wildfire and aspen decline</td>
<td>Mechanical thinning, prescribed burning, etc. would result in short-term direct adverse effects, with long-term beneficial effects</td>
</tr>
</tbody>
</table>
# Chapter 2 – Alternatives

### Environmental Assessment for the Hart Prairie Fuels Reduction and Forest Health Restoration Project

Coconino National Forest 28

<table>
<thead>
<tr>
<th>Resource</th>
<th>Alternative 1: No Action</th>
<th>Alternative 2: Proposed Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scenery Management</td>
<td>No direct effects&lt;br&gt;Indirect adverse effects from continued aspen decline and risk of stand replacing wildfire</td>
<td>Mechanical thinning, prescribed burning, etc. could result in short-term direct adverse effects, with long-term beneficial effects&lt;br&gt;Aspen and forest restoration treatments would result in long-term beneficial effects</td>
</tr>
<tr>
<td>Transportation and Access</td>
<td>No direct effects&lt;br&gt;Indirect adverse effects from lack of maintenance and improvement of system roads, and risk of high intensity wildfire causing erosion</td>
<td>Short-term direct effects from opening previously decommissioned roads for treatment implementation&lt;br&gt;Long-term beneficial effects from improvement and maintenance of system roads</td>
</tr>
</tbody>
</table>
Chapter 3 – Affected Environment and Environmental Consequences

This chapter provides information concerning the affected environment of the Hart Prairie Fuels Reduction and Forest Health Restoration Project area, and potential consequences to that environment from the two alternatives. It also presents the scientific and analytical basis for the comparison of alternatives presented in the previous chapter linked to references and specialist reports. The following analysis of environmental consequences is organized by resource area and discloses the direct, indirect, and cumulative effects of the proposed action and no action on those resources. A list of events considered in the cumulative effects analysis is located in Appendix B; however, not all events are applicable to every resource area and only those events that would cumulatively add to the impacts to the resource were analyzed. The cumulative effects area varies by resource type and is defined under each resource area analyzed in this chapter. Effects are quantified where possible, and qualitative discussions are also included. The means by which potential adverse effects would be reduced or mitigated are described (see also Chapter 2). The project record for the Hart Prairie Fuels Reduction and Forest Health Restoration Project (accessible at the Peaks/Mormon Lake Ranger Districts) includes all project-specific information, including resource reports, watershed analyses, and other results of field investigations. This summary of the effects analysis is organized to first focus on those resources directly related to the purpose and need and the issues defined by scoping. Brief summaries of additional analyses follow and more detailed discussion for these resources can be found in the specialist reports in the Project Record.

Silviculture

The following information has been summarized from the Silviculture Specialist’s Report, located in the project record.

Affected Environment

Vegetation cover types within the project area include ponderosa pine (5050 acres), willow (25 acres), aspen (3740 acres), blue spruce (20 acres), Douglas-fir (640 acres), southwestern white pine (135 acres), reservoirs (2 acre), and grasslands (1715 acres); all acres are approximate. Management Areas (MA) located within the project area include MA 3, 4, 5, 6, 9, 12, and 17. Approximately 43% of the project area is classified as MA 3, Ponderosa Pine and Mixed-conifer Less Than 40% Slopes. Approximately 33% of the project area is classified as MA 5, Aspen. Approximately 14% of the project area is classified as MA 9, Mountain Grassland. The Fern Mountain Botanical Area (MA 17) is located in the southeast portion of the project area (186 acres). In addition to these management areas, the project also contains approximately three acres of Developed Recreation Sites (Flagstaff Nordic Center) and 1142 acres of the Highway 180 Corridor, which consists of MA 3, 5, and 9 located within ¼ mile of Highway 180.

Forest Structure

The Forest Plan requires VSS and canopy cover to be evaluated at three different scales in order to address northern goshawk habitat needs. The three different scales include: ecosystem management area scale, mid-scale by cover type, and small scale of site or stand. Forest Plan standards and guidelines for VSS distribution and canopy cover apply only to northern goshawk habitat, specifically the ponderosa...
pine, mixed-conifer, and spruce-fir cover types. Canopy cover guidelines apply only to mid-aged to old-growth forest (VSS 4-6) within these cover types. See Table 4 for VSS class definitions.

### Table 4. Vegetative Structural Stage definitions

<table>
<thead>
<tr>
<th>Class</th>
<th>Forest stage</th>
<th>Tree sizes (dbh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>VSS 1</td>
<td>Grass-forb/shrub</td>
<td>Non-stocked openings and trees 0-1 inch dbh</td>
</tr>
<tr>
<td>VSS 2</td>
<td>Seedling/sapling</td>
<td>1-5 inches dbh</td>
</tr>
<tr>
<td>VSS 3</td>
<td>Young forest</td>
<td>5-12 inches dbh</td>
</tr>
<tr>
<td>VSS 4</td>
<td>Mid-age forest</td>
<td>12-18 inches dbh</td>
</tr>
<tr>
<td>VSS 5</td>
<td>Mature forest</td>
<td>18-24 inches dbh and greater</td>
</tr>
<tr>
<td>VSS 6</td>
<td>Old-growth forest</td>
<td>special designation given to stands that meet old-growth definitions outlined in the Coconino National Forest Plan</td>
</tr>
</tbody>
</table>

**Vegetative Structural Stage (VSS)**

**Small Scale:** For the small scale VSS analysis, 230 stands were analyzed and given a stand-specific VSS designation. The list of VSS classes for each stand is too extensive to place in this document, but can be found in the project record. These stand-level VSS designations were used to conduct the mid-scale analysis.

**Mid-Scale:** Table 5 displays the VSS distribution by cover type within the project area. The ponderosa pine cover type is dominated by young to mid-aged forest: approximately 37% of the cover type is VSS 3, 43% is VSS 4, and 21% is VSS 5. The Douglas-fir cover type is dominated by young forest: approximately 97% of the cover type is VSS 3 and only 3% is VSS 5. The southwestern white pine cover type is dominated by mid-aged and mature forest: approximately 46% is VSS 4, 30% is VSS 5, and 24% VSS 3. All cover types are lacking in VSS 1, 2, and 6.

### Table 5. Basal area, trees per acre, and percent canopy cover by VSS and cover type within the project area (values are expressed in ranges, with averages in parentheses)

<table>
<thead>
<tr>
<th>Cover Type</th>
<th>VSS</th>
<th>Percent of Cover Type</th>
<th>Basal Area (ft²/ac)</th>
<th>Trees per acre</th>
<th>Percent Canopy Cover (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ponderosa Pine</td>
<td>3</td>
<td>37</td>
<td>57-274 (173)</td>
<td>147-750 (365)</td>
<td>46-86 (73)</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>43</td>
<td>45-300 (182)</td>
<td>84-1233 (267)</td>
<td>39-88 (74)</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>21</td>
<td>52-291 (151)</td>
<td>85-600 (165)</td>
<td>44-87 (69)</td>
</tr>
<tr>
<td>Douglas-Fir</td>
<td>3</td>
<td>97</td>
<td>168-280 (256)</td>
<td>623-850 (733)</td>
<td>73-86 (83)</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>3</td>
<td>180</td>
<td>306</td>
<td>75</td>
</tr>
<tr>
<td>Southwestern white pine</td>
<td>3</td>
<td>24</td>
<td>154-237 (189)</td>
<td>942-1650 (1271)</td>
<td>71-82 (75)</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>46</td>
<td>167-252 (199)</td>
<td>190-510 (405)</td>
<td>73-84 (78)</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>30</td>
<td>297</td>
<td>237</td>
<td>84</td>
</tr>
</tbody>
</table>

**Landscape Scale:** Northern goshawk habitat is dominated by young to mid-aged forest, with approximately 39% within VSS 3 and 41% within VSS 4. In addition, approximately 20% is mature forest (VSS 5). However, none of the area is classified as grass-forb/shrub (VSS 1), seedling/sapling (VSS 2), or old-growth forest (VSS 6). A lack of VSS 1, 2, and 6 at a landscape scale is indicative of a
lack of vertical heterogeneity and a fairly homogenous, even-aged forest structure. Without regeneration to replace older age classes, the forest structure is not sustainable.

**Canopy Cover**

**Small Scale:** For the small scale canopy cover analysis, 230 stands were analyzed and given a stand-average percent canopy cover. The list of average canopy cover values is too extensive to place in this document but can be found in the project record. These stand-level canopy cover values were used to conduct the mid-scale analysis.

**Mid-Scale:** Table 5 displays percent canopy cover by cover type and VSS. Across the ponderosa pine cover type, the majority of stands have closed canopies, with averages greater than 60% canopy cover. All stands within the Douglas-fir cover type have closed canopies, with averages greater than 60% canopy cover. All stands within the southwestern white pine cover type have closed canopies (60%+ canopy cover), with averages greater than 60% canopy cover.

**Landscape Scale:** Northern goshawk habitat is dominated by closed crown canopies. In spruce-fir outside the PFA, canopy cover is 60% in VSS 5. In mixed-conifer outside the PFA, canopy cover averages 78% in VSS 4 and 82% in VSS 5. In ponderosa pine outside of the PFA, canopy cover averages 74% in VSS 4 and 69% in VSS 5. In ponderosa pine inside the PFA, canopy cover averages 86% in VSS 4. In the nest area, canopy cover averages 86% in VSS 4. There is no VSS 5 or 6 inside the PFA or nest area. See Table 1 in the Purpose and Need section for a summary of existing conditions.

Although the Forest Plan does not specify desired percentages within MSO habitat, percent canopy cover was evaluated within MSO habitat to describe existing conditions and changes (or lack thereof). Table 6 displays percent canopy cover within MSO habitat. In protected habitat, canopy cover averages 61%. In restricted habitat, canopy cover averages 84%. Over 75% of MSO habitat contains closed crown canopies (60%+ canopy cover).

Closed crown canopies result in decreased sunlight to the forest floor, decreased understory productivity and diversity, increased inter-tree competition, decreased tree health, growth and vigor, increased insect and disease-related mortality especially in older age classes, decreased understory productivity and diversity, and decreased horizontal heterogeneity. Closed crown canopies also result in decreased natural regeneration of shade intolerant species, such as ponderosa pine and Douglas-fir, and increased natural regeneration of shade tolerant species, such as white fir. White fir is less fire resistant than ponderosa pine and Douglas-fir and results in increased fire hazard.

**Table 6. Basal area, trees per acre, and canopy cover within Mexican spotted owl habitat in the project area (values are expressed in ranges, with averages in parentheses)**

<table>
<thead>
<tr>
<th>MSO Habitat</th>
<th>Acres</th>
<th>Basal Area</th>
<th>Trees per Acre</th>
<th>Percent Canopy Cover</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protected</td>
<td>1603</td>
<td>45-291 (132)</td>
<td>98-1371 (362)</td>
<td>39-87 (61)</td>
</tr>
<tr>
<td>Restricted</td>
<td>292</td>
<td>115-280 (255)</td>
<td>88-1800 (661)</td>
<td>63-86 (84)</td>
</tr>
</tbody>
</table>

**Old-growth**

According to the Coconino National Forest Plan, old-growth forest should be analyzed at multiple scales – one scale above and one scale below the ecosystem management areas. Therefore, old-growth was analyzed at three different scales. For the small scale analysis, old-growth was analyzed by cover type within the project area due to the different minimum criteria for the structural attributes used to determine...
old-growth in different forest cover types in the Forest Plan. For the mid-scale analysis, old-growth was analyzed at the ecosystem management area scale. For the large scale analysis, old-growth was analyzed across the Peaks and Mormon Lake Ranger Districts.

**Small Scale:** Currently, none of the stands within any of the cover types in the project area meet the minimum criteria for old-growth forest. Additionally, none of these stands have been previously designated as developing old-growth forest.

**Mid-Scale:** The project area contains two ecosystem management areas: White Horse Hills and Hochderffer. According to the Coconino National Forest Plan, no less than 20% of each forested ecosystem management area should be allocated to old-growth. Currently, none of the stands within either ecosystem management area meet the minimum criteria for old-growth forest. Additionally, none of these stands have been previously allocated to old-growth forest.

**Landscape Scale:** Across the Peaks and Mormon Lake Ranger Districts, approximately 7430 acres of existing old-growth have been identified and designated. Additionally, 40,967 acres have been previously designated as developing old-growth forest. Combined, these acres constitute approximately 7.6% of the total forested acres capable of achieving the minimum criteria for the structural attributes of old-growth forest, as outlined in the Coconino National Forest Plan.

**Stand Density**

Measures of stand density commonly used include basal area and trees per acre. Basal area is the total cross-sectional area of the trees in a stand, measured in square feet per acre. Trees per acre is simply a count of the number of all trees on an acre. Table 5 summarizes basal area and trees per acre by cover type and VSS classes. Table 6 summarizes basal area and trees per acre within MSO habitat.

**Basal Area**

Across the project area, the vast majority of stands contain high stand densities. Approximately 80% of the conifer cover types contain basal areas greater than 120 ft² per acre, while only 5% contain basal areas of 40-80 ft² per acre. Approximately 15% contain basal areas of 80-120 ft² per acre. High stand densities result in increased inter-tree competition, decreased tree health, growth and vigor, decreased regeneration of shade intolerant species, stagnation of VSS class progression, increased insect and disease-related mortality especially in older age classes, decreased horizontal heterogeneity, decreased understory productivity and diversity, and increased fire hazard.

**Trees per Acre**

Over 80% of the conifer cover types contain greater than 100 trees per acre. Due to high stand densities, conifers across the project area are experiencing increased competition for moisture, nutrients, and sunlight, decreased tree vigor, increased susceptibility to bark beetle attack and mortality, decreased diameter growth, decreased “yellow” pine longevity, decreased regeneration, and decreased understory productivity. Eventually, those trees that are out-competed will die, resulting in increased fuel loading, increased fire hazard, and increased risk of bark beetle attack to residual trees.
Forest Health and Species Diversity

**Aspen**

Over the past 10 years, the majority of aspen sites across the project area have sustained greater than 60% aspen mortality (Fairweather et al. 2008). Aerial detection survey data over this time period show most of the aspen cover type in the project area has been impacted (see Figure 3). Ground surveys revealed aspen decline is due to a range of stressors including: a late season frost event in June of 1999; severe drought in 2002–2003; defoliation by western tent caterpillar in 2004, 2005 and 2007; and multiple secondary agents acting on stressed trees. These agents include Cytospora canker (*Valsa sordida*), bronze poplar borer (*Agrilus liragus*), aspen bark beetles (*Trypophloeus populi* and *Procryphalus mucronatus*), poplar borer (*Saperda calcarata*) and a clearwing moth (*Paranthrene robinae*) (Fairweather et al. 2008). The residual aspen trees are, in general, of poor health with reduced crown canopies.

![Figure 3. Aspen decline in the project area, 1999-2007](image)

The rapid mortality of aspen observed in the Hart Prairie project area occurred across other forests in Arizona over the same time period and resembles a decline disease (USDA 2009). A primary factor is the succession of aspen dominated forests to conifer species that occurred over the past 100 years. Although succession to conifers is a natural event, it was the alteration of fire regimes and livestock grazing since...
European settlement that promoted a more consistent landscape level succession to conifers (USDA 2009). Another predisposing factor is browse impacts which have limited the reproduction of aspen. Browse impacts on aspen within the project area were documented as early as the 1940s, when fences were constructed near Bismark Lake to control the movement of sheep into an aspen regeneration research area (USDA 2009). However, for the past several decades, severe aspen browse impacts are attributed to Rocky Mountain elk (USDA 2009). By the mid 1980s, elk browse impacts were so severe that several harvest areas located within the Hart Prairie Project area failed to regenerate when newly sprouted ramets disappeared. Elk exclosure fences that are six to seven feet tall were first constructed in the mid-1980s around aspen regeneration for protection. Inciting factors in a decline disease are typically of short duration and cause drastic injuries. The inciting factors in aspen decline on the Coconino National Forest are the late season frost of 1999, the severe drought years of 2002 and 2003, and insect defoliation by the western tent caterpillar. The contributing factors of aspen decline include bark beetles, canker fungi, and borers. These organisms are often blamed for causing mortality, but are considered secondary agents that occupy a weakened host. The death of mature aspen, by fire or other natural disturbance, is not in itself cause for alarm because of the natural ability of aspen roots to readily regenerate after death of the overstory trees. However, there is little evidence on the San Francisco Peaks of successful aspen recruitment over the last several decades due in large part to browsing by elk. Successful aspen regeneration is restricted primarily to fenced exclosures, areas that had previously been fenced or contain steep slopes. The few trees that grew above the browse line are impacted by elk antler rubbing and stem barking, resulting in young trees with advanced stem decay that will eventually fail. Widespread mortality of mature aspen trees, chronic browsing by elk, and advanced conifer regeneration is expected to result in rapid vegetation change of many ecologically unique and important sites.

Table 7. Basal area and trees per acre within the aspen cover type (values are expressed as ranges, with averages in parentheses)

<table>
<thead>
<tr>
<th>Basal Area All Species</th>
<th>Basal Area Aspen</th>
<th>Trees per acre All Species</th>
<th>Trees per acre Aspen</th>
</tr>
</thead>
<tbody>
<tr>
<td>55-314 (151)</td>
<td>0-264 (45)</td>
<td>28-637 (306)</td>
<td>0-586 (92)</td>
</tr>
</tbody>
</table>

There are two aspen stands in the project area that are noticeably healthy, compared to the rest of the aspen cover type, with full crowns and minimal conifer encroachment. These “healthy sites” were burned or harvested in the mid 1940s. The site near Arizona Snowbowl received an overstory removal and the understory trees have now matured. The other site is near Bismarck Lake where all trees were harvested or killed and the sprouts were protected from sheep browsing with fencing.

Table 7 displays existing conditions within the aspen cover type in the Hart Prairie project area, including basal area and trees per acre, which further illustrate the nature of previous statements. While total basal area of all species within the aspen cover type averages 151 ft² per acre, the basal area of aspen averages only 45 ft² per acre. The remaining basal area is made up by conifers, such as ponderosa pine, southwestern white pine, and Douglas-fir. Approximately 37% of the aspen cover type contains basal areas of 40-80 ft² per acre of ponderosa pine. Approximately 23% of the aspen cover type contains basal areas of 80-120 ft² per acre of ponderosa pine. Approximately 13% of the aspen cover type contains basal areas of greater than 120 ft² per acre of ponderosa pine.

Table 7 also displays trees per acre within the aspen cover type. While total trees per acre average 306, the number of aspen per acre averages only 92. Nearly one-fourth of the aspen cover type has a species composition of 25-50% ponderosa pine. Approximately 21% of the aspen cover type has a species composition of greater than 50% ponderosa pine. The high density and proportion of ponderosa pine within the aspen cover type is the result of conifer encroachment due to fire suppression and a lack of
aspen regeneration success due to elk browsing. The vast majority of aspen clones within the project area are mid-aged to mature, with few trees less than 5’ dbh. Nearly all aspen clones that have experienced mortality have responded by producing suckers. However, the aspen suckers are not surviving due to severe elk browsing.

**Dwarf Mistletoe**

Dwarf mistletoe (DM) is a parasitic plant that infects ponderosa pine and Douglas-fir and depends almost completely on its host for water and nutrients. Infection is spread via pressure-released seeds and expands at a rate of 1-2 feet per year (Conklin 2000). Overall effects on forest structure in a site that has been infected for many generations include: increased stand openings; lower crown base height; denser tree canopies due to witches’ brooms; and fewer large diameter trees.

Infected host trees experience reduced tree growth and vigor, reduced seed production and viability, branch deformations, a predisposition to bark beetles (USDA 2009) and root disease, and shortened life span and mortality. Only 5% of heavily infected ponderosa pine over 9 in. dbh and no trees 4- to 9 in. dbh survive over a 30-year period, while more than 90% of uninfected and lightly infected trees survive. Trees infected with dwarf mistletoe are more susceptible to insect attack, such as bark beetles, and diseases. Reduced tree growth and shortened life span result in stagnation of VSS classes. Additionally, in comparison to uninfected trees, trees infected with DM are more flammable due to the accumulation of resin and branch deformations (Conklin 2000). Since Euro-American settlement and the advent of fire suppression, DM populations in the southwest are thought to have increased with increased forest densities (Conklin 2000). Fire, both prescribed and natural, can have a sanitizing effect, in which heavily infected trees and the lower branches of moderately and lightly infected trees are killed by fire, thereby lowering infection levels.

Due to the damaging effects of DM on tree growth and forest structure, the Coconino National Forest Plan states, “Silvicultural prescriptions emphasize treating dwarf mistletoe infections to bring them down to acceptable levels…” (USDA 1987, as amended; p. 122-1). However, complete elimination of DM from the project area is neither practical nor desirable. Proposed treatments are not designed to completely eliminate dwarf mistletoe from the project area, but rather decrease infection to manageable levels. Although DM increases fire hazard and has many damaging effects on tree growth, it is a natural occurrence in ponderosa pine ecosystems and has many beneficial effects. Increased snag densities and witches’ brooms in large, infected trees improves habitat values for several wildlife species. Additionally, infection areas are associated with increased insect populations and, therefore present increased foraging opportunities for insect-feeding birds. Although not a primary food source, many wildlife species feed on DM fruits, shoots, and infected bark (Conklin 2000).

Approximately one-third of the area contains some level of DM infection. Approximately 22% of the area contains a light level of DM infection, with infection found mainly in the overstory. Approximately 6% of the area contains a moderate level of infection, found mainly in the overstory. Approximately 5% of the area contains severe infection, with infection both in the overstory and understory. Additional infection centers or “pockets” of DM may exist within the project area in stands that were not surveyed.

**Bark Beetles**

Bark beetle species known to cause ponderosa pine mortality within the project area include roundheaded pine beetle (*D. adjunctus*) and western pine beetle (*D. brevicomis*). Aerial detection surveys over the last 10 years found relatively low levels of bark beetle activity in ponderosa pine stands within the project area; however, based on observations by Forest Health Protection staff, moderate levels of roundheaded pine beetle and western pine beetle occurred between 2004-2007 in the vicinity of the Nordic Center and...
Within the ponderosa pine cover type, stands that have an average dbh greater than 12 inches (VSS 4 and 5) and a basal area greater than 120 ft² per acre are considered at high risk for bark beetle attack (USDA 2009). The average basal area ranges for these stands are 151-182 ft² per acre, thus approximately 60-70% of the project area is currently at moderate to high risk for bark beetle attack. However, VSS 3 stands are rated in the low susceptibility category due to lower quadratic mean diameters. Quadratic mean diameter is the diameter of the tree of mean basal area, measured in inches.

Bark beetle species known to cause Douglas-fir mortality include Douglas-fir beetle. Species known to cause mortality in southwestern white pine include mountain pine beetle. Within the Douglas-fir and southwestern white pine cover type, total basal areas within VSS 4 and 5 stands range from 180-297 ft² per acre, placing these stand in the moderate stand hazard rating category for bark beetle attack. However, mortality data collected in 2007 from two Douglas-fir stands southeast of Bismarck Lake ranged from 3.5 to 12.5 trees per acre, and it was determined that total basal area, Douglas-fir quadratic mean diameter, and average Douglas-fir dwarf mistletoe ratings were all higher in areas with higher tree mortality. Based on this data, stands in this area seem to be in the moderate to high hazard category. However, VSS 3 stands would still be in the low hazard category because of lower quadratic mean diameters.

In general, stands that have a moderate to high hazard rating for potential bark beetle attack are experiencing increased competition between trees for water, nutrients, and growing space, decreased tree vigor, increased tree stress, and compromised insect resistance mechanisms (USDA 2009). In fact, approximately 75% of the forested area is at or above the stand density threshold where inter-tree competition is significant. Natural defense mechanisms against insect attack, such as the production of pitch, are limited at these densities, resulting in increased susceptibility to successful bark beetle attack and mortality. Individual trees exhibit reduced tree growth and vigor, with imminent, competition-based mortality occurring at these stand densities as they reach the point of full site occupancy. These stand densities are not ecologically sustainable. Individual trees exhibit very little or no growth due to inter-tree competition and a lack of adequate moisture, nutrients, and sunlight. Stands are at extreme risk of bark beetle attack and mortality and stand-replacing fire (Long 2005). Eventually, those trees that are out-competed will die, resulting in increased fuel loading, increased fire hazard, and increased potential of bark beetle attack to residual trees.

Understory Vegetation

Research at the Fort Valley Experimental Forest has shown that massive declines in herbaceous vegetation have occurred over the past century due to increased stand densities, increased canopy covers, and increased forest floor depth (Covington et al. 1997). According to research conducted in ponderosa pine around Flagstaff, restoration treatments result in changes in microclimate on the forest floor, specifically increased sunlight penetration to the forest floor, increased soil temperatures, and increased understory productivity (Meyer et al. 2001). Research conducted at the Fort Valley Experimental Forest found that thinning and prescribed burning resulted in increases in herbaceous production (Covington et al. 1997). Research conducted by Griffis et al. (2001) in ponderosa pine forests of northern Arizona found an increase in overall plant diversity and an increase in the abundance of graminoids in thinned and burned stands. Furthermore, prescribed burning is essential to nutrient cycling in ponderosa pine ecosystems.

The project area is dominated by high stand densities and closed crown canopies. Approximately 80% of the forested area has basal areas greater than 120 ft² per acre. Approximately 90% of the area has total canopy covers of 60% or greater. High stand densities and closed crown canopies result in decreased
sunlight to the forest floor, increased forest floor depth, and decreased understory productivity and diversity.

**Meadows**

Approximately 1720 acres within the project area are classified as grassland cover type. Approximately 99% of the grassland cover type in the project area has some degree of conifer encroachment. These grasslands have been experiencing pine encroachment for over 100 years due to fire suppression. Although the majority of trees located within grasslands are less than 60-70 years old, these trees have attained diameters of greater than 12” dbh in many areas due to open growing conditions and a lack of competition for an extended period of time. Quadratic mean diameter ranges averages 17.2 inches. However, as densities increase, individual tree growth decreases. Currently, basal areas range from 81-138 ft² per acre, with an average of 126 ft² per acre. Trees per acre range from 55-161, with an average of 85 trees per acre. The densities within the grassland cover type demonstrate the extent of conifer encroachment as the result of fire suppression. Percent canopy cover ranges from 55-68, with an average of 65. As canopy cover continues to increase, understory productivity and diversity will continue to decrease.

**Alternative 1 - No Action**

**Direct and Indirect Effects**

**Forest Structure**

For the No Action Alternative, data was projected over 40 years using the Forest Vegetation Simulator. Table 8 summarizes VSS designations and canopy cover projected over both 20 and 40 years under the No Action Alternative. There would be no direct effects to forest vegetation because no trees would be harvested, however, there would be indirect adverse effects to forest structure over the long-term.

**Vegetative Structural Stage (VSS)**

*Small Scale:* Table 8 summarizes the stand-level VSS designations projected over both 20 and 40 years. Under the No Action Alternative, there would be no direct effects to forest vegetation because no trees would be harvested, however, there would be indirect effects to forest structure over the long-term. As stand densities continue to increase over the next 40 years, individual tree growth would dramatically decrease and regeneration of shade-intolerant species would be prohibited, resulting in stagnation of VSS class progression and an even-aged, unsustainable forest structure.

**Table 8. Vegetative Structural Stage (VSS), basal area, trees per acre, and percent canopy cover under the No Action Alternative (values are expressed as ranges, with averages in parentheses)**

<table>
<thead>
<tr>
<th>Cover Type</th>
<th>Time Frame</th>
<th>VSS</th>
<th>Percent of Cover Type</th>
<th>Basal Area</th>
<th>Trees per acre</th>
<th>Percent Canopy Cover</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ponderosa pine</td>
<td>Existing Conditions</td>
<td>3</td>
<td>37</td>
<td>57-274 (173)</td>
<td>147-750 (365)</td>
<td>46-86 (73)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>43</td>
<td>45-300 (182)</td>
<td>84-1233 (267)</td>
<td>39-88 (74)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5</td>
<td>21</td>
<td>52-291 (151)</td>
<td>85-600 (165)</td>
<td>44-87 (69)</td>
</tr>
<tr>
<td></td>
<td>+20 years</td>
<td>3</td>
<td>15</td>
<td>133-271 (182)</td>
<td>190-660 (317)</td>
<td>67-85 (75)</td>
</tr>
</tbody>
</table>
## Chapter 3 – Affected Environment and Environmental Consequences

### Table 8: VSS by Percent of Cover Type under the No Action Alternative projected over 40 years

<table>
<thead>
<tr>
<th>Cover Type</th>
<th>Time Frame</th>
<th>VSS</th>
<th>Percent of Cover Type</th>
<th>Basal Area</th>
<th>Trees per acre</th>
<th>Percent Canopy Cover</th>
</tr>
</thead>
<tbody>
<tr>
<td>Douglas fir</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Existing Conditions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>97</td>
<td>168-280 (256)</td>
<td>623-850 (733)</td>
<td>73-86 (83)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>3</td>
<td>180</td>
<td>306</td>
<td>75</td>
<td></td>
</tr>
<tr>
<td>+20 years</td>
<td>3</td>
<td>2</td>
<td>261</td>
<td>665</td>
<td>84</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>95</td>
<td>215-324 (300)</td>
<td>545-626 (608)</td>
<td>79-90 (88)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>3</td>
<td>203</td>
<td>279</td>
<td>78</td>
<td></td>
</tr>
<tr>
<td>+40 years</td>
<td>3</td>
<td>2</td>
<td>271</td>
<td>542</td>
<td>85</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>95</td>
<td>246-324 (307)</td>
<td>448</td>
<td>83-90 (88)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>3</td>
<td>225</td>
<td>259</td>
<td>81</td>
<td></td>
</tr>
<tr>
<td>Southwestern white pine</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Existing Conditions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>24</td>
<td>154-237 (189)</td>
<td>942-1650 (1271)</td>
<td>71-82 (75)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>46</td>
<td>167-252 (199)</td>
<td>190-510 (405)</td>
<td>73-84 (78)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>30</td>
<td>297</td>
<td>237</td>
<td>84</td>
<td></td>
</tr>
<tr>
<td>+20 years</td>
<td>3</td>
<td>5</td>
<td>187</td>
<td>839</td>
<td>76</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>37</td>
<td>209-250 (219)</td>
<td>481-1169 (657)</td>
<td>79-83 (80)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>58</td>
<td>192-271 (242)</td>
<td>130-1025 (302)</td>
<td>77-85 (82)</td>
<td></td>
</tr>
<tr>
<td>+40 years</td>
<td>3</td>
<td>5</td>
<td>203</td>
<td>639</td>
<td>78</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>22</td>
<td>232-270 (245)</td>
<td>410-802 (631)</td>
<td>81-85 (83)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>73</td>
<td>211-289 (243)</td>
<td>115-574 (249)</td>
<td>79-87 (83)</td>
<td></td>
</tr>
</tbody>
</table>

**Mid-scale:** Table 8 summarizes VSS by percent of cover type under the No Action Alternative projected over 40 years. Within the ponderosa pine and Douglas-fir cover type, 40 years under the No Action Alternative would result in a forest structure dominated by mid-aged forest. Note that after 40 years, the VSS distribution for Douglas-fir would remain the same as it was after 20 years, and there would be no increase in mature forest. Within the southwestern white pine cover type, 40 years under the No Action Alternative would result in a forest structure dominated by mature forest.

Within all three cover types, 40 years without treatment would result in the continued absence of the grass-forb/shrub stage (VSS 1) due to high stand densities and a lack of openings. Without openings of sufficient size for regeneration of shade-intolerant species, seedling/sapling (VSS 2) would also continue to be absent. Forest structure would lack vertical heterogeneity and be predominantly even-aged for decades into the foreseeable future.
Table 9. Percent Vegetative Structural Stage distribution within northern goshawk habitat under the No Action Alternative

<table>
<thead>
<tr>
<th>VSS</th>
<th>Current Condition</th>
<th>+20 years</th>
<th>+40 years</th>
<th>Desired Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>3</td>
<td>43</td>
<td>14</td>
<td>2</td>
<td>20</td>
</tr>
<tr>
<td>4</td>
<td>38</td>
<td>61</td>
<td>59</td>
<td>20</td>
</tr>
<tr>
<td>5</td>
<td>18</td>
<td>25</td>
<td>39</td>
<td>20</td>
</tr>
<tr>
<td>6</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>20</td>
</tr>
</tbody>
</table>

**Landscape Scale:** Table 9 displays VSS distribution across northern goshawk habitat under the No Action Alternative. Northern goshawk habitat would be dominated by mid-aged forest for a minimum of 40 years. None of the area within northern goshawk habitat would be grass-forb/shrub (VSS 1) or seedling/sapling (VSS 2). A lack of VSS 1, 2, and 6 at a landscape scale is indicative of a fairly homogenous, even-aged forest structure. Without the formation of VSS 1 and 2 classes, there would be no trees to progress into the young forest (VSS 3) class and it would not be possible to achieve the recommended VSS distribution for the northern goshawk or a sustainable, uneven-aged forest structure. Forest structure would be predominantly even-aged for decades into the foreseeable future.

**Canopy Cover**

**Small Scale:** Table 8 summarizes the stand level cover percentages under the No Action Alternative over the next 40 years. Under the No Action Alternative, there would be no direct effect to canopy cover because no trees would be harvested, however, there would be indirect effects to canopy cover over the long-term. Crown canopies within individual stands would continue to increase and close over the next 40 years. Closed canopy conditions would continue to inhibit understory development, productivity, and diversity. Regeneration of shade intolerant species, such as ponderosa pine and Douglas-fir, would be severely limited under a closed canopy, resulting in a lack of VSS 1 and 2 classes. Mortality of smaller, over-topped, shade intolerant trees would increase, resulting in increased risk of bark beetle attack. Stands would remain even-aged and the forest structure would be unsustainable.

**Mid-Scale:** Table 8 summarizes percent canopy cover by cover type and VSS under the No Action Alternative projected over 40 years. Within the ponderosa pine cover type, 40 years under the No Action Alternative would result in a forest structure dominated by closed crown canopies. After 20 years, average percent canopy cover in VSS 3, 4, and 5 would be above 73%. After 40 years, average percent canopy cover in VSS 3, 4, and 5 would not significantly increase further because the vast majority of stands already have closed canopies, with averages greater than 60% canopy cover.

Within the Douglas-fir cover type, 40 years under the No Action Alternative would also result in a forest structure completely dominated by closed crown canopies. After 20 years, average percent canopy cover in VSS 3, 4, and 5 would be above 78%. After 40 years, average percent canopy cover in VSS 3, 4, and 5 would not significantly increase further because all stands would already have closed canopies, with averages greater than 60% canopy cover.

Within the southwestern white pine cover type, 40 years under the No Action Alternative would also result in a forest structure completely dominated by closed crown canopies. After 20 years, average percent canopy cover in VSS 3, 4, and 5 would be above 76%. After 40 years, average percent canopy
cover in VSS 3, 4, and 5 would not significantly increase further because all stands would already have closed canopies, with averages greater than 60% canopy cover.

**Landscape Scale:** Table 10 summarizes percent canopy cover across northern goshawk habitat. Northern goshawk habitat would be dominated by closed crown canopies. After 20 years under the No Action Alternative, canopy cover across goshawk habitat would range from 45-90%. Approximately 97% of northern goshawk habitat would have total canopy covers of 60% or greater. Only 3% would have moderately open crown canopies (40% - 59% canopy cover). None of the area would have open crown canopies (<40% canopy cover). After 40 years under the No Action Alternative, canopy cover across goshawk habitat would range from 62-90%. Within ponderosa pine inside the PFA and nest area, average percent canopy cover would actually decrease by approximately 3% due to competition-based mortality.

**Table 10. Average percent canopy cover across northern goshawk habitat under the No Action Alternative (values are expressed as ranges, with averages in parentheses)**

<table>
<thead>
<tr>
<th>Northern Goshawk Habitat</th>
<th>Timeframe</th>
<th>VSS 4</th>
<th>VSS 5</th>
<th>VSS 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spruce-fir - Outside PFA</td>
<td>Existing Condition</td>
<td>N/A</td>
<td>60</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>+20 years</td>
<td>N/A</td>
<td>66</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>+40 years</td>
<td>N/A</td>
<td>70</td>
<td>N/A</td>
</tr>
<tr>
<td>Mixed conifer - Outside PFA</td>
<td>Existing Condition</td>
<td>73-84 (78)</td>
<td>75-84 (82)</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>+20 years</td>
<td>79-90 (86)</td>
<td>77-85 (82)</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>+40 years</td>
<td>81-90 (87)</td>
<td>79-87 (83)</td>
<td>N/A</td>
</tr>
<tr>
<td>Ponderosa pine - Outside PFA</td>
<td>Existing Condition</td>
<td>39-88 (74)</td>
<td>44-87 (69)</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>+20 years</td>
<td>45-88 (75)</td>
<td>54-87 (73)</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>+40 years</td>
<td>62-77 (77)</td>
<td>50-87 (72)</td>
<td>N/A</td>
</tr>
<tr>
<td>Ponderosa pine - Inside PFA</td>
<td>Existing Condition</td>
<td>86</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>+20 years</td>
<td>83</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>+40 years</td>
<td>83</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Ponderosa pine - Inside Nest Area</td>
<td>Existing Condition</td>
<td>86</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>+20 years</td>
<td>83</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>+40 years</td>
<td>83</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Table 11 summarizes percent canopy cover within Mexican spotted owl habitat over 40 years under the No Action Alternative. After 20 years under the No Action Alternative, canopy cover within restricted habitat would average of 87%. After 20 years under the No Action Alternative, canopy cover within protected habitat would average of 66%. After 40 years, canopy cover would not increase significantly further because over 60% of MSO habitat would already have closed canopies.

Closed crown canopies would result in decreased sunlight to the forest floor, decreased understory productivity and diversity, increased inter-tree competition, decreased tree health, growth and vigor, increased insect and disease-related mortality especially in older age classes, decreased understory productivity and diversity, and decreased horizontal heterogeneity. Closed crown canopies would also result in decreased regeneration of shade intolerant species, such as ponderosa pine and Douglas-fir, and
increased regeneration of shade tolerant species, such as white fir. White fir is less fire resistant than ponderosa pine and Douglas-fir and would result in an increase in fire hazard.

**Table 11. Basal area, trees per acre, and percent canopy cover within Mexican spotted owl habitat under the No Action Alternative (values are expressed as ranges, with averages in parentheses)**

<table>
<thead>
<tr>
<th>MSO Habitat</th>
<th>Acres</th>
<th>Time Frame</th>
<th>Basal Area</th>
<th>Trees per Acre</th>
<th>Canopy Cover</th>
</tr>
</thead>
<tbody>
<tr>
<td>Restricted</td>
<td>292</td>
<td>Existing Conditions</td>
<td>115-280 (255)</td>
<td>88-1800 (661)</td>
<td>63-86 (84)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+20 years</td>
<td>139-324 (290)</td>
<td>85-1169 (542)</td>
<td>68-90 (87)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+40 years</td>
<td>158-324 (293)</td>
<td>82-754 (395)</td>
<td>72-90 (87)</td>
</tr>
<tr>
<td>Protected</td>
<td>1603</td>
<td>Existing Conditions</td>
<td>45-291 (132)</td>
<td>98-1371 (362)</td>
<td>39-87 (61)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+20 years</td>
<td>56-291 (155)</td>
<td>84-1025 (314)</td>
<td>45-87 (66)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+40 years</td>
<td>67-291 (168)</td>
<td>70-802 (256)</td>
<td>50-87 (69)</td>
</tr>
</tbody>
</table>

**Old-growth**

*Small Scale:* Under the No Action Alternative, there would be no designation of developing old-growth. A minimum of 20% of each forest cover type would not be actively managed to achieve the minimum criteria for the structural attributes used to determine old-growth, as outlined on page 70-2 of the Coconino National Forest Plan.

Additionally, under the No Action Alternative, old-growth would develop slowly within both the ponderosa pine and Douglas-fir cover types. Table 18 summarizes the percent of each cover type in VSS 5 after 40 years under the No Action and the Proposed Action Alternatives. The percent of each cover type advancing into the VSS 5 class is a good measure for the evaluation of old-growth development because it illustrates how slowly or quickly VSS classes are advancing into older/larger structural stages. In general, the No Action Alternative would result in a slow development of old-growth structural attributes due to high stand densities. High stand densities would continue to increase over the next 40 years, resulting in increased inter-tree competition, decreased tree health, growth, and vigor, decreased regeneration, and decreased old, “yellow” pine longevity. Trees would grow into larger diameter classes and VSS classes at a much slower rate due to high stand densities and high competition between trees, resulting in stagnation of VSS classes and slower development of old-growth forest structures. Trees reaching maturity and changing their appearance from black bark to yellow bark would still occur biologically at approximately 150 to 200 years old, but they would have smaller diameters than usually associated with old trees, depending on density conditions within the site. Smaller diameter trees would continue to out-compete and crowd out the remaining older yellow pines, resulting in decreased growth, vigor, and longevity.

*Mid-Scale:* Under the No Action Alternative, there would be no designation of developing old-growth across the two ecosystem management areas located in and adjacent to the project area. Under the No
Action Alternative, approximately 2823 acres, which is 20% of the forested area in the two ecosystem management areas would not be allocated to developing old-growth.

*Landscape Scale:* Under the No Action Alternative, no additional acres would be allocated to developing old-growth. The No Action Alternative would not contribute to an increase in the percentage of existing-developing old-growth across the Peaks and Mormon Lake Ranger Districts.

**Stand Density**

Table 8 summarizes basal area and trees per acre under the No Action Alternative projected over 40 years. Under the No Action Alternative, there would be no direct effect to stand densities because no trees would be harvested, however, there would be indirect adverse effects to stand densities over the long-term.

**Basal Area**

Under the No Action Alternative, nearly 90% of the conifer cover types within the project area would have basal area values in excess of 150 ft² per acre within 40 years. Under the No Action Alternative, increasing basal areas within most ponderosa pine and mixed-conifer stands within the project area would reduce both individual tree and stand vigor and therefore increase stand susceptibility to mortality from bark beetles (USDA 2009). Excess competition from smaller trees would also greatly increase the risk of mortality of old Douglas-fir and “yellow” ponderosa pine.

**Trees Per Acre**

Under the No Action Alternative, it is anticipated that the number of trees per acre would decrease over the next 40 year period due to competition-based mortality and a lack of regeneration. However, nearly all of conifer cover types would still have greater than 100 trees per acre within 40 years. As a result of these high stand densities, trees would experience increased competition for water, nutrients, and sunlight and decreased tree health, growth, and vigor for the next 40 years or until the next harvesting entry.

**Forest Health and Species Diversity**

**Aspen**

Under the No Action Alternative, there would be no direct effect on aspen because no trees would be harvested. There would be no change in aspen clones from existing conditions, however, there would be indirect adverse effects on aspen over the long-term. Table 12 summarizes basal area and trees per acre within the aspen cover type under the No Action Alternative. After 40 years under the No Action Alternative, basal area of all species (aspen and conifers) within the aspen cover type would average 214 ft² per acre, however, the basal area of aspen would only average 77 ft² per acre. This means that the majority of the basal area within aspen clones would be made up by conifers. As conifer density increases, the number of aspen per acre would decrease due to the shade intolerance of aspen. After 40 years, the number of aspen per acre would average 59, however, the total number of trees per acre (aspen and conifers) would average 305. Without protection for aspen seedlings, continued elk browsing would result in continued mortality of aspen seedlings. Additionally, a lack of disturbance and increasing conifer densities would result in continued decline of aspen clones, with aspen eventually either being replaced by conifers or converted to grasslands. There would be a tremendous loss of biodiversity and wildlife habitat across the landscape.
Table 12. Basal area and trees per acre within the aspen cover type under the No Action Alternative (values are expressed as ranges, with averages in parentheses)

<table>
<thead>
<tr>
<th>Time Frame</th>
<th>Basal Area All Species</th>
<th>Basal Area Aspen</th>
<th>Trees per acre All Species</th>
<th>Trees per acre Aspen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing Conditions</td>
<td>55-314 (151)</td>
<td>0-264 (45)</td>
<td>28-637 (306)</td>
<td>0-586 (92)</td>
</tr>
<tr>
<td>+20 years</td>
<td>71-340 (190)</td>
<td>0-332 (61)</td>
<td>27-892 (382)</td>
<td>0-744 (75)</td>
</tr>
<tr>
<td>+40 years</td>
<td>83-369 (214)</td>
<td>0-365 (77)</td>
<td>26-702 (305)</td>
<td>0-630 (59)</td>
</tr>
</tbody>
</table>

Dwarf Mistletoe

Under the No Action Alternative, there would be no direct effect on dwarf mistletoe infection, because no trees would be harvested, however, there would be indirect effects on the level of dwarf mistletoe infection over the long-term. Under the No Action Alternative, dwarf mistletoe infection would continue to spread throughout infected stands, expanding at a rate of 1-2 feet per year, which would result in adverse effects to forest health. Increased dwarf mistletoe infection would result in reduced tree growth, reduced tree vigor, branch deformations, and shortened life span of the infected host (Conklin 2000). Reduced tree vigor and altered pitch flow associated with dwarf mistletoe infection would result in compromise of a tree’s defense mechanisms to combat bark beetle attack, thus increasing the risk of successful bark beetle attack and mortality. Reduced tree growth and shortened life span would result in stagnation of VSS classes. Additionally, the accumulation of resin and branch deformations associated with dwarf mistletoe infection would result in increased fire hazard.

Bark Beetles

Under the No Action Alternative, increasing basal areas within most ponderosa pine and mixed-conifer stands within the project area would reduce both individual tree and stand vigor and therefore increase stand susceptibility to mortality from bark beetles (USDA 2009). Natural defense mechanisms against insect attack, such as the production of pitch, would be limited, resulting in increased susceptibility to successful bark beetle attack and mortality. As stand densities continue to increase over time, those trees that are out-competed would die, thus attracting bark beetles to the project area and further increasing the risk of bark beetle attack to residual trees. Additionally, continuous interlocking crowns and well-developed fuels ladders would leave vegetation on these sites at a high risk of loss from catastrophic wildfire. Competitive stress would result in very little tree growth and decreased vigor due to a lack of adequate moisture, nutrients, and sunlight. Existing old, “yellow” pines would experience decreased vigor and longevity. Trees in general would be unable to produce pitch to fight off bark beetle attack. Trees would also be more susceptible to attack from other insects and diseases. Within 20 years, the project area would be at extreme risk of successful bark beetle attack and mortality.

Understory Vegetation

Under the No Action Alternative, understory vegetation within the project area would experience indirect adverse effects. Understory productivity and diversity would continue to decrease over the next 40 years as crown canopies close. With a lack of broadcast burning across the project area, understory production would be further inhibited by increasing fuel loads and a lack of nutrient recycling from fire.
Meadows
The No Action Alternative would have indirect adverse effects on grasslands within the project area. Over a minimum period of 40 years, grasslands would continue to experience pine encroachment. As conifer density increases over time, grasslands would experience decreased productivity and diversity and loss of functionality in terms of hydrology, biodiversity, horizontal heterogeneity, and wildlife habitat diversity.

Cumulative Effects
The cumulative effects area consists of the project area and associated ecological management units, which are the Hochderffer and White Horse Hills areas. Potential cumulative effects were analyzed by considering the No Action Alternative in the context of past, present, and reasonably foreseeable future activities that have occurred within this cumulative effects analysis area. Past, present, and future activities considered in the cumulative effects analysis include livestock grazing, logging, wild- and prescribed fire, commercial harvests, reforestation, exclosure fencing, dispersed recreation, and illegal firewood cutting. A list of these activities can be found in Appendix B.

Forest Structure and Stand Density
Over the past century, several events, including fire exclusion, livestock grazing, and high-grade timber harvesting, occurred within the majority of the cumulative effects analysis. These events have resulted in altered stand structures, decreased age and size class diversity, changes in successional dynamics, increased stand densities, a lack of old-growth forest structures, and a more even-aged forest structure (Long 2003). Figure 4 depicts changes in trees per acre by size class on non-reserved forest lands in New Mexico and Arizona, including the Coconino National Forest. The graph depicts changes that are typical of southwest ponderosa pine around Flagstaff due to past events and activities. The density of trees has increased over time, especially in diameter classes less than 12 inches, resulting in decreased size class diversity and a more even-aged forest structure. The No Action Alternative has a cumulative effect by maintaining the number of acres on the forest with these conditions. Under the No Action Alternative, the forest structure desired condition would not be attained within the foreseeable future.

Forest Health and Species Diversity
Past and current events have resulted in decline of aspen communities across the cumulative effects analysis area. Aspen communities have been in a gradual state of decline over the past 50 years due to a number of factors including fire suppression, frost, drought, defoliation by western tent caterpillar, canker fungi, wood borers, bark beetles, root disease, and browsing pressure from elk. Many aspen clones are nearing 100% mortality, and at a landscape scale this loss signifies a tremendous loss of biodiversity, with aspen decline cascading into losses of vertebrate species, vascular plants, and likely species from a myriad of other organismal groups (Strand et al. 2009). Aspen communities are a critical element within the forests of northern Arizona, representing one of the most biologically diverse and ecologically unique sites and serve as an indicator of ecological integrity (Di Orio et al. 2005). The aspen located within the project area boundary represents nearly 40% of all of the aspen on the Coconino National Forest. The No Action Alternative has a cumulative effect of continuing the gradual decline of aspen on the forest, which could result in a loss of biodiversity and wildlife habitat.

Past events have also resulted in altered insect and disease dynamics due to increased stand densities, decreased age and size class diversity, and decreased tree vigor within the cumulative effects analysis area. Because of high stand densities, competitive stress, and decreased diversity, the landscape is currently at increased risk for large-scale disturbance via insects, disease, and/or fire. A lack of age and
size class diversity results in a landscape that is less resilient to perturbation. A lack of openings in the forest canopy provides fuel continuity in the event of a crown fire. The current forest structure within the analysis area is not sustainable at the landscape-level. The No Action Alternative has a cumulative effect by maintaining the number of acres on the forest with these conditions.

**Figure 4. Changes in stand density in southwestern ponderosa pine, non-reserved forest lands, New Mexico and Arizona (source: USDA Forest Service, Southwestern Region 2004)**

![Graph showing stand density changes over time](image)

Past events have also resulted in decreased understory species productivity and diversity across the cumulative effects analysis area due to high stand densities and canopy covers. The No Action Alternative has a cumulative effect of maintaining the trend of decreased understory species productivity and biodiversity.

**Alternative 2 - Proposed Action**

**Direct and Indirect Effects**

**Forest Structure**

For the Proposed Action Alternative, the proposed treatments were simulated and data was projected over 40 years after management actions using the Forest Vegetation Simulator. Treatment simulations included all proposed thinning and harvesting activities, prescribed burning, and regeneration. Simulations also accounted for the effects of prescribed burning on regeneration rates. Table 13 summarizes VSS designations and canopy cover projected over both 20 and 40 years under the Proposed Action. There would be beneficial direct and indirect effects to forest vegetation and forest structure as a result of treatment.
Vegetative Structural Stage (VSS)

**Small Scale:** Table 13 summarizes the stand-level VSS designations projected over 40 years. Under the Proposed Action Alternative, there would be both direct and indirect effects to VSS distribution resulting from management actions, resulting in changes in forest structure from the existing forest structure at the stand level. Within stands treated under ponderosa pine and mixed-conifer restoration (approximately 4040 acres), 20% would be regenerated to create openings for VSS 1 and 2. The remaining 80% would be thinned, with an emphasis placed on leaving trees of varying age and size classes to create a more uneven-aged structure at the stand level. However, the extent to which a stand’s structure becomes more uneven-aged after treatment would depend on existing conditions within the stand. In ponderosa pine stands that are fairly even-aged at present, the Proposed Action would result in a more two-storied stand structure. Additional treatments would be required within approximately 40 years to regenerate additional areas for VSS 1 formation, create a third age class, and develop a more uneven-aged structure. In stands that currently contain two or more age classes, the Proposed Action would also result in a more uneven-aged structure. With maintenance burning conducted over the next 20 years, regeneration would be naturally thinned by fire and conditions would be conducive for further regeneration due to nutrient cycling by fire. However, additional treatment would be required in approximately 40 years to regenerate additional areas for VSS 1 recruitment and sustain the uneven-aged structure. In comparison with the No Action Alternative, the Proposed Action would result in increased size class diversity and stand structures that are more uneven-aged. Additionally, because diameter growth is a function of tree density, trees would initially grow into larger diameter classes and VSS classes at a faster rate than the No Action Alternative. However, as stand densities continue to increase over the 40 years following treatment, individual tree growth and regeneration of shade-intolerant species would decrease. Without additional treatment, VSS class progression would begin to stagnate and an uneven-aged forest structure would not be sustained.

Within ponderosa pine and mixed-conifer stands treated under the thin from below (approximately 30 acres), emphasis would be placed on thinning tree less than 9” dbh, resulting in a decrease in size class diversity and a more even-aged forest structure at the stand level. However, the effects would be minimal because these treatments are only occurring on a small percentage of the project area. These areas are located on steep slopes, where mechanized treatments would not be feasible, or on the east side of the Arizona Trail to mitigate potential damages.

Within ponderosa pine and mixed-conifer stands treated under the burn only (approximately 965 acres), younger VSS classes would experience increased mortality in comparison with larger VSS classes. However, VSS class diversity would not be affected to the same extent as the stands treated under the thin from below, depending on burning conditions and the extent of mortality. Overall, forest structure would be more uneven-aged at the stand level, in comparison to the thin from below stands.

**Mid-scale:** Table 13 summarizes VSS by percent of cover type under the Proposed Action Alternative projected over 40 years. The Proposed Action Alternative would directly affect VSS distribution immediately after treatment within the ponderosa pine, Douglas-fir and southwestern white pine cover types, resulting in a forest structure that is more uneven-aged than the existing forest structure. Immediately following treatment, VSS distribution within all three cover types would more closely resemble that recommended for the northern goshawk. After 20 years, additional treatments would be required to increase and decrease percentages of various VSS classes to promote the development of other classes and maintain the recommended forest structure. Without additional treatments, the VSS distribution after 40 years would largely consist of trees within VSS 5.
Table 13. Vegetative Structural Stage (VSS), basal area, trees per acre, and percent canopy cover under the Proposed Action (values are expressed as ranges, with averages in parentheses)

<table>
<thead>
<tr>
<th>Cover Type</th>
<th>Time Frame</th>
<th>VSS</th>
<th>Percent Cover Type</th>
<th>Basal Area</th>
<th>Trees per acre</th>
<th>Percent Canopy Cover</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ponderosa pine</strong></td>
<td>Existing Conditions</td>
<td>3</td>
<td>37</td>
<td>57-274 (173)</td>
<td>147-750 (365)</td>
<td>46-86 (73)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>43</td>
<td>45-300 (182)</td>
<td>84-1233 (267)</td>
<td>39-88 (74)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5</td>
<td>21</td>
<td>52-291 (151)</td>
<td>85-600 (165)</td>
<td>44-87 (69)</td>
</tr>
<tr>
<td></td>
<td>Post-Treatment</td>
<td>1</td>
<td>20</td>
<td>3-19 (6)</td>
<td>3-4 (4)</td>
<td>0-18 (0)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>12</td>
<td>59-225 (71)</td>
<td>74-497 (148)</td>
<td>47-81 (50)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>33</td>
<td>45-272 (77)</td>
<td>46-502 (109)</td>
<td>39-86 (51)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5</td>
<td>35</td>
<td>54-291 (83)</td>
<td>34-370 (75)</td>
<td>44-87 (54)</td>
</tr>
<tr>
<td></td>
<td>+ 20 Years</td>
<td>1</td>
<td>17</td>
<td>1-19 (9)</td>
<td>51-299 (73)</td>
<td>0-18 (2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>2</td>
<td>20-106 (27)</td>
<td>173-1305 (413)</td>
<td>19-62 (24)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>2</td>
<td>58-233 (110)</td>
<td>289-562 (454)</td>
<td>46-82 (58)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>23</td>
<td>43-235 (94)</td>
<td>67-1125 (150)</td>
<td>40-82 (57)</td>
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<tr>
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<td></td>
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<td>56</td>
<td>47-291 (83)</td>
<td>62-844 (120)</td>
<td>41-87 (54)</td>
</tr>
<tr>
<td></td>
<td>+ 40 Years</td>
<td>2</td>
<td>12</td>
<td>6-53 (17)</td>
<td>49-553 (74)</td>
<td>0-44 (13)</td>
</tr>
<tr>
<td></td>
<td></td>
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<td>8</td>
<td>12-218 (50)</td>
<td>48-1046 (141)</td>
<td>6-80 (31)</td>
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<td>84-512 (189)</td>
<td>52-76 (61)</td>
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<td>68</td>
<td>53-291 (101)</td>
<td>60-456 (111)</td>
<td>44-87 (59)</td>
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<tr>
<td><strong>Douglas-fir</strong></td>
<td>Existing Conditions</td>
<td>3</td>
<td>97</td>
<td>168-280 (256)</td>
<td>623-850 (733)</td>
<td>73-86 (83)</td>
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<tr>
<td></td>
<td></td>
<td>5</td>
<td>3</td>
<td>180</td>
<td>306</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>Post-Treatment</td>
<td>1</td>
<td>15</td>
<td>4</td>
<td>304</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
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<td>168</td>
<td>623</td>
<td>73</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>61</td>
<td>108-172 (110)</td>
<td>123-236 (126)</td>
<td>62-74 (62)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5</td>
<td>3</td>
<td>180</td>
<td>306</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>+ 20 Years</td>
<td>2</td>
<td>15</td>
<td>14</td>
<td>346</td>
<td>9</td>
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<td></td>
<td></td>
<td>4</td>
<td>82</td>
<td>148-215 (165)</td>
<td>172-545 (267)</td>
<td>70-79 (72)</td>
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<td></td>
<td></td>
<td>5</td>
<td>3</td>
<td>203</td>
<td>279</td>
<td>78</td>
</tr>
<tr>
<td></td>
<td>+ 40 Years</td>
<td>2</td>
<td>15</td>
<td>35</td>
<td>338</td>
<td>33</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>22</td>
<td>202-246 (243)</td>
<td>204-448 (428)</td>
<td>78-83 (83)</td>
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<tr>
<td></td>
<td></td>
<td>5</td>
<td>63</td>
<td>191-225 (193)</td>
<td>170-259 (175)</td>
<td>77-81 (77)</td>
</tr>
<tr>
<td><strong>Southwestern white pine</strong></td>
<td>Existing Conditions</td>
<td>3</td>
<td>24</td>
<td>154-237 (189)</td>
<td>942-1650 (1271)</td>
<td>71-82 (75)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>46</td>
<td>167-252 (199)</td>
<td>190-510 (405)</td>
<td>73-84 (78)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5</td>
<td>30</td>
<td>297</td>
<td>237</td>
<td>88</td>
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</tbody>
</table>
### Table 14. Percent of Vegetative Structural Stage distribution within northern goshawk habitat under the Proposed Action

<table>
<thead>
<tr>
<th>VSS</th>
<th>Current Condition</th>
<th>Post-Treatment</th>
<th>+20 years</th>
<th>+40 years</th>
<th>Desired Conditions</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>19</td>
<td>16</td>
<td>0</td>
<td>10</td>
</tr>
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<td>2</td>
<td>13</td>
<td>10</td>
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<tr>
<td>3</td>
<td>43</td>
<td>13</td>
<td>2</td>
<td>7</td>
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<td>4</td>
<td>38</td>
<td>32</td>
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<td>54</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>20</td>
</tr>
</tbody>
</table>

**Landscape Scale:** Table 14 summarizes VSS distribution across northern goshawk habitat under the Proposed Action Alternative. Northern goshawk habitat would be more uneven-aged immediately after treatment, in comparison with the No Action Alternative. The VSS distribution immediately after treatment would more closely resemble that which is recommended for the northern goshawk. After 20 years, additional treatments would be required to attain the recommended VSS distribution for the northern goshawk. More specifically, treatments after 20 years would be required to decrease the percent of northern goshawk habitat in mid-aged and mature forest and to increase the percent of young and old-growth forest. If additional treatments are not performed, northern goshawk habitat would be dominated by mature forest within 40 years and the recommended VSS distribution would not be attained.

**Canopy Cover**

**Small Scale:** Table 13 summarizes the stand level cover percentages under the Proposed Action over the next 40 years. Under the Proposed Action Alternative, there would be both direct and indirect effects to percent canopy cover resulting from management actions, altering forest structure at the stand level.
Within stands treated under ponderosa pine and mixed-conifer restoration (approximately 4040 acres), 20% would be regenerated to create openings for VSS 1 and 2. The remaining 80% would be thinned, with an emphasis placed on leaving trees in a “clumpy/groupy” tree arrangement to mimic the spatial arrangement of trees that existed presettlement. The residual forest structure would be more open, variable, and patchy. Therefore, percent canopy cover at the stand level would decrease from the existing canopy cover immediately after treatment. There would also be indirect effects of reduced canopy cover associated with the Proposed Action. Due to the groupy tree distribution, canopy cover would be higher within tree groups and low in openings created for regeneration, and tree groups would vary in percent canopy cover, from “open” to “closed” canopies due to varying tree sizes and densities. Tree groups left at higher canopy covers would exhibit decreased understory development and decreased regeneration. Openings and tree groups left at lower canopy covers would exhibit increased understory development, productivity, and diversity, and increased regeneration due to increased sunlight to the forest floor. At the stand level, forest structure would be considerably less homogeneous and exhibit increased structural diversity and horizontal heterogeneity, in comparison to the No Action Alternative. Over time, percent canopy cover within individual stands would increase and crown canopies would eventually close 20-40 years following treatment. As percent canopy cover increases, understory development, productivity, and diversity would decrease. Regeneration of shade intolerant species, such as ponderosa pine and Douglas-fir, would be severely limited under a closed canopy, resulting in a lack of VSS 1 and 2 classes. Mortality of smaller, over-topped, shade intolerant trees would also increase. Without additional treatment within 20-40 years to reduce canopy cover, stands would be unable to achieve a sustainable, uneven-aged structure.

Within ponderosa pine and mixed-conifer stands treated under the thin from below (approximately 30 acres), percent canopy cover would decrease by thinning trees less than 9” dbh. However, due to a large number of trees over 9” dbh, residual canopy cover would be higher in these treatments compared to the ponderosa pine and mixed-conifer restoration treatments. The resulting stand structure would be less open, variable, and patchy. Higher residual canopy cover would result in decreased regeneration of shade-intolerant species, decreased understory productivity and diversity, and decreased structural diversity, in comparison to the restoration treatment areas. However, these effects would be minimal because these treatments are only occurring on a small percentage of the project area.

**Mid-Scale:** Table 13 summarizes percent canopy cover by cover type and VSS under the Proposed Action projected over 40 years. Under the Proposed Action Alternative, there would be both direct and indirect effects to percent canopy cover resulting from management actions, altering forest structure at the mid-scale level. Within the ponderosa pine cover type, the Proposed Action Alternative would result in decreased canopy cover and a more open forest structure for a minimum of 40 years, in comparison with the No Action Alternative. Immediately after treatment, average percent canopy cover would decrease within all VSS classes. After 40 years, average percent canopy cover would remain lower in all VSS classes, in comparison to the No Action Alternative. However, additional treatments would be required at this time to reduce canopy cover in portions of the ponderosa pine cover type where canopy covers have closed.

Within the Douglas-fir and southwestern white pine cover type, the Proposed Action Alternative would result in a decrease in percent canopy cover. Immediately after treatment, percent canopy cover would mostly be decreased, however additional treatments would be required after 20 and 40 years to maintain a reduce canopy cover. Without additional treatments, canopy cover would proceed to grow and close.

Decreased canopy cover and a more open forest structure would result in increased sunlight to the forest floor, increased understory productivity and diversity, increased regeneration of ponderosa pine, Douglas-fir, and southwestern white pine, decreased inter-tree competition, increased tree health, growth and vigor, decreased insect and disease-related mortality especially in older age classes, increased horizontal
heterogeneity, and a more sustainable, uneven-aged forest structure. However, these benefits of the Proposed Action Alternative would decrease over time as crown canopies grow and close. Additional treatments would be required in approximately 20-40 years to reduce canopy cover to post-treatment levels.

Table 15. Average percent canopy cover across northern goshawk habitat under the Proposed Action (values are expressed as ranges, with averages in parentheses)

<table>
<thead>
<tr>
<th>Northern Goshawk</th>
<th>Time Frame</th>
<th>VSS 4</th>
<th>VSS 5</th>
<th>VSS 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spruce-fir - Outside PFA</td>
<td>Existing Condition</td>
<td>N/A</td>
<td>60</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>Post-Treatment</td>
<td>N/A</td>
<td>60</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>+20 Years</td>
<td>N/A</td>
<td>66</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>+40 Years</td>
<td>N/A</td>
<td>70</td>
<td>N/A</td>
</tr>
<tr>
<td>Mixed-conifer - Outside PFA</td>
<td>Existing Condition</td>
<td>73-84 (78)</td>
<td>75-84 (82)</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>Post-Treatment</td>
<td>1/3 60+, 2/3 40+, 57-74 (60)</td>
<td>50+, 57-75 (62)</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>+20 Years</td>
<td>68-79 (72)</td>
<td>62-84 (68)</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>+40 Years</td>
<td>78-85 (83)</td>
<td>66-81 (72)</td>
<td>N/A</td>
</tr>
<tr>
<td>Ponderosa pine - Outside PFA</td>
<td>Existing Condition</td>
<td>39-88 (74)</td>
<td>44-87 (69)</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>Post-Treatment</td>
<td>40+, 39-86 (51)</td>
<td>40+, 44-87 (54)</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>+20 Years</td>
<td>40-82 (57)</td>
<td>54-87 (73)</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>+40 Years</td>
<td>62-77 (77)</td>
<td>53-87 (72)</td>
<td>N/A</td>
</tr>
<tr>
<td>Ponderosa pine - Inside PFA</td>
<td>Existing Condition</td>
<td>86</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>Post-Treatment</td>
<td>1/3 60+, 2/3 50+, (55)</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>+20 Years</td>
<td>1/3 60+, 2/3 50+, (58)</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>+40 Years</td>
<td>1/3 60+, 2/3 50+, (63)</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Ponderosa pine - Inside Nest Area</td>
<td>Existing Condition</td>
<td>86</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>Post-Treatment</td>
<td>50+ (55)</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>+20 Years</td>
<td>58</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>+40 Years</td>
<td>63</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

**Landscape Scale:** Table 15 summarizes percent canopy cover across northern goshawk habitat under the Proposed Action Alternative. Canopy cover guidelines for VSS 4 and 5 outlined in the Coconino National Forest Plan would be met within northern goshawk habitat immediately after treatment. Canopy cover in spruce-fir outside of the PFA would not decrease from existing conditions because no harvesting of trees is proposed. All stands within the ponderosa pine cover type that are proposed for treatment would maintain a minimum of 40% canopy cover.

Northern goshawk habitat would have lower average percent canopy cover, in comparison with the No Action Alternative, for approximately 20-40 years following treatment. A more open canopy would increase regeneration of shade-intolerant species. Regeneration is vital to the formation of a sustainable, uneven-aged forest structure and attainment of the VSS distribution for the northern goshawk. Forest structure under the Proposed Action would more closely resemble the structure recommend for the northern goshawk, in comparison with the No Action Alternative.
Table 16 summarizes percent canopy cover within Mexican spotted owl habitat over 40 years under the Proposed Action Alternative. No harvesting would be conducted within protected habitat and therefore, there would be no difference in percent canopy cover, compared to the No Action Alternative. In restricted habitat, canopy cover would decrease under the Proposed Action immediately after treatment, however after 40 years, restricted habitat would be dominated by closed canopies. At this time, additional treatments would be required to decrease percent canopy cover to post-treatment levels. More open crown canopies result in increased sunlight to the forest floor, increased understory productivity and diversity, decreased inter-tree competition, increased tree health, growth and vigor, decreased insect and disease-related mortality especially in older age classes, and increased horizontal heterogeneity.

**Table 16. Basal area, trees per acre, and canopy cover within Mexican spotted owl habitat under the Proposed Action (values are expressed as ranges, with averages in parentheses)**

<table>
<thead>
<tr>
<th>MSO Habitat</th>
<th>Acres</th>
<th>Time Frame</th>
<th>Total Basal Area</th>
<th>Trees per acre</th>
<th>Percent Canopy Cover</th>
</tr>
</thead>
<tbody>
<tr>
<td>Restricted</td>
<td>292</td>
<td>Existing Conditions</td>
<td>115-280 (255)</td>
<td>88-1800 (661)</td>
<td>63-86 (84)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Post-Treatment</td>
<td>73-106 (87)</td>
<td>17-309 (134)</td>
<td>52-61 (56)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+20 Years</td>
<td>88-144 (114)</td>
<td>65-1465 (223)</td>
<td>56-69 (63)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+40 Years</td>
<td>101-219 (146)</td>
<td>63-1263 (212)</td>
<td>61-80 (69)</td>
</tr>
<tr>
<td>Protected</td>
<td>1603</td>
<td>Existing Conditions</td>
<td>45-291 (132)</td>
<td>98-1371 (362)</td>
<td>39-87 (61)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+20 Years</td>
<td>56-291 (155)</td>
<td>84-1025 (314)</td>
<td>45-87 (66)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+40 Years</td>
<td>67-291 (168)</td>
<td>70-802 (256)</td>
<td>50-87 (69)</td>
</tr>
</tbody>
</table>

**Old-growth**

**Small Scale:** Table 17 displays developing old-growth designated by cover type under the Proposed Action Alternative. Currently, none of the stands within any of the cover types in the project area meet the minimum criteria for old-growth forest. Additionally, none of these stands have been previously designated as developing old-growth forest. To meet Coconino Forest Plan direction for old-growth, a minimum of 1920 acres within the project area would need to be designated as developing old-growth. Under the Proposed Action, approximately 2544 acres within the project area would be designated as developing old-growth, with a minimum of 20% in each forest cover type. These stands would be managed to achieve the minimum criteria for the structural attributes used to determine old-growth, as outlined on page 70-2 of the Coconino National Forest Plan.

**Table 17. Developing old-growth designated by cover type under the Proposed Action**

<table>
<thead>
<tr>
<th>Cover Type</th>
<th>Total Acres</th>
<th>Minimum Old-growth Requirement (20% Of Total Acres)</th>
<th>Developing Old-growth Designated (Acres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ponderosa pine</td>
<td>5050</td>
<td>1010</td>
<td>1362</td>
</tr>
<tr>
<td>Aspen</td>
<td>3746</td>
<td>749</td>
<td>753</td>
</tr>
<tr>
<td>Douglas-fir</td>
<td>644</td>
<td>129</td>
<td>385</td>
</tr>
<tr>
<td>Southwestern white pine</td>
<td>136</td>
<td>27</td>
<td>28</td>
</tr>
<tr>
<td>Blue spruce</td>
<td>22</td>
<td>4</td>
<td>16</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>9598</strong></td>
<td><strong>1920</strong></td>
<td><strong>2544</strong></td>
</tr>
</tbody>
</table>

Table 18 summarizes a comparison of the percent of each cover type in VSS 5 after 40 years under the No Action and Proposed Action Alternatives. The percent of each cover type advancing into the VSS 5 class...
is a good measure for the evaluation of old-growth development because it illustrates how quickly under the Proposed Action Alternative that VSS classes are advancing into older structural stages. Under the Proposed Action Alternative, old-growth would develop at a faster rate than under the No Action Alternative within both the ponderosa pine and Douglas-fir cover types. Within 40 years, approximately 68% of the cover type would be VSS 5 under the Proposed Action, compared to 40% under the No Action Alternative. Within the Douglas-fir cover type, approximately 63% of the cover type would be VSS 5 within 40 years, compared to only 3% under the No Action Alternative. Within the southwestern white pine cover type, there would not be a significant difference in the percent of VSS 5 after 40 years between the two alternatives.

Table 18. Comparison of old-growth development after 40 years under the No Action Alternative and the Proposed Action

<table>
<thead>
<tr>
<th>Cover Type</th>
<th>Percent of Cover Type in VSS 5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Existing Condition</td>
</tr>
<tr>
<td>Ponderosa pine</td>
<td>21</td>
</tr>
<tr>
<td>Douglas-fir</td>
<td>3</td>
</tr>
<tr>
<td>Southwestern white pine</td>
<td>30</td>
</tr>
</tbody>
</table>

In general, designated developing old-growth stands that are treated under the Proposed Action treatments would achieve old-growth structural attributes more quickly than under the No Action Alternative. The Proposed Action treatments would emphasize retaining old, large diameter trees across all cover types. Additionally, decreased stand densities resulting from the Proposed Action treatments would result in increase tree health, growth, and vigor, increased regeneration, and increased old, “yellow” pine longevity. Trees would grow into larger VSS classes at a faster rate. Trees reaching maturity and changing their appearance from black bark to yellow bark would still occur biologically at approximately 150 to 200 years old, but they would have larger diameters, in comparison to the No Action Alternative due to lower stand densities. Regardless of the alternative, most of the project area would not meet the minimum age requirements for old-growth forest for a minimum of 70-80 years.

**Mid-Scale:** Table 19 summarizes developing old-growth designated by Ecosystem Management Area under the Proposed Action Alternative. To meet Coconino Forest Plan direction for old-growth, a minimum of 2823 acres would need to be designated across the two ecosystem management areas (both inside and outside of the project area). Under the Proposed Action, 2956 acres would be designated as developing old-growth across these two ecosystem management areas. Approximately 2544 acres falls within the project area and 412 acres falls outside of the project area. The Hochderffer Ecosystem Management Area contains 9,432 forested acres, and with 1999 acres allocated to developing old-growth under the Proposed Action, 21% would exceed the CNF Plan standards of 20%. The White Horse Hills Ecosystem Management Area contains 4,681 forested acres, and with 957 acres allocated to developing old-growth, 20% would meet CNF Plan standards. Stands designated as developing old-growth are those stands that either would reach old-growth conditions in the shortest time frame or are located in areas in which old-growth structure are vitally important to wildlife species, such as MSO PACs. However, not all of these stands would reach old-growth conditions at the same time, with timeframes ranging between 50 to 100 years. Under the Proposed Action Alternative, 2956 acres within the Hochderffer and the White Horse Hills Ecosystem Management Area would be designated as developing old-growth, thus exceeding the minimum old-growth requirement of 20% of the forested ecosystem management area (2823 acres).

Table 19. Developing old-growth designated by Ecosystem Management Area under the Proposed Action
### Ecosystem Management Area Table

<table>
<thead>
<tr>
<th>Ecosystem Management Area</th>
<th>Total Acres</th>
<th>Forested Acres</th>
<th>Minimum Old-growth Requirement (20% Of Total Acres)</th>
<th>Developing Old-growth Designated (Acres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hochderffer</td>
<td>11759</td>
<td>9432</td>
<td>1886</td>
<td>1999</td>
</tr>
<tr>
<td>White Horse Hills</td>
<td>8645</td>
<td>4681</td>
<td>936</td>
<td>957</td>
</tr>
<tr>
<td>Total</td>
<td>2823</td>
<td>2956</td>
<td>2823</td>
<td>2956</td>
</tr>
</tbody>
</table>

**Landscape Scale:** With the additional 2956 acres proposed as developing old-growth in the Hochderffer and White Horse Hills Ecosystem Management Areas, the Proposed Action Alternative would increase the percent of existing/developing old-growth across the Peaks and Mormon Lake Ranger Districts from 7.6% to 8.1%.

### Stand Density

Table 13 summarizes basal area and trees per acre under the Proposed Action Alternative projected over 40 years. Under the Proposed Action, there would be direct effects to stand densities across northern goshawk habitat in the thin-from-below and restoration treatments because trees would be harvested. Stand densities would decrease from the existing stand densities, which would have beneficial effects. The Proposed Action Alternative would also have indirect beneficial effects related to stand densities across northern goshawk habitat in the short-term. Decreased stand densities would reduce competition between trees for moisture, nutrients, and sunlight and increase tree vigor and growth. Thinning of smaller, black-barked pine trees around the drip lines of existing old, “yellow” pines would increase nitrogen, carbon, and water uptake of “yellow” pines, thus decreasing inter-tree competition and stress and increasing tree vigor, growth, and longevity (Stone et al. 1999). Trees in general would be less susceptible to insect and disease outbreaks. Residual trees would have a decreased risk of bark beetle attack and mortality. Decreased inter-tree competition would also result in increased diameter growth for individual pine trees. Trees would advance into larger diameter classes and VSS classes at a faster rate, thus improving successional dynamics and VSS distribution. Decreased stand densities would also result in increased understory productivity and diversity, increased regeneration, increased structural diversity, and a more uneven-aged forest structure. However, within 20-40 years, additional treatments would be required to reduce stand densities in order to decrease inter-tree competition, increase regeneration, stimulate understory production, and further perpetuate the development of an uneven-aged forest structure.

### Basal Area

Immediately after treatment, basal area within all three cover types would decrease, compared to existing conditions. After 20 years, additional treatments would be required to reduce stand densities to post-treatment levels in over half of the cover types. In comparison with the No Action Alternative, basal areas within the ponderosa pine cover type would be considerably lower under the Proposed Action Alternative for a minimum of 40 years.

Table 16 summarizes basal areas within Mexican spotted owl habitat under the Proposed Action Alternative. The Proposed Action would not affect stand densities within protected habitat because no trees would be harvested. However, in restricted habitat, stand densities would decrease immediately after treatment. After 20 years, additional treatments would be required to reduce stand densities to post-treatment levels throughout restricted habitat.
Chapter 3 – Affected Environment and Environmental Consequences

*Trees per Acre*

Immediately after treatment, trees per acre within all three cover types would decrease, compared to existing conditions. In comparison with the No Action Alternative, trees per acres within the ponderosa pine and southwestern white pine covers type would be generally lower in VSS 4 and 5 and higher in VSS 1-3 due to increased regeneration. After 20 years, additional treatments would be required to reduce the number of trees per acre in most of the cover types to post-treatment levels. In comparison with the No Action Alternative, trees per acres within the Douglas-fir and southwestern white pine cover type would be lower under the Proposed Action Alternative after 40 years.

Table 16 summarizes trees per acres within Mexican spotted owl habitat under the Proposed Action Alternative. The Proposed Action would not affect trees per acre within protected habitat because no trees would be harvested. However, in restricted habitat, the number of trees per acre would decrease immediately after treatment. After 20 years under the Proposed Action Alternative, trees per acres would increase due to increased regeneration. At this time, additional treatments would be required to reduce the number of trees per acre to post-treatment levels throughout restricted habitat. Without additional treatments, the number of trees per acres would actually decrease between year 20 and year 40. This decrease in the number of trees per acre between 20 and 40 years after the Proposed Action would be due to tree mortality caused by high stand densities and increased inter-tree competition.

Forest Health and Species Diversity

*Aspen*

Table 20 summarizes basal area and trees per acre within the aspen cover type under the Proposed Action Alternative. Under the Proposed Action Alternative, there would be direct beneficial effects within the aspen restoration treatment areas. Immediately after treatment, the basal areas of conifers and total trees per acre would decrease, while basal areas and trees per acre of aspen would remain the same. This represents the removal of conifer encroachment from aspen clones. As time goes on, the basal areas of conifers would remain low as the basal areas of aspen increase at a faster rate compared to the No Action Alternative. Note that after 20 and 40 years, there would be a large increase in the number of trees per acre, which is due to aspen regeneration. Aspen regeneration would increase under the Proposed Action due to the hormonal stimulation and more favorable growing conditions resulting from conifer removal, prescribed burning, and ripping. Additionally, aspen regeneration would be protected through jackstrawing and fencing in those areas proposed for treatment. The lower end of the range of the number of aspen per acre is anticipated to be zero at each time frame due to the inability to treat some aspen clones in the MSO PAC or due to past wildfires and severe browsing.

<table>
<thead>
<tr>
<th>Time</th>
<th>Basal Area All Species</th>
<th>Basal Area Aspen</th>
<th>Trees per acre All Species</th>
<th>Trees per acre Aspen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing Conditions</td>
<td>55-314 (151)</td>
<td>0-264 (45)</td>
<td>28-637 (306)</td>
<td>0-586 (92)</td>
</tr>
<tr>
<td>Post-Treatment</td>
<td>0-272 (66)</td>
<td>0-264 (45)</td>
<td>0-825 (126)</td>
<td>0-586 (92)</td>
</tr>
<tr>
<td>+20 Years</td>
<td>6-296 (92)</td>
<td>0-296 (69)</td>
<td>141-1382 (479)</td>
<td>0-1382 (456)</td>
</tr>
<tr>
<td>+40 Years</td>
<td>16-348 (136)</td>
<td>16-365 (112)</td>
<td>125-932 (441)</td>
<td>0-932 (423)</td>
</tr>
</tbody>
</table>

Environmental Assessment for the Hart Prairie Fuels Reduction and Forest Health Restoration Project  
Coconino National Forest  
54
In comparison with the No Action Alternative, the Proposed Action would result in an increase in both the basal area and trees per acre of aspen across the aspen cover type. This would be the result of conifer removal and aspen regeneration. Aspen clones would experience increased health, growth, and vigor due to the removal of conifer encroachment and the protection of regeneration from elk browsing. Jackstrawing and fencing within aspen clones would provide protection for aspen seedlings from browsing. With increased health and vigor, aspen would be more resilient and less susceptible to disease, with increased longevity. The Proposed Action would result in increased biodiversity and improved wildlife habitat across the landscape.

Under the Proposed Action, exclosures would be constructed around springs and tanks that would not permit elk to access the water. Tanks and springs that would receive fencing are located near aspen or Bebb willow restoration treatments. It is anticipated that preventing elk from accessing the water would reduce the incentive for elk to forage in these areas, thus minimizing browsing impact on aspen regeneration, resulting in a direct beneficial impact. Monitoring would be implemented to validate these assumptions.

**Dwarf Mistletoe**

Under the Proposed Action there would be direct effect on the level and extent of dwarf mistletoe infection within the project area. Treatments to mitigate DM impacts would be integrated with other treatment activities like reducing a stand’s susceptibility to fire or insect outbreaks. Uneven-aged treatments would be utilized in lightly infected stands on good quality sites that have well-defined infection patches. Group selection, with openings up to 4 acres in size, would be used to target the removal of infection centers. In other areas with more severe infection, thinning would be utilized to retain non-host trees and less severely infected trees. The increase in space between trees would help limit the spread of DM infection and reduce inter-tree competition. This would lessen infection levels while still allowing trees to grow to maturity. By decreasing canopy cover and creating a patchy tree distribution, the proposed restoration treatments would decrease the rate at which infection spreads to more closely mimic the natural range of variability, resulting in direct beneficial effects to forest health. In addition, there would be indirect effect on dwarf mistletoe infection within the project area. Forest treatments under the Proposed Action would result in a decreased rate of spread between individual trees and throughout the infected stand, resulting in beneficial effects to forest health. A more open, patchy forest structure would limit the spread of dwarf mistletoe infection (Conklin 2000), and since DM infection occurs more abundantly in the lower crown, broadcast burning conducted across infected areas would emulate the effects of the historic fire regime on dwarf mistletoe infection.

Although decreasing canopy covers and broadcast burning would decrease the severity and spread of DM infection, the beneficial effects would be short-lived without additional future treatments. Without additional treatments, canopy covers would begin to close and approach pre-treatment conditions in approximately 20 years. Maintenance burning conducted over the next 40 years would be beneficial in the treatment of dwarf mistletoe infection. In comparison with the No Action Alternative, the level, extent, and spread of DM infection would be considerably decreased under the Proposed Action Alternative.

**Bark Beetles**

Treatments under the Proposed Action would have an indirect beneficial effect on susceptibility to insect attack and mortality. Decreasing stand densities would reduce competition between trees, resulting in increased tree vigor. Individual trees would have enhanced natural defense mechanisms against insect attack, such as the production of pitch, which would result in decreased susceptibility to bark beetle attack and mortality. For approximately 20 years after implementation of the Proposed Action, the risk of bark
beetle attack and mortality for residual trees would be reduced across 2/3 of the conifer cover types within the project area. Slash generation by harvesting activities and jack-strawing within aspen clones would pose a short-term risk to residual trees in surrounding areas, depending on the timing of harvesting, local population of pine engraver beetles, and site and environmental factors such as site quality and precipitation. However, slash would be pile burned within approximately one year following treatment, followed by broadcast burned. The quick elimination of slash would further reduce the risk of mortality from bark beetles and other insects. In aspen clones, timing of treatments, specifically jack-strawing, would be one way to mitigate the risk of bark beetle mortality to residual conifers in surrounding areas. By conducting treatments in the fall, trees which are jack-strawed would dry out before bark beetles emerge in the late spring/early summer.

**Understory Vegetation**

Under the Proposed Action Alternative there would be indirect beneficial effects on understory vegetation within the project area. With decreased stand densities and crown canopies and prescribed burning, understory productivity and diversity would increase considerably in the 20 years following the implementation treatments. Under the Proposed Action Alternative, areas treated under aspen restoration, meadow restoration, mixed-conifer restoration, ponderosa pine restoration, and thin from below (approximately 8800 acres) would exhibit noticeable increases in understory productivity and diversity for approximately 20-40 years following treatment due to decreased tree densities, increased sunlight to the forest floor, and increased soil temperatures. An additional 965 acres would receive a burn only treatment and most harvested stands would receive a broadcast burn. Broadcast burning would result in an initial decrease in understory vegetation. However, over the long-term, understory productivity and diversity would be higher than the No Action Alternative due to nutrient cycling and decreased fuel loading resulting from prescribed burning. Stands chosen for burn only treatments have existing canopy covers of less than 50% or steep slopes. Broadcast burning, in conjunction with reduced stand densities, would have beneficial effects on understory productivity and diversity.

**Meadows**

Treatments under the Proposed Action would reduce the number of trees within areas that were historically grassland vegetation types (approximately 1515 acres), resulting in direct beneficial effects. Under the Proposed Action, grasslands would be restored to presettlement densities. Presettlement densities are an important reference condition for restoration because they are the densities that evolved in these areas over centuries with fire, drought, frost, wildlife, insects, and disease. Indirect beneficial effects of reduced densities in these areas include increased understory productivity, diversity, and restoration of their functionality in terms of wildlife habitat, watershed production, fire hazard, and scenic values.

**Cumulative Effects**

The cumulative effects area consists of the project area and associated ecological management units, which are the Hochderffer and White Horse Hills areas. Potential cumulative effects were analyzed by considering the Proposed Action in the context of past, present, and reasonably foreseeable future activities that have occurred within this cumulative effects analysis area. Past, present, and future activities considered in the cumulative effects analysis include livestock grazing, logging, wild- and prescribed fire, commercial harvests, reforestation, exclosure fencing, dispersed recreation, and illegal firewood cutting. A detailed list of these activities can be found in Appendix B.
Forest Structure and Stand Density

Over the past century, several events-including fire exclusion, livestock grazing, and high-grade timber harvesting—occurred within the majority of the cumulative effects analysis. These events have resulted in altered stand structures, decreased age and size class diversity, changes in successional dynamics, increased stand densities, a lack of old-growth forest structures, and a more even-aged forest structure (Long 2003). Figure 4 depicts changes in trees per acre by size class on non-reserved forest lands in New Mexico and Arizona. The graph depicts changes that are typical of southwest ponderosa pine around Flagstaff due to past events and activities. The density of trees has increased over time, especially in diameter classes less than 12 inches, resulting in decreased size class diversity and a more even-aged forest structure.

Treatments under the Proposed Action would attempt to address some of the adverse effects of past and ongoing events that have occurred within conifer cover types across the cumulative effects analysis area. The ponderosa pine and mixed-conifer restoration treatments would create openings and a more open canopy which would increase regeneration across the landscape and move towards a more uneven-aged forest structure at a landscape level. A mosaic of varying forest structures, patterns, densities, and size classes would result in increased horizontal and vertical heterogeneity. The Proposed Action would reduce stand densities by focusing on the removal of smaller diameter trees and would retain and produce larger diameter trees for both ecological and social/aesthetic values. Additionally, these treatments would also result in faster development of a landscape-level forest structure recommended by the Coconino National Forest Plan by retaining large trees, creating openings for regeneration, increasing tree growth and vigor, and by promoting the development of a more sustainable, uneven-aged forest structure. Under the Proposed Action, treated areas would progress towards the desired future conditions described in the Forest Plan, however, the beneficial effects would only last for approximately 20 to 40 years, and would require additional harvesting and thinning treatments in order to maintain the recommended forest structure. With additional treatments, the recommended forest structure could be reached within approximately 70 years.

Forest Health and Species Diversity

Past and current events have resulted in decline of aspen communities across the cumulative effects analysis area. Aspen communities have been in a gradual state of decline over the past 50 years due to a number of factors including fire suppression, frost, drought, defoliation by western tent caterpillar, canker fungi, wood borers, bark beetles, root disease, and browsing pressure from elk. Many aspen clones are nearing 100% mortality, and at a landscape scale this loss signifies a tremendous loss of biodiversity, with aspen decline cascading into losses of vertebrate species, vascular plants, and likely species from a myriad of other organismal groups (Strand et al. 2009). Aspen communities are a critical element within the forests of northern Arizona, representing one of the most biologically diverse and ecologically unique sites and serve as an indicator of ecological integrity (Di Orio et al. 2005). Treatments under the Proposed Action would attempt to address some of the adverse effects of past and ongoing events that have occurred within aspen communities across the cumulative effects analysis area. The aspen located within the project area boundary represents nearly 40% of all of the aspen on the Coconino National Forest. Under the Proposed Action, aspen restoration treatments would result in decreased conifer encroachment, increased aspen regeneration, protection of aspen regeneration from elk browsing, increased aspen densities, improved health and vigor, and improved successional dynamics on over 3200 acres. Landscape-scale restoration of aspen communities would increase biological diversity and wildlife habitat and prevent the cascading effects that aspen decline would have on vertebrate species, vascular plants, and a myriad of other organismal groups across the cumulative effects analysis area.
Past events have also resulted in altered insect and disease dynamics due to increased stand densities, decreased age and size class diversity, and decreased tree vigor within the cumulative effects analysis area. Because of high stand densities, competitive stress, and decreased diversity, the landscape is currently at increased risk for large-scale disturbance via insects, disease, and/or fire. A lack of age and size class diversity results in a landscape that is less resilient to perturbation. A lack of openings in the forest canopy provides fuel continuity in the event of a crown fire. The current forest structure within the analysis area is not sustainable at the landscape-level. Treatments under the Proposed Action would attempt to reverse some of the negative effects of these past events by moving toward a forest structure that is more sustainable (i.e., more resilient and capable of maintaining its health in the face of perturbation). The Proposed Action would result in a decreased risk of insect attack and mortality across the cumulative effects analysis area by decreasing stand densities, inter-tree competition and stress and by increasing tree health, growth, and vigor. The Proposed Action would also result in decreased fuel accumulation and continuity, decreased crown fire potential, and decreased fire size and intensity by decreasing crown canopy cover and by creating a more open, patchy tree distribution.

Past events have also resulted in decreased understory species productivity and diversity across the cumulative effects analysis area due to high stand densities and canopy covers. The Proposed Action would help reverse some of these negative effects on understory vegetation and increase the biodiversity at a landscape scale. Overall the Proposed Action would have beneficial cumulative impacts to forest health and species diversity.

Fire and Fuels

The following information has been summarized from the Fire and Fuels Specialist’s Report, located in the project record.

Affected Environment

A fire hazard rating is a relative measure of how virulently a wildfire might burn. It is a good indicator of how effectively and safely fire suppression crews can attack a wildfire and bring it under control. The fire hazard rating is derived by accumulating hazard points associated with canopy closure, tree per acre, height to the bottom of the live crown, fuel loading, slope steepness, and aspect. While we cannot generally change slope steepness or aspect, their effects on fire behavior may influence how much we attempt to reduce other factors. Higher fire hazards are primarily driven by crown closure, trees per acre, crown base height and fuel loading. 65% of the project area falls within the high-extreme fire hazard conditions (see Table 21). Many aspen stands rated above normal for the fire hazard rating, because the stands are small enough that a fire starting in an adjacent conifer stand could easily burn through an aspen stand.

There are three types of fires: surface fires, passive crown fires, and active crown fires. Surface fires occur when there is enough fuel on the ground to sustain a fire. These are the least dangerous type of fires and can even be considered beneficial and desirable for maintaining ecosystem function. Passive crown fires, or torching, occur when flame lengths are long enough to reach the lower edge of the canopy, but others do not. Active crown fires occur when flames reach the canopy and spread through it; these are the most dangerous fires. 6,657 acres or 52% of project area is at risk for active crown fires, 36% is at risk for passive fires, and only 12% is at risk for ground fires.
Critical flame lengths are threshold distances where ground fires can move into canopies; generally, the average critical flame length for tree torching and transitioning to a crown fire is relatively low (2’ to 6’). Under current conditions, the expected ground fire flame length range from 4’ to 6’.

Current fuel conditions would likely generate dangerous fire behavior and undesirable fire effects if and when a wildfire occurs. Modeling indicates that current conditions would result in considerable torching and spot-fires as much as a half mile a head of an intense crown fire in some sites within the project area. Although it would be difficult to initiate a crown fire within many sites, once initiated or if carried in from a neighboring area, several sites have sufficient crown bulk density and canopy closure to sustain a crown fire and spread it to other sites. The existing fire hazard makes it very difficult for initial emergency response personnel to control a wildfire starting in some parts of the project area under weather conditions that occur in the months of April, May, June, September, and October. The forest condition after a high intensity wildfire would not meet management direction in the Coconino National Forest Plan.

Table 22 summarizes the fire regime and condition class within the project area. A natural fire regime is a general classification of the role fire would play across a landscape. The majority (95.5%) of the project area is Fire Regime I, where a fire recurrence of less than 35 years with a low percentage of overstory replacement would be expected under historical conditions. Approximately 2.5% of the project area is Fire Regime II, where a fire recurrence of less than 35 years with a high percentage of overstory replacement would be expected under historical conditions. Areas that were historically Fire Regime II are located in the northern portion of the project area where an arid mixed-conifer vegetation type is found. The remaining 2% of the project area is Fire Regime III, where a fire recurrence of around 35-200 years would be expected with generally mixed to low burn severity. The vegetation type within the project area requires periodic fire to remain balanced, however fuel conditions have reached a point where fire effects are more severe than desired and more severe than would naturally occur.

Table 22. Fire regime and condition class within the project area

<table>
<thead>
<tr>
<th>Fire Regime</th>
<th>Condition Class</th>
<th>Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>I: Frequent Fires (0-35 years), mixed burn severity</td>
<td>2</td>
<td>1,222</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>11,036</td>
</tr>
<tr>
<td>II: Frequent Fires (0-35 years), high burn severity</td>
<td>3</td>
<td>327</td>
</tr>
<tr>
<td>III: Infrequent Fires (35-200 years), mixed burn severity</td>
<td>3</td>
<td>190</td>
</tr>
</tbody>
</table>

Condition classes are based on a relative measure of departure from the natural fire regime: Class 1 signifying conditions within the historical range of variability, and Class 3 signifying a high departure from the historical range of variability. The majority of the project area, 91%, is in Condition Class 3 due to a lack of fire occurrence, which indicates a severe departure from the natural historical regime of...
vegetation characteristics, fuel composition, fire frequency, severity and pattern. The remaining 9% of the project area is in Condition Class 2, signifying a moderate departure from the natural historical regime of vegetation characteristics, fuel composition, fire frequency, severity and pattern. A wildfire occurring under the existing Condition Classes of 2 and 3 would result in more severe effects than would occur under natural fire regime conditions. A wildfire under Condition Class 3 includes a high risk of losing key ecosystem components.

**Alternative 1: No Action**

**Direct and Indirect Effects**

Under the No Action Alternative, fuel treatment objectives would not be met. There would be no direct effects under this alternative. The existing fire hazard would make it difficult for initial emergency response personnel to control a wildfire starting in many parts of the project area under weather conditions that occur in April through September. If and when a wildfire would occur, expected flame lengths would exceed four feet in many sites, making it difficult and unsafe for firecrews to control a wildfire. The critical flame lengths would range 6’-12’, and could ignite canopies. Many of the sampled sites within the project area have two to three times the crown bulk density necessary to sustain a crown fire. Under the No Action Alternative, there would be an increased risk of a crown fire starting and spreading through adjacent areas, including areas that previously have been treated.

Indirect adverse effects of a potential wildfire would include 99% mortality rates of ponderosa pine trees 8-14” dbh. Ponderosa pine trees 16” dbh and greater could suffer mortality rates as high as 65%. Wildfire-induced mortality in mixed conifer 8-14” dbh is not expected to exceed 63%. Wildfire-induced mortality in mixed conifer trees 16” dbh and greater would not likely exceed 27%. The forest condition after a high intensity wildfire would not meet management direction in the Coconino National Forest Plan.

Indirect adverse effects would also include an exacerbated fire hazard over time as vegetation would continue to grow and fuel would continue to accumulate. Competition between trees for moisture, nutrients, and sunlight would continue resulting in decreased tree vigor, increased susceptibility to infestation, disease and then mortality. Dead trees increase the fuel load, the fire hazard, and increase the risk of successive attacks on remaining trees. Sites currently rated with a low or moderate fire hazard rating would develop conditions that result in a worse hazard rating. Those sites would require prescribed burning to maintain a low hazard rating, and some sites would also require thinning to maintain their low rating over the next 20 years. Indirect adverse effects may also include the loss of habitat and wildfire damage to private property in the vicinity of the project area.

Finally, under the No Action Alternative, most of the area would remain in Condition Class 3 (a severe departure from the natural historical regime of vegetation characteristics, fuel composition, fire frequency, severity and pattern). As time passes, the entire project area would transition to a Condition Class 3 and further result in destructive wildfires more severe than the area’s historic fire regime.

**Cumulative Effects**

The analysis area for cumulative effects includes the Peaks/Mormon Lake District of the Coconino National Forest. It constitutes most of the forested land subject to the prevailing winds driving a wildfire into the community of Flagstaff and the surrounding areas. Past actions, such as logging and fire suppression occurred within this area and resulted in increased departures from historic stand structures and densities. Past, present and future fuel reduction projects for the Peaks/Mormon Lake Ranger District were considered. Currently much of the greater-Flagstaff Wildland Urban Interface (WUI) within the
district is at high risk for wildfire. Though approximately 142,700 acres within the cumulative effects boundary are either planned to be or have been treated with fire risk and fuels reduction projects, many will remain untreated. A cumulative effect of the No Action Alternative is that it maintains acres of National Forest System lands within the WUI that are vulnerable to severe fire effects. The fire hazard and fuel profile would increase with time as vegetation continues to grow and fuel continues to accumulate.

Another cumulative effect of the No Action Alternative would be the increased possibility of a wildfire to establish and burn with sufficient intensity to exceed the capability of emergency response personnel. Wildfires in the WUI place particularly high demands on emergency response personnel. Such a fire could threaten multiple structures and multiple groups of people. Firefighting resources would need to be deployed to protect people and property that lie in the fire’s path, thus leaving fewer personnel to actually bring the fire under control. This generally results in larger wildfires and greater resource damage to National Forest as a whole and risk to the communities in the greater-Flagstaff WUI.

**Alternative 2: Proposed Action**

**Direct and Indirect Effects**

Table 23 summarizes the fire hazard rating within the project area after implementation of the Proposed Action. Treatments under the Proposed Action would reduce the crown bulk density (thinning), reduce the canopy closure (thinning), increase the effective crown base height in most sites (thinning and prescribed burning), reduce expected flame length (prescribed burning), and reduce the number and shortening the distance at which spot fires are expected to occur (thinning and prescribed burning). Direct beneficial effects would include reducing the fuel hazard in the project area, and improving protection for resources and adjacent residences.

<table>
<thead>
<tr>
<th>Fire Hazard</th>
<th>Acres</th>
<th>Percent of project area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extreme</td>
<td>423</td>
<td>3%</td>
</tr>
<tr>
<td>Very High</td>
<td>1,059</td>
<td>8%</td>
</tr>
<tr>
<td>High</td>
<td>1,158</td>
<td>9%</td>
</tr>
<tr>
<td>Moderate</td>
<td>4,377</td>
<td>34%</td>
</tr>
<tr>
<td>Low</td>
<td>5,758</td>
<td>45%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>12,775</td>
<td></td>
</tr>
</tbody>
</table>

Under the Proposed Action, it is anticipated that condition classes in all fire regimes in the project area would move towards Condition Class 1 within 20 years, where vegetation composition, structure, and fuels are similar to those of the natural regime. A wildfire occurring under post-treatment conditions would be characteristic of the historic fire regime behavior, severity, and patterns.

Under the Proposed Action, 3,346 acres that are currently rated as moderate fire hazard would be reduced to low fire hazard rating. Treatment would also include thinning and burning 1,085 acres that are currently rated as low fire hazard. Although these acres already have a low fire hazard rating, those characteristics that generate difficult fire behavior would be improved further by thinning. Without the
proposed thinning, stand characteristics in 20 years would cause undesirable fire behavior within the WUI.

In areas receiving mechanical thinning, flame lengths are expected to range between 0.5’ – 3’, making initial attack of a wildfire occurring under modeled conditions safe and effective. After treatment, the critical flame lengths (treetop ignition) would range between 8’-15’. Decreased crown bulk density in conjunction with an open canopy would not sustain a crown fire. In areas that receive prescribed burning only, flame lengths after treatment are expected to range between 1’- 4’, making initial attack of a wildfire safe and effective. The critical flame lengths (treetop ignition) would range between 3’ -7’.

Indirect beneficial effects would include reduced wildfire-induced mortality of trees during the potential event of a wildfire. Wildfire-induced mortality of ponderosa pine trees 8-14” dbh would not exceed 25%, and for trees 16” dbh and greater would not exceed 9%. Wildfire-induced mortality in mixed conifer 8-14” dbh would not exceed 43%, and trees 16” and greater would not exceed 14%.

The Proposed Action could result in a short-term increase in wildfire hazard potential during the implementation of the treatments, because the slash that is produced would be piled on site, thereby temporarily increasing fuel loading until the piles are burned. However, the piles do not pose a hazard until they have dried out, and are usually burned soon afterwards. By timing thinning activities and piling activities so that the slash piles do not pose a hazard for more than a few months, this short-term adverse effect of increased fuel hazard is offset by a long-term beneficial effect of decreased wildfire hazard.

Cumulative Effects

The analysis area for cumulative effects includes the Peaks/Mormon Lake District of the Coconino National Forest. It constitutes most of the forested land subject to the prevailing winds driving a wildfire into the community of Flagstaff and the surrounding areas. Past actions, such as logging and fire suppression, occurred within this area and resulted in increased departures from historic stand structures and densities. Past, present and future fuel reduction projects for the Peaks/Mormon Lake Ranger District were considered. After 2028, modeling indicates that the continuing growth of forest vegetation would cause the fire hazard to approach current conditions; canopies would once again close, crown bulk densities would increase, and the number of new trees and shrubs would lower the effective crown base height.

Fuel reduction treatments within the cumulative effects boundary would reduce expected fire behavior to a level at which a small number of emergency response personnel could quickly and effectively control a wildfire. Reducing the possibility of wildfires establishing and reducing the intensity with which wildfires burn would reduce the demand on emergency response personnel and reduce the threat to life and private property. This would result in an overall beneficial cumulative effect within the WUI. Fewer acres burning less severely would result in less damage to National Forest System lands.

Under the Proposed Action, the risk of a crown fire starting in the project area and spreading as a crown fire through adjacent areas within the WUI would be reduced. The past, current, and future projects include 142,700 acres either treated or proposed for treatment. When combined with these projects, the Proposed Action produces a beneficial cumulative effect. Cumulatively, the fuel reduction projects would reduce the risk of crown fire spreading to nearby urban areas and improve the fire adapted ecosystem. As more acres are treated, the benefits would accumulate and the fire hazard rating would be reduced across the cumulative effects area, as shown in Table 24.
Table 24. Cumulative change in fire hazard rating

<table>
<thead>
<tr>
<th>Fire Hazard Rating across all treated acres in cumulative effects area</th>
<th>Extreme</th>
<th>Very High</th>
<th>High</th>
<th>Moderate</th>
<th>Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Treatment</td>
<td>10%</td>
<td>13%</td>
<td>30%</td>
<td>43%</td>
<td>19%</td>
</tr>
<tr>
<td>Post-Treatment</td>
<td>3%</td>
<td>4%</td>
<td>11%</td>
<td>30%</td>
<td>66%</td>
</tr>
</tbody>
</table>

Overall, the possibility of wildfire-induced tree mortality across all size classes for all cover types would be dramatically reduced, the intensity of wildfires would be reduced, and fire damage to the ecosystems would be reduced. In addition, wildfires occurring in these treated areas would be easier to control and burn less severely over less acres. Cumulatively, there would be a defensible space formed around Flagstaff and its surrounding communities.

Wildlife

The following information has been summarized from the Wildlife Specialist’s Report located in the project record.

Threatened, Endangered and Forest Service Sensitive (TES) Wildlife Species

There are two federally-listed species and 16 Regional Forest Sensitive Species that are present or have habitat within the project area, including ½ mile buffer around the project area (see Table 25).

Table 25. TES wildlife species that are present or have habitat within the project area

<table>
<thead>
<tr>
<th>Species Name</th>
<th>Scientific Name</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birds</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mexican spotted owl</td>
<td>Strix occidentalis lucida</td>
<td>Threatened</td>
</tr>
<tr>
<td>Bald eagle</td>
<td>Haliaeetus leucocephalus</td>
<td>FS Sensitive</td>
</tr>
<tr>
<td>Northern goshawk</td>
<td>Accipiter gentilis</td>
<td>FS Sensitive</td>
</tr>
<tr>
<td>American peregrine falcon</td>
<td>Falco pereginis anatum</td>
<td>FS Sensitive</td>
</tr>
<tr>
<td>Burrowing owl (western)</td>
<td>Athene cunicularia hypugaea</td>
<td>FS Sensitive</td>
</tr>
<tr>
<td>Ferruginous hawk</td>
<td>Buteo regalis</td>
<td>FS Sensitive</td>
</tr>
<tr>
<td>Mammals</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black-footed Ferret</td>
<td>Mustela nigripes</td>
<td>Endangered</td>
</tr>
<tr>
<td>Navajo Mogollon vole</td>
<td>Microtus mogollonensis navajo</td>
<td>FS Sensitive</td>
</tr>
<tr>
<td>Long-tailed vole</td>
<td>Microtus longicaudus</td>
<td>FS Sensitive</td>
</tr>
<tr>
<td>Dwarf shrew</td>
<td>Sorex nanus</td>
<td>FS Sensitive</td>
</tr>
<tr>
<td>Merriam’s shrew</td>
<td>Sorex merriani leucogenys</td>
<td>FS Sensitive</td>
</tr>
<tr>
<td>Allen’s lappet-browed bat</td>
<td>Idionycteris phyllotis</td>
<td>FS Sensitive</td>
</tr>
<tr>
<td>Pale Townsend’s big-eared bat</td>
<td>Corynorhinus townsendii pallescencs</td>
<td>FS Sensitive</td>
</tr>
<tr>
<td>Greater western mastiff bat</td>
<td>Eumops perotis californicus</td>
<td>FS Sensitive</td>
</tr>
<tr>
<td>Invertebrates</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nikomis fritillary</td>
<td>Speyeria 63okomis nokomis</td>
<td>FS Sensitive</td>
</tr>
<tr>
<td>Nitocris fritillary</td>
<td>Speyeria 63okomis nitocris</td>
<td>FS Sensitive</td>
</tr>
<tr>
<td>Four spotted skipperling</td>
<td>Piruna polingii</td>
<td>FS Sensitive</td>
</tr>
<tr>
<td>Amphibians</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Northern leopard frog</td>
<td>Rana pipiens</td>
<td>FS Sensitive</td>
</tr>
</tbody>
</table>
The following sensitive and federally listed wildlife species were not analyzed because there is no suitable or potential habitat for these species within the analysis area: San Francisco Peaks groundsel, Clark’s grebe, narrow-headed garter snake, red bat, spotted bat, and Wupatki Arizona pocket mouse.

**Mexican Spotted Owl**

The project area contains Mexican Spotted Owl (MSO) protected and restricted habitat (see Figure 5). Table 6 summarizes basal area, trees per acre, and canopy cover within MSO habitat.

**Protected Habitat**

MSO protected habitat within the project area includes 161 acres of mixed conifer with slopes greater than 40%. Additionally, two MSO Protected Activity Centers (PACs) are located within the project boundary, Little Spring and Hockderffer (see Figure 5). PAC habitat has an open to closed (39 to 90%) canopy with few openings. Fire hazard rating for the PACs within the project area ranges from low to extreme with the majority (87%) in the high-extreme condition. Fire hazard ratings for protected habitat on slopes greater than 40% range from moderate to very high, with 85% at very high. Beyond the project boundary, there are two PACs within one mile of the project boundary.

The PACs are easily accessible from the Forest Service road system and there are a large number of user-created trails developing and present within it. Specifically, a user-created trail, which is used by motorized and non-motorized users, transects both PACs within the project area.

**Table 26. Existing acres of MSO habitat within the project area**

<table>
<thead>
<tr>
<th>Habitat Type</th>
<th>Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protected Outside of PACs</td>
<td>161</td>
</tr>
<tr>
<td>PAC</td>
<td>1,442</td>
</tr>
<tr>
<td>Restricted Habitat</td>
<td>292</td>
</tr>
<tr>
<td>Threshold Habitat#</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>1,895</td>
</tr>
<tr>
<td>Critical Habitat*</td>
<td>1,836</td>
</tr>
</tbody>
</table>

*Critical Habitat is a subset of the total MSO habitat acres

#Threshold habitat is a subset of restricted habitat

**Restricted Habitat**

Restricted habitat exists in mixed conifer with slopes less than 40%. There are approximately 292 acres of restricted MSO habitat within the project area that are located primarily east of Little Spring PAC (along the Kachina Peaks Wilderness boundary). The mixed conifer restricted habitat has a closed canopy (73-88%) with few openings, and understory production and diversity are limited. Fire hazard ratings are low to extreme with most (58%) extreme hazard and 29% high to very high with the remainder (13%) low to moderate. Riparian habitat contains Bebb willow and has a low fire hazard. The restricted habitat is mostly fragmented and consists of small pockets of mixed conifer and riparian cover types.

**Target/Threshold Habitat**

Target/Threshold Habitat is unoccupied restricted habitat that is being managed specifically for future nesting and roosting conditions to encourage MSO use. Compartment exam data was used to determine whether individual stands met values outlined by the MSO Recovery Plan; however no stands meet threshold values. The Forest Plan directs that 25% of the mixed conifer cover type be identified in restricted habitat as threshold/target habitat. For this project there are 292 acres of restricted habitat, and therefore 83 acres of target habitat have been identified.
Designated Critical Habitat
Critical Habitat is designated by the U.S. Fish and Wildlife Service (FWS) to provide for the survival and recovery of listed species. MSO Critical Habitat within the project consists of 1,604 acres of protected habitat and 233 acres of restricted habitat (see Table 26).
Chapter 3 – Affected Environment and Environmental Consequences

Alternative 1: No Action Alternative

**Direct and Indirect Effects**
Habitat conditions for MSO would remain in their current condition, not withstanding natural processes. Under the No Action Alternative, there would be no direct effect on MSO. However, dense forest conditions would exist and the high fire hazard potential would continue to place MSO habitat at risk with respect to stand-replacing fire. If a crown fire were to occur in MSO habitat, components for nesting, roosting and foraging would be reduced or eliminated, resulting in an indirect adverse effect. In addition, tree densities would continue to be high, slowing their growth into larger diameter classes and thereby limiting habitat for prey. See Table 11 for basal area, trees per acre, and percent canopy cover within MSO habitat under the No Action Alternative. The No Action Alternative would not move to develop or maintain MSO habitat components.

**Cumulative Effects**
The No Action Alternative would maintain the current fire risk to MSO habitat and adjacent forest lands. The No Action Alternative has a cumulative effect of increasing the number of acres of National Forest System lands that are vulnerable to severe fire effects, as the fire hazard would increase over time as vegetation continues to grow and fuel continues to accumulate, continuing to have negative effects to MSO and its critical habitat.

Alternative 2: Proposed Action

**Direct and Indirect Effects**
Protected Habitat
Under the Proposed Action, PAC’s would not be treated, and fire hazards within PACs would not be reduced, although treatments adjacent to PACs would reduce the potential for a wildfire to move into MSO habitat. Table 27 summarizes the treatments that would be implemented in MSO habitat under the Proposed Action. See Table 16 for basal area, trees per acre, and percent canopy cover within MSO habitat under the Proposed Action. Most of the protected habitat would not receive treatment, however approximately 161 acres would receive burn only treatments. Burning would reduce the fire hazard and return the area’s condition back to the desired condition, and would only be implemented when weather conditions are optimal for burning. Smoke generated from burning in protected, or adjacent to protected habitat, could potentially have a direct effects on MSO. Smoke impacts to PACs from burning in spring during breeding seasons would be short-term (3-5 days) and low intensity (drift smoke). MSO are known to return to PACs after fires and smoke events have ceased. Short-term impacts from smoke would be reduced by coordination and timing and type of burning with wind direction, topography, time of year, and distance to PACs. Initial entry prescribed burning would be restricted during the breeding season in areas that may create smoke impacts to occupied PACs. Activities associated with prescribed burning and thinning treatments conducted outside of the breeding season normally do not result in adverse effects to the MSO. Effects from proposed treatments to adult and young owls outside of PACs are unlikely.

Construction of a spring exclosure is proposed in the Little Spring PAC and one water catchment exclosure is proposed in the Hockderffer PAC. Direct effects from exclosure construction could include disturbance to nesting owls, however, mitigation measures would ensure that construction would only take place outside of the MSO breeding season (March 1 to August 31). Design and location of exclosure fences would attempt to avoid the need to cut trees or snags, however if snags must be cut to uphold the integrity of the fence, it would occur at a time when cavity nesting birds are not nesting. Indirect effects...
are not expected from exclosures, as fence design would allow MSO and their prey to access the water. No temporary roads would be constructed within protected habitat.

### Table 27. Acres of treatments proposed in MSO habitat

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Protected Habitat</th>
<th>Restricted Habitat</th>
<th>Critical Habitat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mixed Conifer Restoration</td>
<td>0</td>
<td>256</td>
<td>233</td>
</tr>
<tr>
<td>Bebb Willow Restoration</td>
<td>0</td>
<td>22</td>
<td>0</td>
</tr>
<tr>
<td>Burn Only</td>
<td>161</td>
<td>14</td>
<td>161</td>
</tr>
<tr>
<td>(No Treatment)</td>
<td>1,442</td>
<td>0</td>
<td>1,442</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1,603</strong></td>
<td><strong>292</strong></td>
<td><strong>1,836</strong></td>
</tr>
</tbody>
</table>

**Restricted Habitat including Target/Threshold**

Table 27 summarizes the treatments that would be implemented in MSO habitat under the Proposed Action. See Table 16 for basal area, trees per acre, and percent canopy cover within MSO habitat under the Proposed Action. All restricted habitat would be treated with mixed conifer restoration, Bebb willow restoration and burn only treatments. Broadcast burning would reduce the fire hazard and return the area’s condition back to the desired condition, and would only be implemented when weather conditions are optimal for burning. Thinning or prescribed burning activities may indirectly affect MSO by changing the owl’s habitat structure including snags, downed logs, woody debris, multi-storied canopies, and dense canopy cover. This could result in a potential for owls to relocate. Lining of snags and logs in combination with burning techniques and vegetation treatments designed to protect snags would reduce the number of snags burned. Recruitment snags would be identified from live trees that exhibit defects ideal for wildlife, for example, trees with spiked tops, lightning strikes, mistletoe brooms, or fading crowns.

The proposed thinning and burning may change the structure of MSO prey species’ habitat, affecting the abundance and composition of prey species. Although treatments, especially prescribed burning may have adverse effects to prey species in the short-term (generally one year, depending on climate and moisture) by impacting individuals of prey species due to disturbance of prey species’ habitat, the proposed treatments are designed to increase the diversity of vegetative conditions, which in turn would provide for a diverse prey base. By treating restricted habitat with a mixed conifer restoration treatment or prescribed fire wildfire-induced mortality of key habitat components in restricted habitat would be reduced. Wildfire-induced mortality in mixed conifer 8-14” in diameter would be reduced by 20% and wildfire-induced mortality in mixed conifer trees 16” and greater would be reduced by 13 percent. A change in the number of 18-inch diameter trees would not be detectable from existing conditions. Temporary roads may be needed in restricted habitat in order to accomplish thinning treatments, however these roads would be rehabilitated after harvesting. Effects from proposed treatments to adult and young owls are unlikely.

The Proposed Action identifies 83 acres of mixed conifer cover type as target/threshold habitat that accounts for 28% of restricted habitat, which would be treated to develop into nesting and roosting habitat. Treatments in target threshold habitat would be designed to mimic natural disturbance patterns by incorporating natural variation, such as irregular tree spacing and various patch sizes. Emphasis would be uneven aged management and retention of old, pre-settlement trees while growing more trees 18 inches dbh and greater.

**Designated Critical Habitat**

Table 27 summarizes the treatments that would be implemented in MSO habitat under the Proposed Action. See Table 16 for basal area, trees per acre, and percent canopy cover within MSO habitat under the Proposed Action. Approximately 233 acres of restricted habitat and 161 acres of protected habitat
would be treated within Critical Habitat, however all treatments follow Coconino National Forest Plan (USDA 1987, as amended) standards and guidelines and the MSO Recovery Plan (USDI 1995) in restricted habitat and protected habitat. Broadcast burning would reduce the fire hazard and return the area’s condition back to the desired condition, would only be implemented when weather conditions are optimal for burning. Thinning or prescribed burning activities may indirectly affect MSO by changing the owl’s habitat structure including snags, downed logs, woody debris, multi-storied canopies, and dense canopy cover. This could result in a potential for owls to relocate. Lining of snags and logs in combination with burning techniques and vegetation treatments designed to protect snags would reduce the number of snags burned. Recruitment snags would be identified from live trees that exhibit defects ideal for wildlife, for example, trees with spiked tops, lightning strikes, mistletoe brooms, or fading crowns.

The proposed thinning and burning may change the structure of MSO prey species’ habitat, affecting the abundance and composition of prey species. Although treatments, especially prescribed burning may have adverse effects to prey species in the short-term (generally one year, depending on climate and moisture) by impacting individuals of prey species due to disturbance of prey species’ habitat, the proposed treatments are designed to increase the diversity of vegetative conditions, which in turn would provide for a diverse prey base. Effects from proposed treatments to adult and young owls outside of PACs are unlikely.

**Cumulative Effects**

Cumulative effects were analyzed based on the likelihood of disturbances (smoke, visual and auditory) to impact owls within the project area and a one mile buffer from the project boundary. Reviews of all projects (past, present and reasonably foreseeable) that have the potential to impact owls during implementation were analyzed. Review with the Forest Service Fuels Specialist concluded that smoke from proposed broadcast and pile burning southwest of the project would have similar short-term (3-5 days) and low intensity (drift smoke) effects of smoke to individual MSO.

Burning inside PACs occurs outside the breeding season for all projects; however no burning would occur inside PACs for this project. Burning outside of PACs during the breeding season is conducted in a manner that minimizes smoke impacts to MSO. However, it is anticipated that burning activities on portions of this project could occur simultaneously with burning activities on other fuels reduction projects. While there are numerous burning operations planned in areas adjacent to the project area, ADEQ standards limit the total amount of burning allowed in the airshed at a given time. Thus, smoke impacts to PACs are limited.

Cumulative effects from other projects that include vegetation treatments and recreation use are not expected. However continued use of user-created trails in the project may disturb roosting or nesting owls. New roads or trails would not be designated as part of the project, and all temporary roads created under the Proposed Action to facilitate the harvest and removal of trees would be obliterated after implementation.

Treatments in owl habitat can affect the prey base immediately by impacting individuals of prey species from habitat disturbance and harm from mechanical operations or from fire. However, prey species diversity would increase with increased diversity of vegetation structural stages and improvement of understory vegetation. Over time, a more diverse prey base would prosper during variable climatic conditions, thus improving food availability. In addition, vegetation treatments in adjacent projects would improve tree vigor and growth, and vegetative structural stage diversity, thus promoting the growth of larger trees and habitat components for MSO. Cumulatively, these projects and activities may affect, but are not likely to adversely affect, Mexican spotted owl and its critical habitat.
Black-footed Ferret

No remaining wild populations of black-footed ferrets are known from the project vicinity, the region, or the state, although Gunnison’s prairie dog colonies that ferrets are dependent on exist within and adjacent to the project. Guidelines exist in regards to the minimum amount of black-tailed prairie dog and white-tailed prairie dog habitat needed to support a black-footed ferret; however, there are no guidelines for Gunnison’s prairie dogs (USDI 1988). Prairie dog colonies should have 20 burrows or more per hectare (8 per acre) (USDI 1988). A complex consists of two or more neighboring prairie dog colonies each less than 4.3 miles (7km) from each other. Habitat for black-footed ferrets in northern Arizona is described as medium to large (> 80 hectares or ± 200 acres) prairie dog colonies or complex of colonies (Mikesic and Nystedt 2001). There are five Gunnison’s prairie dog colonies within the Hart Prairie project and one colony adjacent to the project all within 4.3 miles of each other. These six colonies make up this complex totaling approximately 192 acres. Based on this, the project area and the associated complex does not support potential habitat for the black-footed ferret. There are 1566 acres of grassland habitats within the project area. Meadows and openings have been negatively affected by pine encroachment fragmenting habitat for prairie dogs.

Alternative 1: No Action Alternative

Direct and Indirect Effects

Habitat conditions for black-footed ferret would remain in their current condition, not withstanding natural processes. Under the No Action Alternative, there would be no direct effect to black-footed ferret. Indirect effects to the black-footed ferret include effects to potential ferret habitat, prey species populations, or prey species habitat. Under the No Action Alternative, meadows or meadow edges would not be treated and trees would continue to encroach reducing potential habitat for prairie dogs, a primary prey species. This could result in an indirect adverse effect.

Cumulative Effects

The No Action Alternative would maintain the current risk to black-footed ferret habitat and adjacent forest lands. The cumulative effects of the No Action Alternative would be the reduction of grassland acres within National Forest System lands, as dense forest conditions would continue to place black-footed ferret habitat and adjacent habitat at risk of encroachment. The fire hazard would increase over time as vegetation would continue to grow and fuel would continue to accumulate. The No Action Alternative would continue to have adverse effects to black-footed ferret.

Alternative 2: Proposed Action

Direct and Indirect Effects

There would be no direct effects to black-footed ferret, as potential habitat (active prairie dog colonies) would not be treated, although treatments may occur immediately adjacent to occupied prairie dog colonies. Indirect effects to the black-footed ferret include effects to potential ferret habitat, prey species populations, or prey species habitat. Under the Proposed Action, no anticipated adverse effects to prey species populations or prey species habitat are anticipated. The 1516 acres of meadow restoration treatments would improve and increase available habitat for prairie dogs, a primary prey species, resulting in indirect beneficial effects.

Cumulative Effects
The cumulative effects area for analysis is the prairie dog complex of 192 acres. Roads and trails within prairie dog habitat provide access to recreation activities thereby potentially disturbing prairie dogs. The Travel Management Rule (TMR) analysis has been initiated for the Forest and will identify a desired road system and close the Forest to off road travel. The complex is included in this study, and the existing road system is expected to change as a result. The project is also expected to reduce off road vehicle use that compact soils which can negatively affect habitat quality and potentially cause direct disturbance to burrowing mammals. Cumulatively, these projects and activities may result in indirect beneficial effects to habitat although there would be no effect to the black-footed ferret.

**Bald Eagle**

The bald eagle was removed from the list of threatened and endangered species August 8, 2007 (USDI 2007). Eagles are currently protected under the Golden and Bald Eagle Protection Act and are a Forest Service Sensitive species.

Bald eagles are primarily winter visitors to the Coconino National Forest, occupying all habitat types and elevations. Wintering eagles arrive in the fall, usually late October or early November, and leave in early to mid-April. Eagles are often seen perched in trees or snags near water or next to roadways where they feed on road-killed animals. On the forest, small to moderate sized groups (usually 2-48) of bald eagles roost at night in clumps of large trees in protected locations such as drainages and hillsides (Grubb and Kennedy 1982, Dargan 1991). Eagles typically roost in ponderosa pine stands that are variable in size (less than an acre to 43 acres), are often on north or northeast-facing slopes and are close to daytime foraging areas (Dargan 1991). Roost trees are large live or dead ponderosa pine trees averaging 28” dbh that occur in groups and are much larger than other trees in roost stands (Dargan 1991).

The Bald Eagle Midwinter Survey occurs annually in early January. The Highway 180 survey route runs adjacent to the project boundary and bald eagles have been observed along the route both north and south of the project boundary. Other observations have been reported in the vicinity of Fort Valley and Cheshire, and an eagle has been seen near the junction of FR 151 and FR 418 immediately adjacent to the project boundary (C. Overby, personal communication to C. Thompson).

**Nesting:** There are no nesting bald eagles within the project area. The only known nesting eagles on the Coconino National Forest are along north Lower Lake Mary, south Lower Lake Mary and the Verde River 15, 16, and 32 miles from the southern boundary of the project respectively. There is no potential nesting habitat within the project area based on the absence of habitat and nesting structures common to nesting bald eagle sites in the southwest, which are major rivers and reservoirs and mature to over-mature cottonwood and ponderosa pine trees. It is unlikely that the project area will provide nest sites for bald eagles in the future.

**Roosting:** There are no roosts known to occur in the project area. The nearest roost is a winter roost approximately 12 miles east of the project boundary. The project area provides north and northeast facing slopes consisting primarily of mixed conifer with some ponderosa pine drainages and slopes that provide potential suitable roosting habitat.

**Foraging:** Eagles forage widely and opportunistically on carrion, waterfowl or fish on the forest. There are no significant water bodies in the project vicinity, although eagles may feed on mammalian prey in the project area.
Alternative 1: No Action Alternative

**Direct and Indirect Effects**
Habitat conditions would remain in their current condition, not withstanding natural processes. Because there would be no habitat altering activities or disturbance associated with project implementation this alternative would have no effect on the bald eagle. However, dense forest conditions would still occur and the high fire hazard potential would continue to place potential bald eagle roosting and foraging habitat at risk with respect to stand-replacing fire, resulting in indirect adverse effects.

Tree densities would continue to be high, slowing their growth into larger diameter classes and thereby limiting the development of larger diameter (> 18-inch) trees important for roosting and perching. This would have an indirect adverse effect on bald eagle habitat.

**Cumulative Effects**
The No Action Alternative would maintain the current fire risk to bald eagle habitat and adjacent forest lands. The No Action Alternative has a cumulative effect of increasing the number of acres of National Forest System lands that are vulnerable to severe fire effects, as the fire hazard would increase over time as vegetation continues to grow and fuel continues to accumulate, continuing to have negative effects to bald eagle.

Alternative 2: Proposed Action

**Direct and Indirect Effects**
Direct effects would be from activities that cause disturbances (smoke, auditory or visual) to bald eagles within or adjacent to the project. Under the Proposed Action, there would be no direct effects to nesting or roosting eagles as the nearest nesting eagle is 15 miles from the project and the nearest known roost is 12 miles.

Under the Proposed Action, mechanical treatments, broadcast and pile burning, and hauling of timber may cause visual or auditory disturbance to foraging bald eagles. This disturbance would be localized, of short duration and low intensity and may impact individuals, but is unlikely to cause a trend toward listing or loss of viability.

Indirect effects to the bald eagle include effects to eagle habitat, eagle prey species, or prey species habitat. There are no anticipated adverse effects to prey species or prey species habitat. Indirect effects to habitat would occur from treatments that modify the number of trees in a group of suitable roost trees, as eagles prefer to roost in large trees within close proximity to other large trees. However, thinning would improve old tree longevity, resulting in beneficial effects. Lining of snags would reduce potential mortality to these components from burning activities. In addition, the Proposed Action would include developing old-growth stands in 26% of the area that may be used as future winter roost sites for bald eagles.

**Cumulative Effects**
There is no effect to nesting eagles; however, there may be possible short-term disturbance to potential roosting habitat with long-term benefits. Short-term disturbance to roosting and foraging bald eagles would occur during thinning and broadcast burning activities and may cause eagles to forage and roost in nearby areas for the duration of the activity. These short-term impacts added to similar impacts from
past, present, and reasonably foreseeable projects were considered. Implementation of other fuel reduction project activities could occur simultaneously; however, it is not anticipated to combine to cause a negative effect. Other cumulative effects include hazard tree removal for powerlines and highways, which have reduced the number of snags and large trees for perching along potential winter foraging areas in the project area. However, these activities combined with this project’s activities may impact individuals but is not likely to cause a trend toward listing or loss of viability.

Northern Goshawk
A portion (341 acres) of the Whitehorse northern goshawk PFA is located within the project boundary (see Figure 5). The original nest is located outside of the project and was not occupied in 2008. All potential nesting and foraging habitat in the project area and ½ mile beyond the boundary was surveyed for northern goshawks in 2008 according to Region 3 protocol. No goshawk sightings were documented during that survey period. Nest sites and alternate nest sites have been delineated using known nest locations and best available habitat. There is one alternate nest stand located within the northeastern portion of the project area. The remaining nest stand and alternate nest stands are outside the project boundary (see Figure 5). Currently, VSS distribution and canopy cover do not meet those outlined in the Coconino National Forest Plan (see Table 1).

Alternative 1: No Action Alternative

Direct and Indirect Effects
Habitat conditions for wildlife would remain in their current condition, not withstanding natural processes. The No Action Alternative would have no direct effect on goshawks. However, dense forest conditions would still occur and the high fire hazard potential would continue to place goshawk habitat at risk with respect to stand replacing fire. VSS distributions as outlined in the Coconino National Forest Plan and Management Recommendations for the northern Goshawk in the southwestern United States would not be attained (see Table 9). Table 10 summarizes existing percent canopy cover and expected changes up to 40 years within northern goshawk habitat under the No Action Alternative.

Cumulative Effects
The No Action Alternative would maintain the current fire risk to northern goshawk habitat and adjacent forest lands. The No Action Alternative has a cumulative effect of increasing the number of acres of National Forest System lands that are vulnerable to severe fire effects, as the fire hazard would increase over time as vegetation continues to grow and fuel continues to accumulate. The No Action Alternative would not add any additional disturbance to wildlife species or modify habitat components within the analysis area.

Alternative 2: Proposed Action

Direct and Indirect Effects
Under the Proposed Action, treatments in the PFA would include ponderosa pine restoration, meadow restoration, and aspen restoration. For areas outside of the PFA but within northern goshawk habitat, treatments would include mixed conifer restoration, ponderosa pine restoration, thin from below, and burn only. Spring, water tank, and catchment exclosures would be constructed in northern goshawk habitat outside of the PFA.
Noise from mechanical treatments are not likely to directly affect nesting goshawks as no thinning would occur within the nest stands or PFAs during the breeding season. There are potential direct adverse effects from smoke from burning activities that could impact nesting and feeding behavior. Goshawks may be flushed from nest sites and/or change their foraging behavior due to smoke accumulation. This could cause goshawks to expend more energy and/or cause them to be detectable to predators during movements. Smoke from broadcast burning may disturb individual birds, although this would be a short-term effect and activities would be temporally and spatially separated, which would reduce overall effect. Impacts from smoke are reduced by the coordination of timing and type of burning with wind direction, topography, time of year and distance to the goshawk nesting area.

Prescribed burning or thinning activities may indirectly affect the goshawk by changing the goshawks habitat structure (snags, downed logs, woody debris, vegetative structural stages, and dense canopy cover). In addition the proposed activities may change the structure of goshawk prey species’ habitat, affecting the abundance and composition of prey species. Although treatments, especially prescribed burning, may have adverse effects to prey species and their habitat in the short-term, the proposed treatments may increase diversity of vegetative conditions, which would provide for a diverse prey base. Overall this would have an indirect beneficial impact on goshawks.

Although some snags and logs could be lost during broadcast burning, mitigation measures such as appropriate ignition and piling techniques, and lining of most snags and large logs, would minimize this effect. In addition, after burning, selected trees would be felled to replace logs burned up during prescribed fire to meet Coconino National Forest Plan guidelines. Recruitment snags would be identified from live trees that exhibit defects ideal for wildlife, for example, trees with spiked tops, lightning strikes, mistletoe brooms, or fading crowns.

Reduction of snags and logs would have an adverse impact on numbers of prey items and prey availability for northern goshawk. The impact of this effect is expected to be short-term as snags fall and become logs, and trees would be felled to create logs. The number of snags is expected to increase in the future as other trees grow, age, and die. Under the Proposed Action, the resiliency of the area to withstand wildfire would improve, and fire hazard potential in foraging areas would be reduced.

Canopy Cover
The Proposed Action would meet Coconino National Forest Plan guidelines. See Table 15 for a summary of canopy cover across northern goshawk habitat under the Proposed Action. The alternate nest area in the project area would retain a 55% or greater canopy cover. Post-treatment canopy cover would maintain groups and clumps of trees with variable canopy cover to allow for wildlife and prey species habitat, tree regeneration, and understory diversity. Openings would be scattered throughout the PFAs and foraging areas and would not be greater than 2 acres in PFAs and 4 acres in foraging areas. The Proposed Action would maintain canopy cover values as identified in desired conditions in foraging areas, and would maintain 55% canopy cover in nest stands.

Vegetative Structural Stages (VSS)
Treatments described in the Proposed Action would alter VSS class distribution. See Table 14 for VSS distribution across northern goshawk habitat under the Proposed Action. Although the desired future condition would not be met immediately after implementation, the forest structure would be such that it would be moving towards it. The Proposed Action would offer higher quality foraging habitat over time due to improved habitat conditions for prey species.

Cumulative Effects
The cumulative effects analysis area is the project and a ½ mile area surrounding the boundary.
There are additional indirect effects from vegetation modification activities, including hazard tree removal for powerlines and highways, as well as tree removal for development of state and private lands. Generally, Forest Service projects are designed to move toward the desired conditions for northern goshawks as identified in the Coconino National Forest Plan. Cumulatively, these projects and activities may impact northern goshawks but are not likely to cause a trend toward listing or loss of viability.

**American Peregrine Falcon**

The peregrine falcon was removed from the Federal List of Endangered and Threatened Wildlife in August 1999 and is now a Forest Service Sensitive species. The essential habitat for peregrine falcon includes rock cliffs for nesting and a large foraging area. Peregrines occur state-wide as a migrant, transient and/or wintering individual. The subspecies *anatum* breeds on selected isolated cliff ledges and is a permanent resident on the Coconino National Forest. There are two nests approximately 6 miles southwest of the project area and one nest approximately 10 miles to the northwest. Peregrines likely forage in the project area on bats, mammals and birds. The peregrine breeding season is from March 1 to August 31. The main threat to the peregrine falcon is the continued contamination of its environment by synthetic organochlorine contaminants (e.g., DDT). These contaminants result in eggshell thinning and direct mortality to this species. Other threats include disturbance from rock climbing near nests and mortality from encounters with powerlines.

**Alternative 1: No Action Alternative**

**Direct and Indirect Effects**

Under the No Action Alternative, there would be no direct or indirect effects to peregrines. There would be no change to the prey species base, and no change in falcon hunting patterns within associated forest structure.

**Cumulative Effects**

The No Action Alternative would maintain the current fire risk to peregrine falcon habitat and adjacent forest lands. The No Action Alternative has a cumulative effect of increasing the number of acres of National Forest System lands that are vulnerable to severe fire effects, as the fire hazard would increase over time as vegetation continues to grow and fuel continues to accumulate, continuing to have negative effects to northern goshawk.

**Alternative 2: Proposed Action**

**Direct and Indirect Effects**

Under the Proposed Action, no direct effects from thinning or burning are expected since no activities would take place within six miles of nest locations. Under the Proposed Action, there would be indirect effects from the modification of vegetation. Thinning could adversely affect the prey base on a short-term basis by impacting individuals of prey species due to disturbance of prey species’ habitat and harm from fire. However, over the long-term an increased diversity of vegetative structural stages and improved understory vegetation would increase prey species, resulting in indirect beneficial impacts. Thinning of the forest would increase sight distance for foraging peregrine falcons which facilitates hunting conditions, resulting in an indirect beneficial impact.
Chapter 3 – Affected Environment and Environmental Consequences

**Cumulative Effects**
Under the Proposed Action, there would be an additive indirect effect from activities that modify vegetation. Other projects where thinning occurs could affect the prey base on a short-term basis by impacting individuals of prey species due to disturbance of prey species’ habitat and harm from fire. However, projects would be implemented at different times and different locations, thus disturbances to the prey base would be minimized. An additional cumulative effect includes unmanaged climbing in areas where peregrine falcons are known to nest. In the last ten years, rock climbing has doubled, which could result in peregrine nesting success. Cumulatively, these projects and activities may impact peregrine falcons but are not likely to cause a trend toward listing or loss of viability.

**Western Burrowing Owl**
The project elevation is higher in elevation than where burrowing owls are documented to nest in Arizona. There are no records of burrowing owls in the project area or vicinity although five prairie dog colonies exist within the project area (owls have been known to use prairie dogs burrows). They are all within 4.3 miles of each other. Together these colonies form a complex of 527 acres. Like prairie dogs, burrowing owls are associated with the grassland cover type. Meadows and openings have been negatively affected by pine encroachment, fragmenting prairie dogs habitat.

**Alternative 1: No Action Alternative**

**Direct and Indirect Effects**
There would be no direct effects to burrowing owls. The No Action Alternative would not treat meadows and trees would continue to encroach on these habitats over time, reducing potential habitat for prairie dogs and consequently burrowing owls. This would result in an indirect adverse effect.

**Cumulative Effects**
The No Action Alternative would maintain the current risk to burrowing owl habitat and adjacent forest lands. The No Action Alternative has a cumulative effect of reducing the number of grassland acres within National Forest System lands, as dense forest conditions would continue to place burrowing owl habitat and adjacent habitat at risk of tree encroachment. The fire hazard would increase over time as vegetation would continue to grow and fuel would continue to accumulate. The No Action alternative would continue to have negative effects to burrowing owl.

**Alternative 2: Proposed Action**

**Direct and Indirect Effects**
Direct effects to burrowing owl could occur if vegetation treatments or prescribed burning impact potentially occupied habitat. No treatments would occur within occupied prairie dog colonies, although treatments may occur immediately adjacent to occupied prairie dog colonies. Direct effects to burrowing owl would be from smoke created from broadcast and pile burning or disturbance caused by mechanical operations. Indirect effects to burrowing owls include effects to owl habitat, owl prey species populations, or prey species habitat. Under the Proposed Action, there would be no adverse effects to prey species populations or habitat. Meadow restoration treatments would improve and increase available habitat for prairie dogs, which would subsequently provide habitat for burrowing owls. The Proposed Action would increase available habitat for prairie dogs with 1515 acres of meadow enhancement treatments, resulting in an indirect beneficial effect.
Cumulative Effects

The cumulative effects area for analysis is the project area. Roads and trails within prairie dog habitat provide access to recreation activities thereby potentially disturbing prairie dogs and burrowing owls. The Travel Management Rule (TMR) analysis has been initiated for the Forest and will identify a desired road system and close the Forest to off-road travel. As a result, the existing road system within the project area is expected to change. TMR is also expected to reduce off-road vehicle use that compact soils which can negatively affect habitat quality and potentially cause direct disturbance to burrowing owls. Cumulatively, these projects and activities may impact burrowing owls, but are not likely to cause a trend toward listing or loss of viability.

Ferruginous Hawk

Ferruginous hawks historically nest in open shrublands, woodlands, and grasslands in southeastern and northern Arizona. Ferruginous hawks’ nests have not been documented on the Coconino National Forest, although they do forage in grasslands in the Flagstaff vicinity in fall and winter months. Ferruginous hawks are associated with grassland habitats in the project area as they provide foraging habitat where prairie dogs exist. There are five prairie dog colonies within the project area. Meadows and openings have been negatively affected by pine encroachment, fragmenting prairie dogs habitat.

Alternative 1: No Action Alternative

Direct and Indirect Effects

There are no direct effects to ferruginous hawks. The No Action Alternative would not treat meadows within the project area and trees would continue to encroach, reducing potential habitat for prairie dogs and consequently ferruginous hawks. This would result in an indirect adverse effect.

Cumulative Effects

The No Action Alternative would maintain the current risk to ferruginous hawk habitat and adjacent forest lands. The No Action Alternative has a cumulative effect of reducing grassland acres within National Forest System lands, as dense forest conditions would continue to place ferruginous hawk habitat and adjacent habitat at risk of tree encroachment. The fire hazard would increase over time as vegetation would continue to grow and fuel would continue to accumulate, continuing to have negative effects to ferruginous hawk.

Alternative 2: Proposed Action

Direct and Indirect Effects

There are no direct effects to ferruginous hawks as these hawks do not nest in the project area. Indirect effects to the ferruginous hawk include affecting prey species populations or prey species habitat. There are no anticipated adverse effects to prey species populations or habitat. Meadow restoration treatments would improve and increase available habitat for prairie dogs, a primary prey species. The Proposed Action would increase available habitat for prairie dogs with 1515 acres of meadow enhancement treatments, resulting in an indirect beneficial effect.

Cumulative Effects

The cumulative effects area for analysis is the project area. Roads and trails within prairie dog habitat provide access to recreation activities thereby potentially disturbing prairie dogs. The Travel Management
Rule (TMR) analysis has been initiated for the forest and will identify a desired road system and close the forest to off-road travel. As a result, the existing road system within the project area is expected to change. TMR is also expected to reduce off-road vehicle use that compact soils which can negatively affect habitat quality and potentially cause direct disturbance to ferruginous hawks. Cumulatively, these projects and activities may impact ferruginous hawks, but are not likely to cause a trend toward listing or loss viability.

Navajo Mogollon Vole
Vole runways have been documented in the eastern portion of the project area, and vole populations likely occur in the project area. Navajo Mogollon voles occupy meadows and riparian areas above the Mogollon Rim associated with ponderosa pine or other coniferous forests. They also occur within forested areas where tree densities are low. Potentially suitable habitat within the project area includes grassland cover type and any openings within the ponderosa pine and mixed conifer cover type.

Alternative 1: No Action Alternative

Direct and Indirect Effects
Under the No Action Alternative, there would be no disturbance and no direct effects. Although habitat would to be provided for this species, most of the forested area within the project is currently is moderately closed to closed condition, which provides low quality habitat for the Mogollon vole. Under the No Action Alternative, meadows would not be rehabilitated, thus there would no benefits to the vole. Favorable habitat would decrease over time as conifers encroach into meadows and canopy closure increases, resulting in an indirect adverse effect. In addition, high fire hazard potential would persist, and a large crown wildfire event would have the potential to affect many individuals.

Cumulative Effects
The No Action Alternative would maintain the current fire risk to vole habitat and adjacent forest lands. The No Action Alternative has a cumulative effect of increasing the number of acres of National Forest System lands that are vulnerable to severe fire effects, as the fire hazard would increase over time as vegetation continues to grow and fuel continues to accumulate, continuing to have negative effects to Navajo Mogollon vole.

Alternative 2 – Proposed Action

Direct and Indirect Effects
Under the Proposed Action, thinning and broadcast burning activities may disturb individual voles, resulting in direct adverse effects. Broadcast burning would result in the temporary removal of cover and food in some areas; however, it is anticipated that meadows and open areas would rebound afterwards, with more vigorous herbaceous vegetation and healthier understory habitats. However, such activities would occur across the project area at different times; thereby reducing impacts to this species. In addition, the effect would be short-term. The reduction of dense forest canopy and increased growth in the herbaceous vegetation on the forest floor would result in indirect beneficial impacts to the vole. Forest conditions after treatment would improve vole habitat within the project area.

Under the Proposed Action, spring and water tank exclosures would improve riparian vegetation, increasing availability of food for small mammals over the long-term, resulting in indirect beneficial impacts. Fence design would allow access to small mammals.
Cumulative Effects
Recreation (e.g., hiking, biking, and camping) and road travel pose an adverse effect to voles due to soil and vegetation disturbance and soil compaction. Recreational activities would continue to occur in the project area, resulting in decreased habitat for voles; however, forest management practices that promote herbaceous growth could lead to increased vole populations. Development of private and state land has the greatest potential impact to vole habitat. Cumulatively, these projects and activities may impact the Navajo Mogollon vole but are not likely to cause a trend toward listing or loss of viability.

Long-tailed Vole
Most of the long-tailed vole’s range is outside Arizona but within Arizona the range includes Coconino, Apache-Sitgreaves and Kaibab Forests. The long-tailed vole’s habitat is montane subalpine grassland with minimal canopy cover, mixed conifer and spruce-fir with dispersion of structure and openings, including meadows with well developed herbaceous understory and wet ground. They burrow in and use soil for cover. Long-tailed vole habitat can be found in alpine-tundra, mixed conifer, montane subalpine grassland, and spruce-fir vegetation types. There are 2515 acres of potential habitat within the project area.

Alternative 1 – No Action Alternative

Direct and Indirect Effects
Under the No Action Alternative, there would be no disturbance and no direct effects. Although habitat would to be provided for this species, most of the forested area within the project is currently is moderately closed to closed condition, which provides low quality habitat for the vole. Under the No Action Alternative, meadows would not be rehabilitated, thus there would no benefits to the vole. Favorable habitat would decrease over time as conifers encroach into meadows and canopy closure increases, resulting in an indirect adverse effect. In addition, high fire hazard potential would persist, and a large crown wildfire event would have the potential to affect many individuals.

Cumulative Effects
The No Action Alternative would maintain the current fire risk to vole habitat and adjacent forest lands. The No Action Alternative has a cumulative effect of increasing the number of acres of National Forest System lands that are vulnerable to severe fire effects, as the fire hazard would increase over time as vegetation continues to grow and fuel continues to accumulate, continuing to have negative effects to long-tailed vole.

Alternative 2 – Proposed Action

Direct and Indirect Effects
Under the Proposed Action, thinning and broadcast burning activities may disturb individual voles, resulting in direct adverse effects. Broadcast burning would result in the removal of cover and food; however it is anticipated that meadows and open areas would rebound afterwards, with more vigorous herbaceous vegetation and healthier understory habitats. However, such activities would occur across the project area at different times; thereby reducing impacts to this species. In addition, the effect would be short-term. There would be no effects to population viability of voles. The reduction of dense forest canopy and increased growth in the herbaceous vegetation on the forest floor would result in indirect beneficial impacts to the vole. Forest conditions after treatment would improve vole habitat within the project area.
Under the Proposed Action, spring and water tank exclosures would improve riparian vegetation, increasing availability of food for small mammals over the long-term, resulting in indirect beneficial impacts. Fence design would allow access to small mammals.

**Cumulative Effects**
Recreation (e.g., hiking, biking, and camping) and road travel pose an adverse effect to voles due to soil and vegetation disturbance and soil compaction. Recreational activities would continue to occur in the project area, resulting in decreased habitat for voles, however, forest management practices that promote herbaceous growth could lead to increased vole populations. Ungulate grazing within the project area reduces understory vegetation, which reduces plant availability used by voles for food and cover. Approximately half of the project area is currently not being grazed by livestock and the remainder is managed on a rotational grazing system designed to allow forage a chance to recover from livestock grazing, reducing the potential for cumulative impacts. However, elk browsing and trampling would continue to reduce vegetative understory in meadows and around waters. Development of private and state land has the greatest potential impact to vole habitat. Cumulatively, these projects and activities may impact the long-tailed vole but are not likely to cause a trend toward listing or loss of viability.

**Dwarf Shrew**
The dwarf shrew has a limited range and is known to occur on the Kaibab Plateau, San Francisco Peaks, and White Mountains (Hoffmeister 1986). Habitat includes rocky areas, talus slopes with fallen logs in alpine tundra into subalpine coniferous forest and herbaceous wetlands. They can also be found in meadows, ponderosa pine and pinyon-juniper with well developed herbaceous understory and wet ground. Within the project area, habitat would include grasslands, spruce fir, and ponderosa pine cover types.

**Alternative 1 – No Action Alternative**

**Direct and Indirect Effects**
Under the No Action Alternative, there would be no disturbance and no direct effects. Although habitat would to be provided for this species, most of the forested area within the project is currently is moderately closed to closed condition, which provides low quality habitat for the dwarf shrew. Under the No Action Alternative, meadows would not be rehabilitated, thus there would no benefits to the shrew. Favorable habitat would decrease over time as conifers encroach into meadows and canopy closure increases, resulting in an indirect adverse effect. In addition, high fire hazard potential would persist, and a large crown wildfire event would have the potential to affect many individuals.

**Cumulative Effects**
The No Action Alternative would maintain the current fire risk to shrew habitat and adjacent forest lands. The No Action Alternative has a cumulative effect of increasing the number of acres of National Forest System lands that are vulnerable to severe fire effects, as the fire hazard would increase over time as vegetation continues to grow and fuel continues to accumulate, continuing to have a negative effect to dwarf shrew.
Alternative 2 – Proposed Action

Direct and Indirect Effects
Under the Proposed Action, thinning and broadcast burning activities may disturb individual shrews, resulting in direct adverse effects. Broadcast burning would result in the removal of cover and food; however it is anticipated that meadows and open areas would rebound afterwards, with more vigorous herbaceous vegetation and healthier understory habitats. However, such activities would occur across the project area at different times; thereby reducing impacts to this species. In addition, the effect would be short-term. There would be no effects to population viability of shrews. The reduction of dense forest canopy and increased growth in the herbaceous vegetation on the forest floor would result in indirect beneficial impacts to the shrew. Forest conditions after treatment would improve shrew habitat within the project area.

Under the Proposed Action, spring and water tank exclosures would improve riparian vegetation, increasing availability of food for small mammals over the long-term, resulting in indirect beneficial impacts. Fence design would allow access to small mammals.

Cumulative Effects
Recreation (e.g., hiking, biking, and camping) and road travel pose an adverse effect to shrews due to soil and vegetation disturbance and soil compaction. Recreational activities would continue to occur in the project area, resulting in decreased habitat for shrews, however, forest management practices that promote herbaceous growth could lead to increased shrew populations. Ungulate grazing within the project area reduces understory vegetation, which reduces plant availability to adult insects, a primary food source. Approximately half of the project area is currently not being grazed by livestock and the remainder is managed on a rotational grazing system designed to allow forage a chance to recover from livestock grazing, reducing the potential for cumulative impacts. However, elk browsing and trampling would continue to reduce vegetative understory in meadows and around waters. Development of private and state land has the greatest potential impact to shrew habitat. Cumulatively, these projects and activities may impact the dwarf shrew but are not likely to cause a trend toward listing or loss of viability.

Merriam’s Shrew
This shrew is distributed throughout the west and is associated with multiple potential natural vegetation types. Habitat includes herbaceous ground cover, moist soils, logs and coarse woody debris and proximity to water. They inhabit cool, grassy places near coniferous forests, dry places often near water but not along streams. This shrew is associated with grasslands interspersed or associated with water and wetlands.

Alternative 1 – No Action Alternative

Direct and Indirect Effects
Under the No Action Alternative, there would be no disturbance and no direct effects. Although habitat would to be provided for this species, most of the forested area within the project is currently is moderately closed to closed condition which provides low quality habitat for the shrew. Under the No Action Alternative, meadows would not be rehabilitated, thus there would no benefits to the shrew. Favorable habitat would decrease over time as conifers encroach into meadows and canopy closure increases, resulting in an indirect adverse effect. In addition, high fire hazard potential would persist, and a large crown wildfire event would have the potential to affect many individuals.
Chapter 3 – Affected Environment and Environmental Consequences

**Cumulative Effects**

The No Action Alternative would maintain the current fire risk to shrew habitat and adjacent forest lands. The No Action Alternative has a cumulative effect of increasing the number of acres of National Forest System lands that are vulnerable to severe fire effects, as the fire hazard would increase over time as vegetation continues to grow and fuel continues to accumulate, continuing to have negative effects to Merriam’s shrew.

**Alternative 2 – Proposed Action**

**Direct and Indirect Effects**

Under the Proposed Action, thinning and broadcast burning activities may disturb individual shrews, resulting in direct adverse effects. Broadcast burning would result in the removal of cover and food; however it is anticipated that meadows and open areas would rebound afterwards, with more vigorous herbaceous vegetation and healthier understory habitats. However, such activities would occur across the project area at different times; thereby reducing impacts to this species. In addition, the effect would be short-term. There would be no effects to population viability of shrews. The reduction of dense forest canopy and increased growth in the herbaceous vegetation on the forest floor would result in indirect beneficial impacts to the vole. Forest conditions after treatment would improve shrew habitat within the project area.

Under the Proposed Action, spring and water tank exclosures would improve riparian vegetation, increasing availability of food for small mammals over the long-term, resulting in indirect beneficial impacts. Fence design would allow access to small mammals.

**Cumulative Effects**

Recreation (e.g., hiking, biking, and camping) and road travel pose an adverse effect to shrews due to soil and vegetation disturbance and soil compaction. Recreational activities would continue to occur in the project area, resulting in decreased habitat for shrews, however, forest management practices that promote herbaceous growth could lead to increased shrew populations. Ungulate grazing within the project area reduces understory vegetation, which reduces plant availability to adult insects, a primary food source. Approximately half of the project area is currently not being grazed by livestock and the remainder is managed on a rotational grazing system designed to allow forage a chance to recover from livestock grazing, reducing the potential for cumulative impacts. However, elk browsing and trampling would continue to reduce vegetative understory in meadows and around waters. Development of private and state land has the greatest potential impact to shrew habitat. Cumulatively, these projects and activities may impact the Merriam’s shrew but are not likely to cause a trend toward listing or loss of viability.

**Allen’s Lappet-browed Bat**

Allen’s lappet-browed bat maternity roost has been documented in a basalt shelter cave and several ephemeral tree/snag roosts are located on the Coconino National Forest. Within the project area, habitats include ponderosa pine, mixed conifer, and riparian forest. These bats forage in riparian with bank vegetation. A study conducted on the Coconino National Forest documented Allen’s lappet-browed bats using snags as roost sites. Suitable habitat within the project area would include large snags used for roosting, and foraging habitat including areas with water and insects.
Alternative 1: No Action

**Direct and Indirect Effects**

Under the No Action Alternative, there would be no disturbance and no direct effects to Allen’s lappet-brown bats. Habitat would still exist for this species, however, the high fire hazard potential would persist, and a large crown wildfire event could have the potential to affect individuals, resulting in indirect adverse effects.

**Cumulative Effects**

The No Action Alternative would maintain the current fire risk to bat habitat and adjacent forest lands. The No Action Alternative has a cumulative effect of increasing the number of acres of National Forest System lands that are vulnerable to severe fire effects, as the fire hazard would increase over time as vegetation continues to grow and fuel continues to accumulate, continuing to have negative effects to Allen’s lappet-browed bat.

Alternative 2: Proposed Action

**Direct and Indirect Effects**

Under the Proposed Action, thinning and broadcast burning activities could potentially disturb bats if they are roosting in snags within the project area. Burning may also result in the loss of snags which could potentially affect roosting bats, however mitigation including fire-lining all snags 18” dbh and greater prior to prescribed burning would reduce the impact. The Proposed Action is expected to result in a slight short-term decrease in snags followed by an increase over the long-term. This short term loss of snags is not expected to affect the overall distribution of Allen’s lappet-browed bats on the forest. Broadcast burning would result in the removal of cover and food; however it is anticipated that meadows and open areas would rebound afterwards, with more vigorous herbaceous vegetation and healthier understory habitats. The reduction of dense forest canopy and increased growth in the herbaceous vegetation on the forest floor would result in indirect beneficial impacts to bats. Forest conditions after treatment would improve bat habitat within the project area. Under the Proposed Action, spring and water tank exclosures would improve riparian vegetation, increasing availability of food for bats over the long-term, resulting in indirect beneficial effects.

**Cumulative Effects**

The cumulative effects considered includes all projects (past, present and reasonably foreseeable) that have the potential to impact Allen’s lappet-browed bats were analyzed. Ungulate grazing within the project area reduces understory vegetation, which reduces plant availability to adult insects, a primary food source. Approximately half of the project area is currently not being grazed by livestock and the remainder is managed on a rotational grazing system designed to allow forage a chance to recover from livestock grazing, thereby reducing the potential for cumulative impacts. However, elk browsing and trampling would continue to reduce vegetative understory in meadows and around waters. Cumulatively, these projects and activities may impact Allen’s lappet-browed bat but are not likely to cause a trend toward listing or loss of viability.

**Pale Townsend’s Big-eared Bat**

Townsend’s big-eared bats were documented to use caves on the Peaks/Mormon Lake and Red Rock Districts. There are no roosts located within the project area. Townsend’s big-eared bats were not
documented using ephemeral trees/snags as roosts on the Coconino, although they likely do. Habitat is found within the ponderosa pine cover type within the project area.

**Alternative 1: No Action Alternative**

**Direct and Indirect Effects**
Under the No Action Alternative, there would be no disturbance and no direct effects. Foraging habitat would still exist for this species, however, the high fire hazard potential would persist, and a large crown wildfire event could have the potential to affect individuals, resulting in indirect adverse effects.

**Cumulative Effects**
The No Action Alternative would maintain the current fire risk to bat habitat and adjacent forest lands. The No Action Alternative has a cumulative effect of increasing the number of acres of National Forest System lands that are vulnerable to severe fire effects, as the fire hazard would increase over time as vegetation continues to grow and fuel continues to accumulate, continuing to have negative effects to Pale Townsend’s big-eared bat.

**Alternative 2 – Proposed Action**

**Direct and Indirect Effects**
Under the proposed Action, disturbance from thinning and broadcast burning activities is highly unlikely. In addition, direct effects to roosting Townsend’s big-eared bat from project implementation are not anticipated.

Broadcast burning would result in the removal of cover and food; however it is anticipated that meadows and open areas would rebound afterwards, with more vigorous herbaceous vegetation and healthier understory habitats. Indirect effects would result from vegetation modification activities such as thinning and broadcast burning. These activities would disturb or remove understory vegetation, subsequently reducing availability to insects. These effects would be short-term and minimized due to activities being temporally and spatially separated. In contrast, reducing canopy closure, removing trees in and at edges of meadows, restoring meadows and broadcast burning would encourage the development of understory vegetation, increasing availability of food for the bat over the long-term. Under the Proposed Action, spring and water tank exclosures would improve riparian vegetation, increasing availability of food for bats over the long-term, resulting in indirect beneficial impacts.

**Cumulative Effects**
The cumulative effects area considered is the project area and all projects (past, present and reasonably foreseeable) that have the potential to impact Pale Townsend big-eared bats were analyzed. Ungulate grazing within the project area reduces understory vegetation, which reduces plant availability to adult insects, a primary food source. Approximately half of the project area is currently not being grazed by livestock and the remainder is managed on a rotational grazing system designed to allow forage a chance to recover from livestock grazing, reducing the potential for cumulative impacts. However, elk browsing and trampling would continue to reduce vegetative understory in meadows and around waters. Cumulatively, these projects and activities may impact Pale Townsend’s big-eared bat but are not likely to cause a trend toward listing or loss of viability.
Greater Western Mastiff Bat

Range for this bat includes most Arizona counties, but are documented to be located mostly on the North Kaibab in Arizona. There are no roost locations known to occur on the Coconino National Forest. Greater western mastiff bats use multiple vegetation types for foraging. Forest habitat includes diverse cover types with snags and/or dead and dying trees with loose bark, and openings, meadows, and wet soils with vegetative herbaceous ground cover. Pools, tanks, and openings with wet ground also support prey.

Alternative 1 - No Action Alternative

**Direct and Indirect Effects**

Under the No Action Alternative, there would be no disturbance and no direct effects. Foraging habitat would still exist for this species, however, the high fire hazard potential would persist, and a large crown wildfire event could have the potential to affect individuals, resulting in indirect adverse effects.

**Cumulative Effects**

The No Action Alternative would maintain the current fire risk to bat habitat and adjacent forest lands. The No Action Alternative has a cumulative effect of increasing the number of acres of National Forest System lands that are vulnerable to severe fire effects, as the fire hazard would increase over time as vegetation continues to grow and fuel continues to accumulate, continuing to have negative effects to greater western mastiff bat.

Alternative 2 – Proposed Action

**Direct and Indirect Effects**

Under the Proposed Action, disturbance from thinning and broadcast burning activities is highly unlikely. In addition, direct effects to roosting greater western mastiff bat from project implementation are not anticipated.

Broadcast burning would result in the removal of cover and food; however it is anticipated that meadows and open areas would rebound afterwards, with more vigorous herbaceous vegetation and healthier understory habitats. Indirect effects would result from vegetation modification activities such as thinning and broadcast burning. These activities would disturb or remove understory vegetation, subsequently reducing availability to insects. These effects would be short-term and would be minimized due to activities being temporally and spatially separated. In contrast, reducing canopy closure, removing trees in meadows, restoring meadows and broadcast burning would encourage the development of understory vegetation, increasing availability of food for the bat over the long-term. Under the Proposed Action, spring and water tank exclosures would improve riparian vegetation, increasing availability of food for bats over the long-term, resulting in indirect beneficial impacts.

**Cumulative Effects**

The cumulative effects area considered is the project area; all projects (past, present and reasonably foreseeable) that have the potential to impact greater western mastiff bats were analyzed. Ungulate grazing within the project area reduces understory vegetation, which reduces plant availability to adult insects, a primary food source. Approximately half of the project area is currently not being grazed by livestock and the remainder is managed on a rotational grazing system designed to allow forage a chance to recover from livestock grazing, reducing the potential for cumulative impacts. However, elk browsing...
and trampling would continue to reduce vegetative understory in meadows and around waters. Cumulatively, these projects and activities may impact greater western mastiff bat but are not likely to cause a trend toward listing or loss of viability.

**Invertebrates**
Three sensitive species of invertebrates have potential habitat within the project area. They are spotted skipperling, mountain silverspot butterfly and blue-black silverspot butterfly. These butterfly species inhabit moist meadows, seeps, springs, and streams within ponderosa pine and mixed conifer vegetation types, and in some cases other habitat types with riparian areas.

There are no documented populations of these butterfly species within the project area; however suitable habitat does exist at several tanks, springs and wet meadows. Best potential habitat is Little Spring, Wilson Spring and Otto Spring and the several tanks within the project boundary.

**Alternative 1 – No Action Alternative**

**Direct and Indirect Effects**
Under the No Action Alternative, there would be no direct effect to these species. Under the No Action Alternative, meadows would not be rehabilitated, thus there would no benefits to these species. Favorable habitat would decrease over time as conifers encroach into meadows and canopy closure increases and understory productivity and diversity decreases, resulting in an indirect adverse effect. High fire hazard potential in the project area would persist.

**Cumulative Effects**
The No Action Alternative would maintain the current fire risk to invertebrate habitat and adjacent forest lands. The No Action Alternative has a cumulative effect of increasing the number of acres of National Forest System lands that are vulnerable to severe fire effects, as the fire hazard would increase over time as vegetation continues to grow and fuel continues to accumulate, continuing to have negative effects to Sensitive invertebrates.

**Alternative 2 – Proposed Action**

**Direct and Indirect Effects**
Under the Proposed Action, no activities would occur within or near wet meadows. Individuals may be impacted by treatment activities, such as contact with machinery and tools. These activities would be minimal and short term. Spring and water tank exclosures would increase riparian vegetation increasing availability of food and reproductive sites for these species over the long-term.

Indirect effects would result from vegetation modification activities such as thinning and broadcast burning. These activities would disturb or remove understory vegetation, in effect reducing availability to adult butterflies and/or caterpillars. However, these would be short-term effects and would be minimized due to activities being temporally and spatially separated. In contrast, reducing canopy closure, removing trees in meadows, restoring meadows and broadcast burning would encourage the development of understory vegetation, increasing availability of food and reproductive sites for these species over the long-term, resulting in indirect beneficial effects. Improvement to meadows and vegetation around springs and waters under the Proposed Action would be beneficial to these butterfly species.
Cumulative Effects
Ungulate grazing within the project area reduces understory vegetation, which reduces plant availability to adult insects, a primary food source. Approximately half of the project area is currently not being grazed by livestock and the remainder is managed on a rotational grazing system designed to allow forage a chance to recover from livestock grazing, reducing the potential for cumulative impacts. However, elk browsing and trampling would continue to reduce vegetative understory in meadows and around waters. Cumulatively, these projects and activities may impact invertebrates but are not likely to cause a trend toward listing or loss of viability.

Northern Leopard Frog
There are no known existing or historic locations of northern leopard frogs within or adjacent to the project area. One historic location is known 1.5 miles west of the project boundary. Best potential habitat within the project area is tanks and springs that provide permanent water. Potential threats to local populations of northern leopard frogs include changes in wetlands, especially the alteration of marshy ponds to reservoirs and natural local extirpations as ponds dry up during years of low precipitation. Other threats include alteration of riparian vegetation by grazing, predation and competition by introduced bullfrogs and other non-native aquatic species, and fungus.

Alternative 1: No Action

Direct and Indirect Effects
Under the No Action Alternative, habitat conditions for wildlife would remain in their current condition, notwithstanding natural processes. The No Action Alternative would have no direct effect on northern leopard frog. However, dense forest conditions would still occur and the high fire hazard potential would persist. Large crown-wildfires could adversely affect potential habitat by destroying understory and overstory vegetation. As a result overland flow would increase, and soil erosion would increase with potentially high sediment loads. Water quality would be adversely affected on a wide-scale basis, resulting in indirect adverse effects.

Cumulative Effects
The No Action Alternative would maintain the current fire risk to frog habitat and adjacent forest lands. The No Action Alternative has a cumulative effect of increasing the number of acres of National Forest System lands that are vulnerable to severe fire effects, as the fire hazard would increase over time as vegetation continues to grow and fuel continues to accumulate, continuing to have negative effects to northern leopard frog.

Alternative 2: Proposed Action

Direct and Indirect Effects
Under the Proposed Action, there would be no direct effects to northern leopard frog eggs, larvae, or adults from mechanical treatment and/or prescribed burning. Under the Proposed Action spring and water tank exclosures would increase riparian vegetation increasing availability of food and reproductive sites for these species over the long-term, resulting in direct beneficial effects to habitat.
Cumulative Effects

The Proposed Action has no effect on northern leopard frogs. No cumulative effects to northern leopard frogs is anticipated when added to past, present and reasonably foreseeable future activities. Implementation of BMPs would curtail soil erosion and minimize potential for inflow into potential northern leopard frog habitat. There would be no impact to northern leopard frog.

Management Indicator Species

Management indicator species (MIS) for this project are evaluated based on indicator habitat located within the project area. Table 28 lists MIS known to be present within the project area and summarizes population and habitat trends from the forest-wide report (USDA 2002). The following MIS species were excluded from analysis due to lack of indicator habitats or features within the project area: juniper (plain) titmouse, cinnamon teal, Lucy’s warbler, and yellow-breasted chat.

Table 28. Management Indicator Species within the project area with their indicator habitats and forest trends.

<table>
<thead>
<tr>
<th>MIS Species</th>
<th>Indicator Habitat</th>
<th>Forest Habitat Trend</th>
<th>Forest Population Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abert Squirrel</td>
<td>Early seral ponderosa pine</td>
<td>Stable</td>
<td>Inconclusive</td>
</tr>
<tr>
<td>Red Squirrel</td>
<td>Late seral mixed conifer, spruce-fir</td>
<td>Declining</td>
<td>Inconclusive</td>
</tr>
<tr>
<td>Mexican spotted owl</td>
<td>Late seral mixed conifer, spruce-fir</td>
<td>Declining</td>
<td>Inconclusive</td>
</tr>
<tr>
<td>Northern goshawk</td>
<td>Late seral ponderosa pine</td>
<td>Declining</td>
<td>Variable</td>
</tr>
<tr>
<td>Pygmy Nuthatch</td>
<td>Late seral ponderosa pine</td>
<td>Declining</td>
<td>Stable</td>
</tr>
<tr>
<td>Turkey</td>
<td>Late seral ponderosa pine</td>
<td>Declining</td>
<td>Increasing</td>
</tr>
<tr>
<td>Elk</td>
<td>Early seral pinyon-juniper, ponderosa pine, mixed conifer, spruce-fir</td>
<td>pinyon-juniper – Stable ponderosa pine – Stable mixed conifer and spruce-fir - increasing</td>
<td>Stable-to-slightly increasing</td>
</tr>
<tr>
<td>Hairy woodpecker</td>
<td>Snag component of ponderosa pine, mixed conifer, spruce-fir</td>
<td>ponderosa pine snags declining mixed conifer and spruce fir snags increasing</td>
<td>Stable-to-slightly increasing</td>
</tr>
<tr>
<td>Mule deer</td>
<td>Early seral aspen and pinyon-juniper</td>
<td>pinyon-juniper – Stable Aspen - Declining</td>
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<td>Late seral and snag component of aspen</td>
<td>Declining</td>
<td>Stable</td>
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<td>Antelope</td>
<td>Early and late seral grasslands</td>
<td>Stable-to-declining</td>
<td>Declining</td>
</tr>
<tr>
<td>Lincoln’s sparrow</td>
<td>Late seral, high elevation riparian</td>
<td>Inconclusive</td>
<td>Stable</td>
</tr>
</tbody>
</table>

Abert Squirrel

The Abert squirrel as an MIS for early seral stage ponderosa pine forests. Forest-wide population trend is inconclusive since there is little forest-specific data; however, state-wide information indicates a stable
Chapter 3 – Affected Environment and Environmental Consequences

trend. Abert squirrels are currently found throughout the ponderosa pine in the project area. Abert squirrel nesting habitat includes high canopy cover with interlocking canopies, multi-storied structure, and high basal area with 18” dbh trees distributed throughout. The forest-wide habitat trend is stable. The age class distribution of ponderosa pine has remained essentially the same, dominated by mid-seral stage stands, with some loss of old-growth and older trees, and some early seral stage habitat created by wildfire.

Alternative 1: No Action

**Direct and Indirect Effects**
Habitat conditions for wildlife would remain in their current condition, notwithstanding natural processes. The No Action Alternative would have no direct effect on Abert squirrel forest-wide habitat or population trends. However, dense forest conditions would still occur and the high fire hazard potential would continue to place squirrel habitat at risk with respect to stand replacing fire, resulting in an indirect adverse effect. The project area would continue to be lacking in the higher basal areas made up of large trees that provide high quality nesting habitat. Foraging habitat would continue to be limited as large tree basal areas would remain lower and small tree densities would remain higher reducing tree growth rates and limiting cone production.

**Cumulative Effects**
The No Action Alternative would maintain the current fire risk to squirrel habitat and adjacent forest lands. The No Action Alternative has a cumulative effect of increasing the number of acres of National Forest System lands that are vulnerable to severe fire effects, as the fire hazard would increase over time as vegetation continues to grow and fuel continues to accumulate. The No Action Alternative would not add any additional disturbance to this species or modify habitat components within the analysis area.

Alternative 2: Proposed Action

**Direct and Indirect Effects**
Under the Proposed Action, quality nesting habitat for the squirrel would be reduced by 758 acres or less than 1% habitat available forest-wide. This would be too minimal to result in change to forest-wide trends. Canopy closures and basal areas would be reduced overall, with the exception of MSO habitats, PFAs and steep slopes. There would not be a substantial difference in the number of 18” dbh trees across the landscape. Tree group sizes would vary across the landscape with groups up to 0.7 acres in size with crowns that have interlocking canopies. Trees would grow into a larger diameter class at a faster rate compared with the No Action Alternative. Although mid-seral habitat quality would be reduced, the Proposed Action would continue to provide recruitment, nesting and foraging habitat for Abert squirrels in the project area. The reduction in nesting habitat quality is too small to alter the forest-wide habitat or population trends. In addition, treatments proposed for this project would provide protection from stand-replacing crown fires to squirrel habitat within the project area.

**Cumulative Effects**
There would be no effect to forest-wide habitat or population trends and there would be no cumulative effect from past, present or foreseeable projects. Past fuel reduction treatments have reduced habitat quality due to lower tree densities and lack of interlocking crowns (USDA 2002), however, MSO protected habitat and northern goshawk PFAs have similar habitat qualities as those required for higher quality Abert squirrel habitat and densities. These protected habitats are scattered across the landscape.
and provide habitat for squirrels. Past fuel treatments have maintained large trees across the landscape and are reducing competition between trees for water and nutrients thereby moving toward the larger VSS size classes, which are important for Abert squirrels.

**Red Squirrel**

The red squirrel is an MIS for late-seral mixed conifer and spruce-fir habitat. Red squirrels often nest in tree cavities, with preferred mean diameters are 14”. Large standing snags and large down logs are important sites for caches. Most caches are centered within a group of trees containing at least one or more large dominant conifers. Forest-wide population trend is inconclusive since there is no forest-specific data, however state-wide data indicates a secure population. Forest-wide habitat trend is declining. From 1989 to 2002, stand replacing fires have affected approximately 12% of mixed conifer and spruce-fir on the forest, resulting in a shift to early seral stage.

**Alternative 1: No Action Alternative**

**Direct and Indirect Effects**

Habitat conditions for wildlife would remain in their current condition, not withstanding natural processes. The No Action Alternative would have no direct effect on red squirrel forest-wide habitat or population trends. However, dense forest conditions would still occur and the high fire hazard potential would continue to place squirrel habitat at risk with respect to stand replacing fire, resulting in an indirect adverse effect. Foraging habitat would continue to be limited as large tree basal areas would remain lower and small tree densities would remain higher, thus reducing tree growth rates and limiting cone production.

**Cumulative Effects**

The No Action Alternative would maintain the current fire risk to squirrel habitat and adjacent forest lands. The No Action Alternative has a cumulative effect of increasing the number of acres of National Forest System lands that are vulnerable to severe fire effects, as the fire hazard would increase over time as vegetation continues to grow and fuel continues to accumulate. The No Action Alternative would not add any additional disturbance to this species or modify habitat components within the analysis area.

**Alternative 2: Proposed Action**

**Direct and Indirect Effects**

Under the Proposed Action, mixed conifer restoration would reduce overall stand densities which would result in greater tree vigor and increased resistance to insect and disease. This would create better quality habitat, resulting in an indirect beneficial effect. Restoration treatments would reduce late-seral habitat by 49 acres within treated areas, which is less than 1% of available habitat forest-wide; this would be too minimal to result in an effect, thus there would be no effect to habitat trend from the Proposed Action. There would be no substantial difference in the number of 18”dbh trees across the landscape. Caches would be identified and all trees would be retained within a 26 foot radius. Treatments proposed for this project would provide protection from stand-replacing crown fires to squirrel habitat within the project area.
Chapter 3 – Affected Environment and Environmental Consequences

**Cumulative Effects**
There would be no effect to forest-wide habitat or population trends and there would be no cumulative effect from past, present or foreseeable projects. Past fuel reduction treatments included very few acres of treatments in mixed conifer habitat. Wilderness, MSO protected habitat and northern goshawk PFAs have similar habitat qualities as those required for higher quality red squirrel habitat and densities. These protected habitats are scattered across the landscape thereby providing habitat for squirrels.

**Mexican Spotted Owl**
Mexican spotted owl as an MIS for late-seral mixed conifer and spruce-fir habitat. Important attributes used by Mexican spotted owls include cool microclimates, multistoried, multi-species stands with high canopy cover, large number of snags, high basal area, rocky outcrops and/or cliffs, and small openings. Forest-wide population trend for MSO is inconclusive. The Coconino National Forest has monitoring data on territory occupancy and reproduction, and a demography study from 1991-1998, but this data does not yield reliable population trend information. The demography study indicated a declining trend, but the study did not span a sufficient time period to make long-term population trend estimates, and climatic factors are thought to play a significant role in influencing survival and reproduction of owls (Seamens 2002). Forest-wide habitat trend is declining, as stand replacing fires have affected approximately 12% of mixed conifer and spruce-fir on the forest, resulting in a shift to early seral stage.

**Alternative 1: No Action Alternative**

**Direct and Indirect Effects**
Habitat conditions for wildlife would remain in their current condition, notwithstanding natural processes. The No Action Alternative would have no direct effect on MSO forest-wide habitat or population trends. However, dense forest conditions would still occur and the high fire hazard potential would continue to place owl habitat at risk with respect to stand replacing fire, resulting in an indirect adverse effect.

**Cumulative Effects**
The No Action Alternative would maintain the current fire risk to MSO habitat and adjacent forest lands. The No Action Alternative has a cumulative effect of increasing the number of acres of National Forest System lands that are vulnerable to severe fire effects, as the fire hazard would increase over time as vegetation continues to grow and fuel continues to accumulate. The No Action Alternative would not add any additional disturbance to this species or modify habitat components within the analysis area.

**Alternative 2: Proposed Action**

**Direct and Indirect Effects**
Under the Proposed Action, mixed conifer restoration would reduce overall stand densities which would result in greater tree vigor and increased resistance to insect and disease. This would create better quality habitat, resulting in an indirect beneficial effect. Prescribed burns would be of low intensity. By creating openings, restoration treatments would reduce a portion of late-seral habitat, which represents less than 1% of available habitat forest-wide; this would be too minimal to result in an effect, thus there would be no effect to habitat trend from the Proposed Action. There would be no noticeable difference in the number of 18” dbh trees across the landscape. The Proposed Action would provide protection from stand-replacing crown fires to MSO habitat within the project area. For additional information about impact to MSO, see analysis in TES section above.
Chapter 3 – Affected Environment and Environmental Consequences

**Cumulative Effects**
There would be no effect to forest-wide habitat or population trends and there would be no cumulative effect from past, present or foreseeable projects. Past fuel reduction treatments have included very few acres of treatments in mixed conifer habitat. In addition, MSO PACs would not receive treatment.

**Northern Goshawk**
Northern goshawks are an MIS for late seral stages of ponderosa pine forests (VSS 5 and 6). The forest-wide trend is inconclusive. Although the Coconino National Forest has some information on territory occupancy and reproduction, these data are not designed to detect changes in population trend. The total number of territories has increased, and state-wide data indicate a significant increase, but some indicators of occupancy and productivity appear to be declining on the forest. There is one Post-fledgling Family Area (PFA) delineated within the project area. The forest-wide habitat trend for late-seral ponderosa pine has declined. The age class distribution of ponderosa pine has remained essentially the same, dominated by mid-seral stage and, with some loss of old-growth and older trees, and some early-seral stage habitat created by wildfire.

**Alternative 1: No Action Alternative**

**Direct and Indirect Effects**
Indicator habitat conditions for goshawks would remain in their current condition, not withstanding natural processes. The No Action Alternative would have no direct effect to forest-wide habitat or population trends for northern goshawk. However, dense forest conditions would still occur and the high fire potential would continue to place goshawk habitat at risk with respect to stand replacing fire, resulting in and indirect adverse effect to habitat. The desired conditions for sustaining and developing late seral ponderosa pine habitat would never be attained.

**Cumulative Effects**
The No Action Alternative would maintain the current fire risk to goshawk habitat and adjacent forest lands. The No Action Alternative has a cumulative effect of increasing the number of acres of National Forest System lands that are vulnerable to severe fire effects, as the fire hazard would increase over time as vegetation continues to grow and fuel continues to accumulate. The No Action Alternative would not add any additional disturbance to this species or modify habitat components within the analysis area.

**Alternative 2: Proposed Action**

**Direct and Indirect Effects**
Under the Proposed Action, the quantity and quality of late-seral (VSS 5 and 6) goshawk indicator habitat would increase, resulting in a direct beneficial effect to habitat. The Proposed Action would provide an increase of 682 acres (1% of available habitat forest-wide) of goshawk nesting habitat over time as potential nesting habitat progresses to larger VSS classes. The Proposed Action is expected to have no effect to the forest-wide population trends for the northern goshawk. The increase in development in late-seral stage habitat is beneficial, but the amount of change is not enough to change forest-wide habitat or population trend.
Chapter 3 – Affected Environment and Environmental Consequences

**Cumulative Effects**

There are additional indirect effects from vegetation modification activities occurring in other projects, including hazard tree removal for powerlines and highways, as well as tree removal for development of state and private lands. Generally, projects on Forest Service lands are designed to move toward the desired conditions for northern goshawks as identified in the Coconino National Forest Plan. Cumulatively, these projects combined with the Proposed Action would have no effect to the forest-wide population or habitat trend for the northern goshawk.

**Pygmy Nuthatch**

The Pygmy nuthatch an MIS for late seral stage ponderosa pine forests. The pygmy nuthatch is generally associated with mature ponderosa pine forests, where it prefers open, park-like stands of old yellow pines. This nuthatch requires dead trees or dead-top trees where it builds nests in cavities. The forest-wide population trend is stable, although there are dramatic population fluctuations in the short-term, and small, local populations, such as those in snowmelt drainages, may be temporarily extirpated. Pygmy nuthatches have been observed throughout the project area. The age class distribution of ponderosa pine has remained essentially the same, dominated by mid-seral stage, with some loss of old-growth and older trees, and some early-seral stage habitat created by wildfire. Overall snags are thought to be increasing in the ponderosa pine.

**Alternative 1: No Action Alternative**

**Direct and Indirect Effects**

Habitat conditions for wildlife would remain in their current condition, not withstanding natural processes. The No Action Alternative would have no direct effect on pygmy nuthatches. However, dense forest conditions would still occur and the high fire hazard potential would persist, resulting in an indirect adverse impact.

**Cumulative Effects**

The No Action Alternative would maintain the current fire risk to pygmy nuthatch habitat and adjacent forest lands. The No Action Alternative has a cumulative effect of increasing the number of acres of National Forest System lands that are vulnerable to severe fire effects, as the fire hazard would increase over time as vegetation continues to grow and fuel continues to accumulate. The No Action Alternative would not add any additional disturbance to this species or modify habitat components within the analysis area.

**Alternative 2: Proposed Action**

**Direct and Indirect Effects**

Under the Proposed Action, trees would grow into the larger diameter classes at a faster rate than compared to the No Action Alternative. The Proposed Action would increase late seral stage habitat by 682 acres within treated areas, which represents less than 1% of available habitat forest-wide; and would offer higher quality nesting habitat over time due to the increase in the acres of VSS 5 and 6 stands, resulting in a direct beneficial effect to habitat. Management of old-growth, MSO habitat, northern goshawk PFAs, and snags under the Proposed Action would provide habitat for the pygmy nuthatch. There would be no effect to the forest-wide population trend for the pygmy nuthatch. The increase in
development in late-seral stage habitat is beneficial, but the amount of change is not enough to change forest-wide trend.

**Cumulative Effects**

There are additional indirect effects from vegetation modification activities occurring in other projects, including hazard tree removal for powerlines and highways, as well as tree removal for development of state and private lands. Generally, projects on Forest Service lands are designed to move toward the desired conditions for pygmy nuthatch. Cumulatively, these projects combined with the Proposed Action would have no effect to the forest-wide population or habitat trend for the pygmy nuthatch.

**Turkey**

The turkey as an MIS for late seral stage ponderosa pine forests, based on roost habitat requirements. The forest-wide population trend is increasing. The project area provides both roosting and nesting habitat for turkey, with 13 turkey roosts and 19 characteristic turkey roosts identified within the project area. The age class distribution of ponderosa pine has remained dominated by mid-seral stage stands, with some loss of old-growth and older trees, and some early seral stage habitat created by wildfire. This has resulted in a decline in forest-wide habitat trend for late seral- ponderosa pine habitat.

**Alternative 1: No Action Alternative**

**Direct and Indirect Effects**

Habitat conditions for wildlife would remain in their current condition, not withstanding natural processes. The No Action Alternative would have no direct effect on turkey. However, dense forest conditions would still occur and the high fire hazard potential would persist, resulting in an indirect adverse effect. There would be no effect to the forest-wide population or habitat trend for turkey.

**Cumulative Effects**

The No Action Alternative would maintain the current fire risk to turkey habitat and adjacent forest lands. The No Action Alternative has a cumulative effect of increasing the number of acres of National Forest System lands that are vulnerable to severe fire effects, as the fire hazard would increase over time as vegetation continues to grow and fuel continues to accumulate. The No Action Alternative would not add any additional disturbance to this species or modify habitat components within the analysis area.

**Alternative 2: Proposed Action**

**Direct and Indirect Effects**

Under the Proposed Action, all yellow-barked ponderosa pine trees within turkey roosting and nesting habitat would be retained while old tree longevity is improved. Furthermore, old-growth recruitment areas are identified within turkey habitat and would add to the potential numbers of turkey roost tree groups. Trees would grow into the larger diameter classes at a faster rate than compared to the No Action Alternative. The Proposed Action would increase late seral stage habitat by 682 acres within treated areas, which represents less than 1% of available habitat forest-wide, resulting in a direct beneficial effect to habitat. The Proposed Action would offer higher quality roosting habitat over time due to the increase in VSS 5 and 6 stands. Under the Proposed Action spring and water tank exclosures would increase riparian vegetation increasing availability of food for turkey over the long-term. Fence design would
allow access for turkey. The Proposed Action would increase quality roosting habitat over time, but the amount of chance is not enough to affect the forest-wide trend for turkey habitat or populations.

**Cumulative Effects**

There are additional indirect effects from vegetation modification activities occurring in other projects, including hazard tree removal for powerlines and highways, as well as tree removal for development of state and private lands. Generally, projects on Forest Service lands are designed to move toward the desired conditions for turkey. Cumulatively, these projects combined with the Proposed Action would have no effect to the forest-wide population or habitat trend for the turkey.

**Elk**

Elk is as an MIS for early seral stages of ponderosa pine, mixed conifer, and spruce-fir habitat types. Grasslands and early-seral stage woodlands are also important to this species. The forest-wide habitat trend is stable. The age class distribution of ponderosa pine has remained essentially the same, dominated by mid-seral stage stands, with some loss of old-growth and older trees, and some early seral-stage habitat created by wildfire. Early seral-stage ponderosa pine has not increased to any large degree.

Elk populations are managed by the Arizona Game and Fish Department (AGFD), and have fluctuated over time. Forest-wide population trend is considered to be stable. Elk are found throughout the project area and are known to calve throughout the project area. The analysis area provides summer range for elk and is located within AGFD Game Management Unit (GMU) 7E. Game Management Unit 7 shows a generally increasing trend in elk numbers. The Arizona Game and Fish Department Elk Management Plan objectives are to stabilize that portion of the herd residing in Unit 7E as their population objectives have been met (AGFD 2007).

**Alternative 1: No Action Alternative**

**Direct and Indirect Effects**

Habitat conditions for wildlife would remain in their current condition, notwithstanding natural processes. Under the No Action Alternative, there would be no direct effect on population trends for elk. However, dense forest conditions would still occur and the high fire hazard potential would persist, resulting in an indirect adverse effect on habitat. Dense forest conditions would not reduce grazing pressure to aspen, oak meadows and riparian habitats which are documented to be impacted by elk grazing within the project area.

**Cumulative Effects**

The No Action Alternative would maintain the current fire risk to elk habitat and adjacent forest lands. The No Action Alternative has a cumulative effect of increasing the number of acres of National Forest System lands that are vulnerable to severe fire effects, as the fire hazard would increase over time as vegetation continues to grow and fuel continues to accumulate. The No Action Alternative would not add any additional disturbance to this species or modify habitat components within the analysis area.
Chapter 3 – Affected Environment and Environmental Consequences

Alternative 2: Proposed Action

**Direct and Indirect Effects**

The Proposed Action would increase the amount of early seral stage ponderosa pine by 720 acres and increase early seral stage mixed-conifer by 49 acres, resulting in a direct beneficial effect on habitat. Open canopy areas in ponderosa pine and mixed conifer would increase throughout the project area, increasing foraging habitat quality and quantity for elk. This is anticipated to distribute elk foraging throughout the project area. The spring and water tank exclosures are intended to reduce browsing pressure by elk on adjacent aspen and willow stands. However elk have been known to travel long distances for water, and since there are several sources of water within the project area that are not proposed to receive fencing (including private tanks and ponds), elk may return to browse on the aspen and willow stands receiving treatment. Fencing of waters adjacent to the early seral ponderosa pine would reduce the quality of habitat to elk (by removing access to water), but would not render it unusable, because there would be no change in the vegetation. This decrease in habitat quality and quantity is too small to alter forest-wide population and habitat trends. Although elk are not considered a MIS for aspen, they are known to browse on aspen. The Proposed Action includes fencing and jackstrawing of some aspen areas. Fencing aspen stands would leave those areas inaccessible for elk, and jackstrawing aspen stands would hopefully deter elk from entering the stand. However, over the long-term, these treatments would improve regeneration and increase quality habitat. Removing these areas for elk would not alter forest-wide population or habitat trends.

**Cumulative Effects**

Roads and trails within elk habitat provide access to recreation activities thereby potentially disturbing elk. The Travel Management Rule (TMR) analysis has been initiated for the Forest and will identify a desired road system and close certain roads to public use. The project area is included in this study, and the existing road system is expected to change as a result, however is not expected to have any adverse effects on elk distribution or population. There would be no effect to forest-wide population or habitat trends, and there would be no cumulative effect from past, present or foreseeable projects.

**Hairy Woodpecker**

The hairy woodpecker is an MIS for snags in ponderosa pine, mixed conifer, and spruce-fir. Hairy woodpeckers are most abundant in mature forests with large old trees suitable for cavity nesting and are also common in medium-aged forests. Data from the Coconino National Forest, as well as statewide data, indicate that hairy woodpecker populations are stable, or slightly increasing on the forest. Overall snags are thought to be increasing in the ponderosa pine and mixed conifer. Hairy woodpeckers are fairly common in conifer forest types within the project area.

Alternative 1: No Action Alternative

**Direct and Indirect Effects**

Habitat conditions for wildlife would remain in their current condition, notwithstanding natural processes. The No Action Alternative would have no direct effect on hairy woodpeckers. However, dense forest conditions would still occur and the high fire hazard potential would persist, resulting in indirect adverse effects.
Chapter 3 – Affected Environment and Environmental Consequences

**Cumulative Effects**
The No Action Alternative would maintain the current fire risk to woodpecker habitat and adjacent forest lands. The No Action Alternative has a cumulative effect of increasing the number of acres of National Forest System lands that are vulnerable to severe fire effects, as the fire hazard would increase over time as vegetation continues to grow and fuel continues to accumulate. The No Action Alternative would not add any additional disturbance to this species or modify habitat components within the analysis area.

**Alternative 2: Proposed Action**

**Direct and Indirect Effects**
Under the Proposed Action, management of old-growth, MSO habitats, northern goshawk PFAs and snags would provide habitat for the hairy woodpecker. The Proposed Action progresses stands to larger VSS classes providing for more recruitment snags over the long-term, however there may be some losses of snags immediately after treatment, which would slightly reduce habitat quantity and quality over the short-term. This loss of snags would not alter enough habitats to affect to the forest-wide habitat or population trend for the hairy woodpecker.

**Cumulative Effects**
Private land development would reduce habitat for these species. Removal of hazard trees for powerlines and highway safety would reduce snags and habitat for snag-dependant species. However, these activities combined with the Proposed Action are not expected to reduce habitat quality enough to alter forest-wide population or habitat trends.

**Mule Deer**
The mule deer is an MIS for early-seral stages of aspen and pinyon-juniper woodlands. The MIS report did not state an amount of early-seral aspen. The Forest Plan estimates 4,487 acres of aspen on the Forest although estimates by the Forest Health Group prior to the recent mortality event estimate over 10,000 acres of aspen. Early seral stages of ponderosa pine, mixed conifer, and chaparral habitats are also important for this species. Mule deer are primarily browse on green shoots and fruits of shrubs and trees, but also feed on grasses and forbs. The forest-wide population trend is declining. In good years, fawn production has been at levels minimal to sustaining populations, but in poor precipitation and forage years, fawn production has not kept up with mortality rates. Forest-wide habitat trend is declining. Some early seral stage stands are being created through wildfire and management activities, but aspen recruitment is limited primarily due to grazing by animals. Management activities have not been implemented to a level, or over enough area, to prevent loss of aspen patches and provide adequate aspen recruitment.

**Alternative 1: No Action Alternative**

**Direct and Indirect Effects**
Habitat conditions for wildlife would remain in their current condition, not withstanding natural processes. The No Action Alternative would result in continued loss of aspen habitat for mule deer, resulting in a direct adverse effect to habitat. Pine encroachment and browsing by ungulates would continue to reduce the ability of sites to develop into mature aspen stands important to mule deer. Dense forest conditions would still occur and the high fire hazard potential would persist, resulting in additional
indirect adverse effects on habitat. However, this alternative would have no effect on forest-wide population trend, but may affect forest-wide habitat trends for aspen.

**Cumulative Effects**
The No Action Alternative would maintain the current fire risk to mule deer habitat and adjacent forest lands. The No Action Alternative has a cumulative effect of increasing the number of acres of National Forest System lands that are vulnerable to severe fire effects, as the fire hazard would increase over time as vegetation continues to grow and fuel continues to accumulate. The No Action Alternative would not add any additional disturbance to this species or modify habitat components within the analysis area.

**Alternative 2: Proposed Action**

**Direct and Indirect Effects**
Under the Proposed Action, aspen restoration treatments would increase early seral aspen habitat, resulting in a direct beneficial effect to habitat. The Proposed Action would treat 3,215 acres of late-seral aspen or 32-72% of forest-wide habitat. Treatments would maintain late-seral aspen while improving recruitment. The Proposed Action would contribute positively to the forest-wide habitat trend. However, some of these aspen areas would be fenced and those areas would not be accessible to mule deer in the short-term. Over the long-term, the fencing of aspen areas would improve regeneration and increase indicator habitat. Mule deer utilize a variety of habitats and this improvement in early seral-stage aspen would not change the forest-wide population trends.

**Cumulative Effects**
The Proposed Action would have no effect to forest-wide population trends; however there would be a beneficial effect to forest-wide habitat trends from aspen treatment. Combined with effects from past, present or reasonably foreseeable projects, no cumulative effects to population trends are anticipated. Past and current livestock and ungulate grazing and browsing has contributed to the declining habitat trend, however treatments proposed for the project area are still anticipated to have beneficial effects to habitat trends.

**Red-naped (Yellow-bellied) Sapsucker**
The red-naped sapsucker is an MIS for the late seral stage and snag component of aspen. Red-naped sapsuckers nest primarily in aspen, or in deciduous/mixed conifer forest, often near water. Live trees are preferred although dead trees (usually spruce or other conifers) are used at times. Live trees are preferred although dead trees (usually spruce or other conifers) are used at times. Data indicate that red-naped sapsucker populations fluctuate over time, but are stable forest-wide.

The forest-wide habitat trend is declining. The MIS report did not state an amount of late-seral aspen. The Forest Plan estimates 4,487 acres of aspen on the forest although recent estimates by the Forest Health Group estimate over 10,000 acres of aspen. On the forest, mid to late-seral stage aspen are declining, due to both natural causes and management actions to regenerate stands. Some early seral stage stands are being created through wildfire and management activities, but recruitment is limited primarily due to grazing by animals. Management activities have not been implemented to a level, or over enough area, to prevent loss of aspen patches and provide adequate aspen recruitment. The forest-wide snag distribution of aspen has also been declining. Currently, most aspen on the forest is in the older age classes, providing habitat for sapsuckers, but future forest-wide trends are of concern, since aspen regeneration remains an
on-going problem. In addition, the lack of recruitment to eventually replace late-seral stage aspen results in a lack of snag recruitment. The project area contains 3,215 acres of late-seral aspen or 32-72% of forest-wide habitat.

Alternative 1: No Action

**Direct and Indirect Effects**
The No Action Alternative would result in continued loss of aspen habitat for sapsuckers. Pine encroachment and browsing by ungulates would continue to reduce the ability of sites to develop into mature aspen stands important to sapsuckers. Dense forest conditions would still occur and the high fire hazard potential would persist, resulting in additional effects on habitat. Late-seral aspen would be lost with no young aspen to replace it. This could potentially cause a decline in forest-wide population trends.

**Cumulative Effects**
The No Action Alternative would maintain the current fire risk to red-naped sapsucker habitat and adjacent forest lands. The No Action Alternative has a cumulative effect of increasing the number of acres of National Forest System lands that are vulnerable to severe fire effects, as the fire hazard would increase over time as vegetation continues to grow and fuel continues to accumulate. Late-seral aspen would continue to be lost due to conifer encroachment and livestock and ungulate grazing and browsing resulting in a loss of forest-wide habitat and therefore a loss of forest-wide population.

Alternative 2: Proposed Action

**Direct and Indirect Effects**
The Forest Plan estimates 4,487 acres of aspen on the forest although recent estimates by the Forest Health Group estimate over 10,000 acres of aspen. The Proposed Action would treat 3,215 acres of late-seral aspen or 32-72% of forest-wide habitat. Treatments would maintain healthy late-seral aspen and would treat unhealthy stands with high tree mortality to encourage recruitment. Late-seral aspen would be expected to increase over the long-term. The Proposed Action would contribute positively to the forest-wide habitat trend. Under the Proposed Action, aspen snags would be used for jackstrawing if conifers are lacking. However, aspen snags would not be reduced below Coconino Forest Plan standards and guidelines. The proposed aspen treatments would increase late seral stage aspen in the long-term.

**Cumulative Effects**
Past and current livestock and ungulate grazing and browsing has contributed to the declining habitat trend, however livestock grazing is managed to minimize the effects on herbaceous ground cover. However, some negative effects to the quality and quantity of wildlife food and cover may occur. The Proposed Action, combined with past, present and reasonably foreseeable projects, is anticipated to have beneficial effect to forest-wide population and habitat trends.

**Pronghorn Antelope**
Pronghorn antelope is an MIS for early and late seral grassland type. The forest-wide pronghorn antelope trend is declining, although not equally on the forest. Declining numbers of animals is documented for all Game Management Units on the Coconino National Forest except for the Game Management Unit 7; the project area is located within this unit. Pronghorn have been reported north of the project area and no fawning areas are documented within the project area. The forest-wide habitat trend is stable to declining.
Although the total amount of grassland habitat has generally remained stable, habitat quality is stable to declining due to tree encroachment, fire suppression, long-term climatic changes, short-term drought, and ungulate grazing. Meadows and openings have been negatively affected by pine encroachment fragmenting habitat for pronghorn.

Alternative 1: No Action Alternative

**Direct and Indirect Effects**
Habitat conditions for wildlife would remain in their current condition, notwithstanding natural processes. Under the No Action Alternative, meadows would not be rehabilitated, and favorable habitat for pronghorn would decrease over time as conifers would continue to encroach in meadows, resulting in a direct adverse impact to habitat. Dense forest conditions would still occur and the high fire hazard potential would persist, resulting in an indirect adverse impact. However, the No Action Alternative is expected to have no effect on forest-wide population trends.

**Cumulative Effects**
The No Action Alternative would maintain the current fire risk to antelope population or habitat trends. The No Action Alternative has a cumulative effect of reducing the grassland acres within National Forest System lands, as dense forest conditions would continue to place populations and habitat at risk of habitat loss. The fire hazard would increase over time as vegetation would continue to grow and fuel would continue to accumulate, continuing to have a negative effect on grassland habitats. Alternative 2: Proposed Action

Alternative 2: Proposed Action

**Direct and Indirect Effects**
Under the Proposed Action, meadows grasslands would be restored, resulting in direct beneficial effect to habitat. Meadow restoration would increase vegetative species composition and diversity and improve the distribution and diversity of vegetative ground cover. The Proposed Action would result in both an increase of habitat, and an increase in habitat quality for pronghorn. However, the increase in habitat quality is too small to alter forest-wide population or habitat trends.

**Cumulative Effects**
The Proposed Action would have no effect to forest-wide population trends; however there would be a beneficial effect to habitat trends from meadow restoration treatments. Combined with effects from past, present or reasonably foreseeable projects, no cumulative effects to population trends are anticipated. Past and current livestock and ungulate grazing and pine encroachment has contributed to the declining habitat trend, however treatments proposed for the project area are still anticipated to have beneficial effects to habitat.

**Lincoln’s sparrow**
Lincoln’s sparrow is an MIS for late seral, high elevation riparian (>7000’) habitat. Lincoln’s sparrow is not common on the forest except for some winters. It is a localized breeder in Arizona and is found in wet areas such as bogs, marshes and wet meadows. It can also be found in dense willow or alder thickets, along forest edges, in open forests with well-developed understories and in clearings. The forest-wide population trend is inconclusive. Currently Lincoln’s sparrows are only known to nest in the inner basin.
on the San Francisco Peaks. Otherwise, nesting information is lacking, and population trend is unknown. Forest-wide habitat trend is stable, but most reaches are functioning below potential. Otto, Wilson and Little Spring, Bismarck Lake and a portion of Volunteer Wash near The Nature Conservancy Hart Prairie Preserve are considered habitat. The springs are classified as non-functional, Bismarck Lake is classified as functional-at-risk, and the stream channel is stable, but Bebb willows are not regenerating.

Alternative 1: No Action Alternative

**Direct and Indirect Effects**

Habitat conditions for wildlife would remain in their current condition, not withstanding natural processes. Under the No Action Alternative, riparian habitats would not be rehabilitated, thus there wouldn’t be any benefit to this species. Favorable habitat would decrease over time as riparian associated biota continued to be impacted, resulting in a direct adverse effect. However, the No Action Alternative is not expected to have any effect on forest-wide population trends. Dense forest conditions would still occur and the high fire hazard potential would persist, resulting in indirect adverse effects to habitat.

**Cumulative Effects**

The No Action Alternative would maintain the current fire risk to Lincoln’s sparrow habitat and adjacent forest lands. The No Action Alternative has a cumulative effect of increasing the number of acres of National Forest System lands that are vulnerable to severe fire effects, as the fire hazard would increase over time as vegetation continues to grow and fuel continues to accumulate. The No Action Alternative would not add any additional disturbance to this species or modify habitat components within the analysis area.

Alternative 2: Proposed Action

**Direct and Indirect Effects**

The Proposed Action would improve riparian habitat within the project area. Restoration treatments would occur on 22 acres of riparian habitat, and exclosures would be constructed around three springs. This is anticipated to have a direct beneficial effect on the habitat and indirectly on the species; however it is not anticipated to change forest-wide population or habitat trends.

**Cumulative Effects**

The beneficial effects to riparian habitat under the Proposed Action are not anticipated to substantially add to cumulative effects to forest-wide habitat or population trends.

**Macroinvertebrates**

As a group, aquatic macroinvertebrates are identified as an MIS for high and low elevation late-seral riparian areas. Riparian ecosystems are normally associated with seeps, springs, streams, marshes, ponds or lakes. Although sampled populations fluctuate over time, the overall forest-wide population trend appears to be stable. Forest-wide habitat trend is stable, but most reaches are functioning below potential. A portion of Volunteer Wash near The Nature Conservancy Hart Prairie Preserve is considered riparian; the stream channel is stable, but Bebb willows are not regenerating.
Alternative 1: No Action

**Direct and Indirect Effects**
Under the No Action Alternative, riparian habitats would not be rehabilitated, thus there wouldn’t be a benefit to macroinvertebrates. Favorable habitat would decrease over time as riparian associated biota continued to be impacted, resulting in a direct adverse effect to habitat. However, the No Action Alternative is not expected to have any effect on forest-wide habitat or population trends. Dense forest conditions would still occur and the high fire hazard potential would persist, resulting in indirect adverse effects.

**Cumulative Effects**
The No Action Alternative would maintain the current fire risk to invertebrate habitat and adjacent forest lands. The No Action Alternative has a cumulative effect of increasing the number of acres of National Forest System lands that are vulnerable to severe fire effects, as the fire hazard would increase over time as vegetation continues to grow and fuel continues to accumulate. The No Action Alternative would not add any additional disturbance to wildlife species or modify habitat components within the analysis area.

Alternative 2: Proposed Action

**Direct and Indirect Effects**
The Proposed Action would improve riparian habitat within the project area. Restoration treatments would occur on 22 acres of riparian habitat, and exclosures would be constructed around three springs. This is anticipated to have a direct beneficial impact on the habitat and indirectly on the species; however it is not anticipated to change forest-wide population or habitat trends.

**Cumulative Effects**
The beneficial effects to riparian habitat under the Proposed Action are not anticipated to substantially add to cumulative effects to forest-wide habitat or population trends.

**Migratory Birds**
The nearest Important Bird Area to the project area is located more than 15 miles away. There are no important overwintering areas within the project area. The Arizona Partners in Flight (APIF) Plan and the Birds of Conservation Concern (BCC) lists priority species of concern. A total of 17 species have been identified as species of concern that occur within the project area, and are discussed more below. Impacts to MSO, northern goshawk, ferruginous hawk, burrowing owl, and red-naped sapsucker are discussed in detail under the Threatened, Endangered, Sensitive Species and MIS sections of this report.

**Olive-sided Flycatcher**
The olive-sided flycatcher prefers forest openings and edges within mature ponderosa pine and mixed conifer forests with snags. They prefer areas abundant with snags and trees with dead limbs where they forage on insects, and semi-open stands with low canopy cover.

**Cordilleran Flycatcher**
Cordilleran flycatchers are considered a common summer resident and uncommon transient, and are associated with snags and high overstory canopy closure. Stands of old-growth ponderosa pine and closed canopy forest within the project area occur in small patches, on steep slopes, or in pine stringers in small drainages. Cordilleran flycatchers are considered to be on the increase, but at risk due to concerns about
loss of suitable habitat and habitat components such as snags, downed logs, and loss of closed canopy. Within the project area, it is expected that this species is static to increasing.

Olive Warbler
Distribution of olive warblers in the state extends along the Mogollon Rim but they also occur in southeastern Arizona. Olive warblers are found primarily in open ponderosa pine forests, including those forests with a Gambel oak component. They are also found regularly in mixed conifer forests. In southeastern Arizona, they occur in madrean pine-oak forests characterized by an overstory of ponderosa pine with an understory of several species of evergreen oaks and alligator juniper. They build nests in conifers. The migratory birds arrive in March to nest and have been heard singing through July.

Greater Pewee
Arizona is the very northern portion of this species range and greater pewees occur along the Mogollon rim and in southeastern Arizona. They occupy open ponderosa pine forests, including those forests with a Gambel oak component. Greater pewees are also found regularly in mixed conifer forests. In southeastern Arizona, where they are found more frequently, they occur in madrean pine-oak forests characterized by an overstory of ponderosa pine with an understory of several species of evergreen oaks and alligator juniper. Greater Pewees arrive in March, nest in mid-May through mid-July, and are still feeding fledglings into August. Nests are typically constructed in ponderosa pines and are placed on a horizontal limb in the top half to third of the tree.

Grace’s Warbler
Grace’s warblers primarily occur in ponderosa pine forests, but are occasional found in mixed conifer and pinyon-juniper woodlands. Grace’s warblers arrive mid to late April, nest mainly in mid-June and mid-July, with nesting occurring as late as the end of July. These warblers place their compact, cups-like nests well away from the trunk in the cluster of needles at the end of branches. Their range within Arizona is mainly along the Mogollon Rim, with some occurrences in the northeast, southeast, and northwest portions of the state.

Lewis’ Woodpecker
Lewis’ woodpeckers are found in open ponderosa pine (including pine/oak) forests and riparian woodlands from about 6,200 to 8,900 feet in elevation. They use brushy understories, snags for perching, and open areas for foraging; all of which is frequently provided in burn areas. They nest in the abandoned cavities of other woodpeckers, in natural cavities, or make their own cavities. They nest most frequently in ponderosa pine or cottonwood trees. While most Lewis’ woodpeckers are resident some migrate to lower elevations.

Flammulated Owl
These owls nest in old-growth coniferous forests including ponderosa pine, pine/oak, and mixed conifer, where they nest in natural cavities of live trees, snags, and dead limbs or abandoned cavities of flickers and sapsuckers. Flammulated owls arrive mid-April, with breeding occurring into July. Migration south occurs from August through October.

Purple Martin
Purple martins are an uncommon summer resident in ponderosa pine, and have been nearly extirpated from ponderosa pine forests since fire suppression has resulted in much denser conditions and logging has reduced the number of snags and large old trees. Data indicates that this species is static to slightly declining.

Swainson’s Hawk
Chapter 3 – Affected Environment and Environmental Consequences

These hawks occur in large expanses of open grasslands that may have interspersed shrubs and trees. They nest in trees such as cottonwoods, acacia, and junipers. They eat a wide variety of items; insects, reptiles, birds, and small mammals.

**Grasshopper Sparrow**
These sparrows nest in southeast Arizona, but are rare transients/migrants on the Coconino in grasslands and wetlands.

**McGillvray’s Warbler**
This warbler occurs in patches of dense and brushy deciduous riparian areas at higher elevations.

**Red-faced Warbler**
This warbler occurs in high elevation riparian areas, usually shaded canyons, where mixed conifer forests occur in the uplands.

**Alternative 1: No Action**

**Direct and Indirect Effects**
Under the No Action Alternative, there would be no changes in the project area. Habitat conditions for birds would generally remain the same, notwithstanding natural processes. The No Action Alternative would have no direct effect on migratory birds. However, dense forest conditions would continue to place forest-dwelling migratory bird habitat at risk with respect to stand-replacing fire, resulting in indirect adverse effects.

**Cumulative Effects**
The No Action Alternative would maintain the current fire risk to migratory bird habitat and adjacent forest lands. The cumulative effects of the No Action Alternative would be the increase in number of acres of National Forest System lands that are vulnerable to severe fire effects, as dense forest conditions would continue to place migratory bird habitat and adjacent habitat at risk of stand-replacing fire. The fire hazard would increase over time as vegetation would continue to grow and fuel would continue to accumulate, continuing to have a negative effect to migratory birds. Unintentional take could occur to migratory birds if habitat is not protected. No Action Alternative, when added to past, present and reasonably foreseeable future actions would put migratory bird habitat at greater risk.

**Alternative 2: Proposed Action**

**Direct and Indirect Effects**
Under the Proposed Action, ponderosa pine habitat would be treated. There is little to no Gambel oak within the project area and therefore no effects to this habitat. Eight species have been identified as species of concern in pine-pine/oak habitats. They are northern goshawks, Cordilleran flycatchers, olive warblers, greater pewee, Grace’s warbler, Lewis’s woodpecker, flammulated owl and purple martins. Species associated with forest openings and edges such as the purple martin would benefit from restoration treatments including ponderosa pine restoration. Due to the creation of openings within the project, there would be a slight increase in prey availability within the project. Through vegetation modification this project would create some open habitat and reduce tree densities, which favors early successional birds. However, the project area would continue to support mostly mid-succession and late-succession vegetation stages. Burning would likely have short-term beneficial effects by temporarily increasing insect abundance.
Under the Proposed Action, mixed conifer habitat would be treated. Most of the high species rich areas are associated with MSO habitat in the project area and treatments are designed to maintain habitat components important for these species as well as forest-dwelling passerine birds.

Under the Proposed Action, aspen habitat would be treated, and would result in increased size class distribution, increased health, growth and vigor and would increase biodiversity within aspen stands. Drought conditions and ungulate grazing over the past several years have affected aspen stands in the project area. The remaining living aspen are severely stressed and are primarily seedlings. The Proposed Action would treat aspen within the project area in an effort to provide young seedlings an opportunity to develop into mature aspen over time. These treatments would move toward improving habitat for a multitude of passerine birds that use this habitat.

Under the Proposed Action, grassland habitat would be treated, and species associated forest openings and edges such as the purple martin, Swainson’s hawk and grasshopper sparrow would benefit from restoration treatments including grassland restoration.

The Proposed Action would treat riparian habitat designed to restore the Bebb’s willow community. Additionally, fences would be constructed around three springs in the area in an attempt to deter browsing and increase riparian vegetation around those springs. These treatments would improve habitat conditions for McGillvray’s warbler and red-faced warbler by increasing biodiversity and insect abundance.

In all habitat types, disturbances to individuals from thinning, burning and smoke may cause individuals to temporarily move to other areas. Individuals may be directly impacted if burning occurs during times when young are unable to relocate. The effects from smoke and fire would be isolated, of low intensity and short duration. However, prescribed burning would likely have long-term beneficial effects by increasing insect abundance post burn. Effects from vegetation modification and burning treatments would have long-term beneficial effects by creating openings and edges, and the retention of snags and large trees. MSO protected habitat and steep slopes and developing old-growth would continue to provide habitat for species that require old-growth coniferous forests such as the flammulated owl and cordilleran flycatcher.

Under the Proposed Action Alternative, unintentional take could occur. When prescribed burning occurs during the spring and early summer there could be some take of migratory birds from smoke impacting breeding birds and potentially impacting nesting success. Unintentional take could occur if occupied snags are burned during implementation. Design features, such as timing restrictions in MSO and goshawk habitats, lining of snags and logs, and lighting techniques designed to reduce the loss of snags have been incorporated to reduce the potential for unintentional take to occur.

**Cumulative Effects**

The area of analysis is the project area. Other cumulative effects that occur within the project area include recreational activities, land development, and hazard tree removal. Ongoing recreational activities may result in disturbance of migratory birds. Private and state land development would reduce habitat for these species. Removal of hazard trees for powerlines and highway safety would reduce snags and reduce habitat for snag dependant species. Present and future Coconino National Forest projects activities have common objectives to improve current conditions by improving soil conditions, reducing competition of trees, managing for return of the large tree components and providing snags, logs and coarse woody debris in sufficient quantity to provide for raptor species.
Under the Proposed Action, treatments would provide protection from stand-replacing crown fires to high
species-rich habitats. The amount of impacts from vegetation treatments that would occur to migratory
birds from implementation of the Proposed Action when added to past, present and reasonably
foreseeable future actions is not likely to be to an extent that there would be a measureable negative effect
on migratory bird populations.

Special Status Plants
The following information has been summarized from the Botany Specialist’s Report located in the
project record. The project area does not include any locations or potential habitat for Threatened or
Endangered plant species.

Affected Environment
Three Forest Service sensitive plant species are currently known to occur within the project area
including, Bebb willow (*Salix bebbiana*), Blumer’s dock (*Rumex orthoneurus*) and Rusby milkvetch
(*Astragalus rusbyi*).

**Bebb Willow**
Approximately 1300 Bebb willow plants occur in the project area. Conservation of Bebb willow is the
focus of the Fern Mountain Botanical Area and is a species of major interest on the adjacent Nature
Conservancy Hart Prairie Preserve. The Fern Mountain Botanical Area is included in Management Area
17 of the Coconino National Forest Plan, and is defined as “a 186-acre high elevation riparian scrub
community [that] is dominated by Bebb willow, and represents a unique riparian community”. The
adjoining Hart Prairie Preserve owned and operated by the Nature Conservancy contains 245 acres.
Much of the work at the Preserve focuses on conservation of the Bebb willow community, which is
considered a globally rare community type. The presence of Bebb willow strongly enhances the diversity
of understory plants and animals in the community. Bebb willow is a very widespread species in northern
Canada to northern US, and mountainous western US, but plant communities where Bebb willow is the
dominant species are very rare and the community within the Fern Mountain Botanical Area and adjacent
Nature Conservancy property is one of the largest existing examples of the community type.

Currently, the Bebb willow plants are mostly confined to the older age classes and are decadent. In its
current state, the Bebb willow community may be susceptible to loss or severe impacts from uncontrolled
wildfires. If a fire were to enter the Bebb willow community in its current condition, individual plants
may die.

**Blumer’s dock**
Blumer’s dock is a large, long-lived herbaceous perennial plant endemic to New Mexico and Arizona.
Habitat for the species is mid- to high-elevation wetlands with moist, organic soil adjacent to perennial
springs or streams in canyons or meadows. There are populations of Blumer’s dock that grow in
association with Bebb willow in enclosures on Forest Service and Nature Conservancy property and along
the creek. The known locations of Blumer’s dock in the project area include a few enclosures around
springs and wet areas. There may be additional undetected populations in the area; however, Blumer’s
dock is very palatable to livestock and wildlife so animals would likely eat plants on unprotected sites.

**Rusby milkvetch**
Rusby milkvetch is a narrow endemic found on basaltic soils northwest and west of Flagstaff, Arizona.
The range is limited to areas on the Coconino National Forest around the San Francisco Peaks and on the
adjacent Kaibab National Forest. Habitats for this plant include aspen groves, mixed conifer, ponderosa
pine/Arizona fescue, and ponderosa pine/Gambel oak sites in dry or temporarily moist basaltic soils.
There are numerous occurrences of Rusby milkvetch within the project area. In the surveyed areas, numerous occurrences of Rusby milkvetch were found around the bases of dying aspen trees.

**Alternative 1: No Action**

**Direct and Indirect Effects**

Under the No Action Alternative, none of the management actions proposed for the Fern Mountain Botanical Area would occur. Management of three sensitive species would remain the same, and there would be no direct effects to these populations. Under the No Action Alternative, high fire hazard potential would persist and increase, resulting in an indirect effect. Forest fuels would continue to increase, resulting in increased risk of landscape or crown fire. In the event of a wildfire, the risk of death by fire to individuals and groups of Rusby milkvetch would increase. If a large stand replacing wildfire occurred, the plant community would be impacted and sensitive plant populations would be lost due to large expanses of the forest burning at one time. Severe wildfires often result in deaths of all plants including TES plant species, loss of seed banks and removal of nutrients. These are generally long-term effects on the plant community. Plants eliminated due to large, hot-burning wildfires may take years re-establish and long-term alteration of habitat would occur.

Under the No Action Alternative, trees would not be removed and tree density and canopy closure would continue to increase, reducing the availability of resources such as light and water to understory plants, including Rusby milkvetch, resulting in the reduction or elimination of understory plants.

**Cumulative effects**

The cumulative effects are similar to the indirect effects discussed above. If none of the management actions proposed for this project are undertaken, high fire risk would exist and continue to increase and forest fuels would continue to increase, resulting in increased risk of landscape or crown fire. Additionally, there would be no reduction of tree density and canopy within the project area. Therefore, competition among all plant species for resources such as light and water would increase. Specifically, these indirect effects have minor but notable effects on the potential habitat of Rusby milkvetch.

**Alternative 2: Proposed Action**

**Direct and Indirect Effects**

**Bebb Willow**

Under the Proposed Action, prescribed burning would be implemented in the grasslands within the Botanical Area. The objectives of burning would be to restore fire to the ecosystem from which fire has been absent for long periods. A result of this absence is the interruption of natural ecological processes within the grassland habitat. Mitigation measures outlined in Chapter 2 would be implemented to prevent impacts from prescribed burning, and fencing would be constructed to prevent impacts from potential browsing. Under the Proposed Action, the risk of uncontrolled wildfires would be reduced, resulting in an indirect beneficial effect.

Management actions such as planting and fencing for the Bebb willow in the project area would aid in preserving and regenerating the community, resulting in direct beneficial effects. Planting or other regeneration methods could help establish younger plants within the community. Fencing around springs may provide additional sites for planting or regeneration. The Proposed Action may impact individuals of Bebb willow, but is not likely to result in a trend toward federal listing or loss of viability.
Blumer’s dock
Under the Proposed Action, there would be no direct effects to known locations of Blumer’s dock. However, fencing around springs may indirectly benefit Blumer’s dock by reducing or eliminating grazing pressures around springs and wet areas where this species occurs. The Proposed Action would have no adverse impact on Blumer’s dock.

Rusby milkvetch
Under the Proposed Action, management actions such as thinning and prescribed burning may cause death to individuals or group of plants, resulting in a direct adverse effect. Some individuals may be killed during prescribed burning, especially in areas where only isolated individuals occur or in areas where plants were not detected during previous surveys. However, prescribed burning may also have indirect beneficial effects, as Rusby milkvetch has been documented to respond favorably to disturbances such as burning. The effects of burning may initially be adverse by reducing the numbers of individuals but would be beneficial in the long-term by reducing competition, increasing the amount of available sunlight and by increasing available nutrients. Limited deaths of small groups of plants would not significantly contribute to the overall decline of populations of this species within the project area or over the ranges of this species.

Slash piles created from thinned material may have adverse direct and indirect effects on Rusby milkvetch, if the pile is placed in or near existing populations. However, mitigation measures outlined in Chapter 2 are designed to avoid placing slash piles within 10 to 20 feet from existing populations. Pile burning would create burned sites, which can result in an indirect adverse effect, by reducing or losing the seed bank and an increased risk of noxious weed invasion. Noxious or invasive weeds may have adverse effects by competing with native species for resources and altering habitat. Mitigation measures outlined in Chapter 2 would minimize these impacts.

Direct and indirect effects of temporary roads include destruction of individual plants, localized disturbance of suitable habitat and the potential introduction of noxious or invasive weeds. However, these effects can generally be mitigated through surveying areas that may be disturbed and avoiding existing plant populations. The Proposed Action may impact individuals of Rusby milkvetch, but is not likely to result in a trend toward federal listing or loss of viability.

Cumulative Effects
Bebb willow
The cumulative effects boundary is limited to the project area. The Fern Mountain Botanical Area was established in 1987 in the Coconino National Forest Plan. The plan recognized the uniqueness of the Bebb willow community and established the Botanical Area. According to the plan “The botanical areas and the geological area are managed to maintain, as nearly as possible, existing conditions and natural processes for public enjoyment, demonstration, and study. Interpretative and educational demonstration opportunities are emphasized and enhanced through selective facility development. Natural events are not rehabilitated. Off-road driving is prohibited.” The plan also prohibits timber harvest and wood cutting within the Botanical Area.

Coconino National Forest Botanists have collaborated with Nature Conservancy personnel to study and monitor Bebb willow in the project area for several years. Activities include construction of two enclosures, one on Conservancy property and one on Forest Service System land to facilitate and monitor regeneration of Bebb Willow, inventory and mapping of mature trees and removal of a metal stock tank. The Conservancy has done roadway reconstruction on their property and adjacent Forest Service property to improve drainage and restore a more natural water flow to the grassland habitat. In addition, the Forest
Service conducted habitat restoration project near the Preserve that included thinning and burning. The Proposed Action, in addition to past and present projects would have overall beneficial cumulative effects on the Bebb willow community.

Blumer’s dock
The cumulative effects boundary is limited to the project area. The cumulative effects to Blumer’s dock from the Proposed Action are similar to those for Bebb willow. Many of the past actions that have benefitted Bebb willow in the enclosures present on Forest Service System land and Conservancy property have allowed the Blumer’s dock to escape the pressures of grazing, thrive and reproduce in the enclosures. Without these enclosures, Blumer’s dock would be absent or severely reduced in the area.

Rusby milkvetch
The cumulative effects boundary includes the range of Rusby milkvetch within the Coconino National Forest. Cumulative effects for Rusby milkvetch include past and ongoing events such as wildlife and management actions by the Forest Service, including fire suppression, grazing, timber sales, prescribed burning, transportation, and recreation.

Fire suppression has affected all vegetation including Rusby milkvetch through changes in tree density and understory species composition. Elimination of fire in the project area and throughout most of the range of Rusby milkvetch has allowed tree canopy and stand density to increase in some areas, reducing the abundance or eliminating of most understory species, including Rusby milkvetch. The elimination of fire has also resulted in the increase in litter in some areas which has adverse effects on understory plant species by eliminating plants and by contributing to the increase in fire spread, length of residence time of fire and fire severity.

Several large wildfires have resulted in deaths of all plants, including TES plant species, loss of seed banks and removal of nutrients. These effects generally have long-term effects on the plant community. Plants eliminated due to large, hot-burning wildfires may take years re-establish and long-term alteration of habitat occurs. One of the objectives of this project is to reduce the risk of severe wildfires such as those mentioned above.

Past fuels reduction project within the Rusby milkvetch habitat have been analyzed with the resulting effects being, “may affect individuals but not likely to adversely affect” the species as a whole.

Grazing within the project area includes grazing by domestic ungulates and wild grazers. The cumulative effects of grazing include past and present loss of individual plants and alteration of habitat from trampling and compaction. Deer and elk may preferentially select legumes when they find them (Springer 2004), however palatability and use of Rusby milkvetch by grazers is unknown. The effects of cattle grazing are unknown.

Rusby milkvetch has been observed along the Schultz Trail, which is adjacent to the project area. Several of the locations detected by survey crews are along the trail. Trail users may impact individual plants at these locations through trampling and compaction of soil, especially in areas where trail users leave established routes.

In 2000, the forest withdrew the San Francisco Mountain and Mount Elden areas from mineral exploration. This withdrawal could have indirect long-term beneficial effects on species such as Rusby milkvetch by preserving habitat that might otherwise be altered through mineral exploration.

The Coconino National Forest is in the process of analyzing the Travel Management Rule. It is expected to reduce the adverse effects from off-road motorized travel, such as crushing of plants, damage to
potential habitat such damage to soils, fragmentation of habitat, and introduction of noxious or invasive weeds. It is anticipated that this project would aid in reducing pressures from vehicle travel in sensitive areas where plants and potential habitat occur.

Under the Proposed Action, management actions would have no significant negative effects on the overall distribution and abundance within the project area or within the total range of Rusby milkvetch, provided the mitigations recommended in this document are incorporated into the project design and implementation. The management actions would not significantly contribute to the cumulative effects discussed above, due to described mitigation. Overall, the project would have beneficial direct and indirect effects on Rusby milkvetch by reducing fire risk and the threat of severe wildfire within the potential habitat of Rusby milkvetch within the project area. Additionally, Rusby milkvetch would benefit from the reduction of tree density and canopy in certain areas of the project area by reducing competition for nutrients, light and growing space.

**Noxious or Invasive Weeds**

The following information has been summarized from the Botany Specialist’s Report located in the project record.

**Affected Environment**

Noxious or invasive weeds can affect composition, structure and function of native ecosystems and can affect factors such as fire interval and intensity, species composition within communities, and successional pathways. Several noxious or invasive weed species have been detected in the project area, see Table 29. Infestations range from a few scattered plants to localized but severe infestations.

**Table 29. Noxious or invasive weeds detected in the project area**

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Scientific Name</th>
<th>Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>Musk thistle</td>
<td><em>Carduus nutans</em></td>
<td>Eradicate</td>
</tr>
<tr>
<td>Scotch thistle</td>
<td><em>Onopordum acanthium</em></td>
<td>Eradicate/Control</td>
</tr>
<tr>
<td>Dalmatian toadflax</td>
<td><em>Linaria dalmatica</em></td>
<td>Contain/Control</td>
</tr>
<tr>
<td>Bull thistle</td>
<td><em>Cirsium vulgare</em></td>
<td>Contain/control</td>
</tr>
</tbody>
</table>

**Musk thistle**

Musk thistle grows in disturbed soils growing on roadsides, pastures, and forestlands. It can quickly form a monoculture if not promptly controlled. It has been reported from various locations in and around Flagstaff including populations along Fort Valley Road and near Kachina Peaks Wilderness.

**Scotch thistle**

Scotch thistle grows in disturbed habitats, along roadsides and in waste areas and occurs in many locations on the Coconino National Forest. The seeds of this thistle are long-lived, persisting in the soil for many years. There are numerous infestations of Scotch thistle along the right-of-way on Highway 180. Arizona Department of Transportation has treated these infestations periodically for many years. There is some risk that these infestations may spread into the surrounding forest, especially if there is disturbance nearby from management activities.
Chapter 3 – Affected Environment and Environmental Consequences

Dalmatian toadflax
Dalmatian toadflax is widespread in the ponderosa pine forest type and numerous small infestations occur within the project area, often limited to a few plants scattered over large areas.

Bull thistle
Bull thistle grows in numerous areas of the Coconino National Forest, mostly in the ponderosa pine forests, where it invades disturbed sites such as slash piles, old log decks, and roadsides. Several small groups of bull thistle have been documented in the project area; however most are limited to a few small plants in any given area.

Common mullein
Although common mullein is an invasive weed, no treatments are currently proposed for this species on the Coconino National Forest. It was considered but not included as a species to be treated in the Final Environmental Impact Statement for the Integrated Treatment of Noxious or Invasive Weeds, Coconino, Kaibab and Prescott National Forests (FEIS) (USDA 2005). Common mullein infestations can cover several acres but tend to be episodic and disappear over time as the source of disturbance passes. Management activities may lead to temporary increases in common mullein but these infestations would decrease as the disturbance passes and the species is eliminated from the plant community by more competitive species. No further discussion of this species will be included in the effects analysis.

Alternative 1: No Action

Direct and Indirect Effects
There would be no direct effects from management actions because none of the management actions identified in the proposed action would occur. No tree thinning would occur and there would be no prescribed burning. Under the No Action Alternative, no noxious or invasive weed treatments would occur in the project area except those accomplished by other projects such as limited manual control by Forest Service crews or control efforts by other entities such as treatment of right-of-ways by Arizona Department of Transportation.

With no treatment, the risk of severe wildfire and of a wildfire transitioning to a crown fire would continue to increase in the project area. Severe wildfires often result in complete removal of tree canopy, complete loss of ground cover and understory plant community and alteration of soil structure and nutrients. These conditions provide potential sites for noxious or invasive weed invasion through creation of bare soil, increased light and absence of competition from desirable plant species. Therefore, increases in fire hazard and severity that would occur would also increase the risk of or invasive weed invasions in the project area, resulting in indirect adverse effects.

Under the No Action Alternative, noxious or invasive weed treatments or mitigations that would help prevent the spread of noxious or invasive weeds would not occur. Noxious or invasive weed populations would remain untreated and continue to expand, resulting in indirect adverse effects.

Cumulative Effects
Past forest activities such as grazing, vegetation treatments, recreation uses, road maintenance and travel along roadways, including paved roads and highways probably affected the abundance and distribution of noxious or invasive weeds in the project area. However, without information on known distribution of noxious or invasive weed species, the past effects of management actions would be unclear. Sources of introduction for noxious or invasive weeds are often unclear and difficult to verify.
Historically, fire suppression and alteration of the fire regime have affected all understory vegetation through changes in density, abundance and species composition and through changes to hydrologic function. Elimination of fire has allowed tree canopy and stand density to increase in some areas, severely reducing or eliminating most understory species. As a result, the healthy, resilient plant community that would be present in many areas is absent and there are few desirable understory species present to provide competition that would help reduce the potential of invasion from noxious or invasive weeds. Past fire suppression has increased the risk and severity of wildfires when they do occur. The effects of the resulting severe fires include high levels of disturbance, loss of the plant community and possible alteration of habitat.

Grazing within the project area includes grazing by cattle and wildlife. The cumulative effects of grazing on noxious or invasive weeds include disturbance, trampling, consumption of desirable plants that could provide competition for noxious or invasive weeds, and possible introduction through feces or contaminated feed. Many of the effects of grazing by cattle can be mitigated by using BMPs; however, the Forest Service has no control on the effects of wild grazers.

The Coconino National Forest is in the process of analyzing the Travel Management Rule. The cumulative effects of this could be the reduction in the number of motorized routes and the elimination of cross country travel. Any adverse effects from off-road motorized travel such as crushing of plants, damage to potential habitat such damage to soils, fragmentation of habitat and introduction of noxious or invasive weeds into the habitats and/or populations could be reduced.

Cumulative effects from human activities such as dispersed recreation travel on roadways, hunting and fishing, and fire-wood gathering have occurred in the project area. Effects of these activities include disturbance and possible dispersal of noxious or invasive weeds into or within the project area. The extent and overall past and future effects of these activities on noxious weeds are unknown. Many of these activities have occurred in the past and would continue to occur in the future.

Under the No Action Alternative disturbances from burning, tree removal and road construction would not occur. The risk of severe wildfire would continue to increase, increasing the risk of severe disturbance and noxious weed invasions. Tree canopy would continue to increase, decreasing resources available for healthy understory plant communities, which are more resilient and resistant to noxious weed invasions. Noxious weeds in the project area may remain the same or continue to increase through time and without treatment.

**Alternative 2: Proposed Action**

**Direct and Indirect Effects**

Under the Proposed Action, direct effects to noxious or invasive weeds include ground-disturbing activities that have the potential to increase the acreage and/or density of the existing noxious or invasive weed infestations within the project area, such as pile burning, temporary road construction and machines used for mechanical thinning. Disturbance may contribute to the spread of weeds by eliminating competition from existing vegetation and creating bare ground that can be more easily invaded than in undisturbed areas. This would result in a direct adverse effect; however, these effects would be mitigated using mitigation measures identified in Chapter 2.

Tree removal indirectly affects noxious or invasive weeds by reducing tree canopy and stand density. Treatments that reduce tree canopy and lower the stand density would affect all understory plants.
including noxious or invasive weeds by allowing more sunlight, increasing available nutrients and temporarily decreasing interspecies competition as well as intra species (between tree) competition. The increased availability of resources and decrease in competition can also provide favorable conditions for noxious or invasive weeds and could increase the size and density of existing populations, especially in areas where weed infestations already exist. These effects would be reduced by incorporating mitigation measures identified in Chapter 2.

Under the Proposed Action, implementation of prescribed fire may benefit understory vegetation and may eventually lead to a more resilient, weed resistant plant community within the project area and on an area-wide basis, which would be a beneficial indirect effect. Prescribed fire would reduce the risk of uncontrolled wildfire, which is a more severe disturbance than prescribed fire especially when wildfires become landscape in scale. Under the conditions of severe landscape scale wildfire, the risk and likelihood of noxious or invasive weed invasions are higher than under the less severe conditions of prescribed fire.

Under the Proposed Action, noxious or invasive weeds may be manually removed in the project area to reduce or eliminate the infestations, resulting in a direct beneficial effect. Several techniques may be used for this control including hand pulling and removal of weeds with hand tools. Under the Proposed Action, there could be releases of biological control insects on diffuse knapweed and Dalmatian toadflax. The indirect beneficial effect of these releases is a decrease in the density and area of coverage of targeted weed species. However, biological control agents would not completely eliminate noxious or invasive weeds in the project area or elsewhere on the forest. No herbicide treatments are being proposed as part of the management actions in this project, so there would be no direct or indirect effects from treatments.

**Cumulative Effects**

Past forest activities such as grazing, vegetation treatments, recreation uses, road maintenance and travel along roadways, including paved roads and highways probably affected the abundance and distribution of noxious or invasive weeds in the project area. However, without information on known distribution of noxious or invasive weed species, the past effects of management actions would be unclear. Sources of introduction for noxious or invasive weeds are often unclear and difficult to verify.

Historically, fire suppression and alteration of the fire regime have affected all understory vegetation through changes in density, abundance and species composition and through changes to hydrologic function. Elimination of fire has allowed tree canopy and stand density to increase in some areas, severely reducing or eliminating most understory species. As a result, the healthy, resilient plant community that would be present in many areas is absent and there are few desirable understory species present to provide competition that would help reduce the potential of invasion from noxious or invasive weeds. Past fire suppression has increased the risk and severity of wildfires when they do occur. The effects of the resulting severe fires include high levels of disturbance, loss of the plant community and possible alteration of habitat.

The beneficial effects of restored fire include reversal of those factors mentioned above, including restoration of understory species, and reduction of fire risk and severity. There have been prescribed burns within the project area, however, there are no data to suggest that these actions increased or decreased noxious or invasive weeds. The effects of these actions were likely similar to the direct and indirect effects discussed in the Proposed Action, except no noxious or invasive weed treatments or mitigations were included or required.
There are no records of recent timber sales within the project area, so there are no cumulative effects from timber sale activity. The cumulative effects of past timber sales usually include reduction of stand density and canopy cover and possible introduction and/or increase of noxious or invasive weeds.

Grazing within the project area includes grazing by cattle and wildlife. The cumulative effects of grazing on noxious or invasive weeds include disturbance, trampling, consumption of desirable plants that could provide competition for noxious or invasive weeds, and possible introduction through feces or contaminated feed. Many of the effects of grazing by cattle can be mitigated by using BMPs; however, the Forest Service has no control on the effects of wild grazers.

Under the Proposed Action, disturbance from treatments, especially in areas of existing noxious or invasive weed infestations may contribute to additional growth of the infestations, however, weed control as part of the Proposed Action would help to control noxious weed invasions within the project area as well as within the surrounding area.

The Coconino National Forest is in the process of analyzing the Travel Management Rule. The cumulative effects of this could be the reduction in the number of motorized routes and the elimination of cross country travel. Any adverse effects from off-road motorized travel such as crushing of plants, damage to potential habitat such damage to soils, fragmentation of habitat and introduction of noxious or invasive weeds into the habitats and/or populations could be reduced.

Cumulative effects from human activities such as dispersed recreation travel on roadways, hunting and fishing, and fire-wood gathering have occurred in the project area. Effects of these activities include disturbance and possible dispersal of noxious or invasive weeds into or within the project area. The extent and overall past and future effects of these activities on noxious weeds are unknown. Many of these activities have occurred in the past and would continue to occur in the future.

**Soils**

The following information has been summarized from the Soil and Water Specialist’s Report, located in the project record.

**Affected Environment**

The Terrestrial Ecosystem Survey (TES) defines erosion hazard based on bare ground (complete removal of vegetation and litter). A slight rating indicates that all vegetative ground cover could be removed from the site and the resulting soil loss will not exceed "tolerance" soil loss rates. A moderate rate indicates that predicted rates of soil loss will result in a reduction of site productivity if left unchecked. Conditions in moderate erosion hazard sites are such that reasonable and economically feasible mitigation measures can be applied to reduce or eliminate soil loss. A severe rating indicates that predicted rates of soil loss have a high probability of reducing site productivity before mitigating measures can be applied. Table 30 summarizes the amount of acres classified with soil ratings within the analysis area (also see Appendix A in the Soil and Water Specialist Report in the Project Record). Soil conditions are identified by map unit; however there are instances where there are unsatisfactory soil conditions within an overall satisfactory soil map unit. For example, there are rills and gullies – an unsatisfactory soil condition - forming along Forest Road 151 at the base of Hochderffer Hills, which is within a map unit that is determined to have an overall satisfactory condition.

**Table 30. Soil erosion hazard rating in project area (acres are approximate)**
Revegetation potential refers to the probable success and ease that native grasses can establish. This potential rating is influenced by climate, soil characteristics, and slope. The rating system is based on use of a variety of seeding methods (e.g., rangeland drill, broadcast seeder, aerial seeding) with no consideration for site preparation (removal of trees, etc.). A low or moderate rating alerts the land manager to potential limitations for successful revegetation of an area. Soils associated with a “high” rating offer the best opportunity for success. For the project area, Table 31 summarizes the natural revegetation potential.

Table 31. Natural revegetation data within the project area (acres are approximate)

<table>
<thead>
<tr>
<th>Natural Revegetation Potential</th>
<th>Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>3,324</td>
</tr>
<tr>
<td>Low – Moderate</td>
<td>64</td>
</tr>
<tr>
<td>Low - High</td>
<td>12</td>
</tr>
<tr>
<td>Moderate</td>
<td>933</td>
</tr>
<tr>
<td>Moderate - High</td>
<td>546</td>
</tr>
<tr>
<td>High</td>
<td>7,899</td>
</tr>
<tr>
<td>Total</td>
<td>12,775</td>
</tr>
</tbody>
</table>

Natural regeneration potential refers to the probable success in the establishment and survival of trees under inherent site conditions. This rating is influenced primarily by climate and soil characteristics. This information will assist managers toward meeting policy with regard to natural regeneration. A low or moderate rating alerts the land manager to potential problems for successful natural regeneration of an area. Soils associated with a high rating offer the best opportunity for success. For the project area, Table 32 summarizes the natural regeneration potential.

Table 32. Natural regeneration data within the project area (acres are approximate)

<table>
<thead>
<tr>
<th>Natural Regeneration Potential</th>
<th>Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>No regeneration potential</td>
<td>2,191</td>
</tr>
<tr>
<td>Low</td>
<td>957</td>
</tr>
<tr>
<td>Low - High</td>
<td>130</td>
</tr>
<tr>
<td>Moderate</td>
<td>754</td>
</tr>
<tr>
<td>High</td>
<td>8,746</td>
</tr>
<tr>
<td>Total</td>
<td>12,775</td>
</tr>
</tbody>
</table>

For soil resources, units of measure include acres of high intensity burns and acres of ground disturbance from equipment use (e.g., mechanical timber harvesting equipment). However, impacts to soil resources can be mitigated through the use of resource protection measures (i.e., BMPs).

Alternative 1: No Action

Direct and Indirect Effects-Soils

Long-term direct effects to soil loadings of coarse woody debris would occur through natural processes, which is expected to increase over time as small diameter material begins rotting and falling. Under the No Action alternative, harvesting or prescribed burning activities would not be implemented and thus
there would be no acres of ground disturbance from mechanized logging or burning; therefore there would be no direct effects to soil.

Indirect effects from the No Action Alternative would include an increase in course woody debris resulting in very high tons per acre in both live and dead fuel loads. The risk of a stand replacing, high intensity fire would increase over time; these types of fires would result in adverse effects on soils. Historically, large stand-replacing fires on the Coconino National Forest contain approximately 20-30% of high intensity fire. Therefore, if a 1,000 acre fire were to occur within the analysis area, approximately 200 to 300 acres of high intensity fire could adversely impact soil properties.

Table 33. Summary of direct soil effects for the No Action Alternative (acres are approximate)

<table>
<thead>
<tr>
<th>Measure</th>
<th>Acres</th>
<th>% of analysis area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acres of Higher Intensity Burn effects</td>
<td>0 acres</td>
<td>0%</td>
</tr>
<tr>
<td>Acres of Soil Disturbance</td>
<td>0 acres</td>
<td>0%</td>
</tr>
</tbody>
</table>

Cumulative Effects

The geographic setting for the cumulative effects analysis includes the Upper Deadman Wash and Volunteer Wash Watersheds, which total approximately 54,500 acres (see Water Resources section for more information on watersheds). The timeframe for past actions is 10 years, based on vegetative and course woody debris recovery of the site.

Cumulative effects include timber sales and thinning that can affect the acres of ground disturbance, primarily through fuel treatments, as well as past burning and wildfires, range allotments, road maintenance, and recreation activities. Past timber sale include the Crowley Sale which covered 1,550 acres; past fires include the Pipe, Crowley prescribed burn, Hart, and Bismark Lake. Present actions include range management activities, road maintenance, recreation activities, the Arizona Trail construction, and private land development. Reasonable foreseeable future actions include the Coconino National Forest Travel Management Rule (TMR), in addition to the continuation of recreational activities. Please refer to the soil and water specialist report in the Project Record for a more detailed analysis of cumulative effects of past, present and future/foreseeable activities that apply to the soil and water activities.

Recreational activities include: hiking, viewing wildlife, hunting, dispersed car-camping, backpack camping, orienteering, horseback riding, caving, rock climbing, photography, picnicking, taking scenic drives, off road vehicle (ORV)/all terrain vehicle (ATV) use, bicycling, shooting, and gathering in family or social groups. The area is part of the Arizona Game and Fish Department’s hunt “Unit 7A” and is popular for turkey, elk and deer hunting in the fall. Snowmobile use and cross-country skiing are increasing as popular uses in the area. During normal winters, snowmobiles are the only vehicles that access the area. Other potential uses within the project area include: firewood cutting, post and pole cutting, collecting boughs and cones, collecting and transplanting wildlings, gathering antlers, collecting food and medicinal resources such as berries, nuts, mushrooms, and bracken fern, and collecting biological specimens for research.

There are approximately 318 miles of roads within the cumulative effects area, which equal approximately 580 acres of ground disturbance. There are 70 stock tanks within the analysis area, which equal approximately 820 acres of disturbance (primarily at watering and salting sites). Grazing from both domestic cattle and wildlife removes biomass that can affect soil productivity, but as this is difficult to
Chapter 3 – Affected Environment and Environmental Consequences

quantify it will not be measured for this analysis. Overall, the past timber sale activities have had an estimate of 10-15% ground disturbing activities within the past 10 years, or approximately 155-230 acres. Disturbance from past prescribed fire and wildfire estimate at 1-5% of the burn acres, or approximately 22-110 acres. Thus, ground disturbance from past and present activities total about 1,577-1,740 acres for this analysis (about 3% of the cumulative effects analysis area).

The No Action alternative would not add any additional ground disturbing activities within the cumulative effects analysis area; therefore, there would be no direct cumulative effect from this alternative.

**Alternative 2: Proposed Action**

**Direct and Indirect Effects**

Thinning approximately 7,250 acres (ponderosa pine, mixed conifer, and aspen restoration treatments) under the Proposed Action would reduce the potential of stand-replacing fire which would result in a long-term indirect benefit to soils. Short-term direct benefits to soil include slash from thinning activities being place on the ground, which would create a microclimate and protect soils, as well as provide for sufficient course-woody debris on-site. Approximately 1,060 acres of treatment is proposed to occur on soils with severe erosion rating (see Table 34), however, the BMP’s listed in the Design Features section in Chapter 2 are designed to minimize impacts to severe erosion hazard sites. More information on location/sites and treatments that are proposed on sites with severe erosion hazard is listed in Appendix B in the Soil and Water Specialist Report in the Project Record.

Under the Proposed Action, thinning of trees would be implemented either by hand or mechanized. Hand thinning would be performed by chainsaw and not with heavy logging/shearing equipment. This would occur on approximately 55 acres (thin from below and slope stabilization treatments) and would result in limited ground disturbance, mostly from vehicles driving off road to access the sites. It is estimated that only 1 acre of ground would be disturbed by this treatment, and would occur in the form of compaction, as opposed to disturbance that results in exposing mineral soil.

**Table 34. Acres of treatment type on severe erosion hazard soils (acres are approximate)**

<table>
<thead>
<tr>
<th>Treatment Type</th>
<th>Acres of severe hazard soils</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aspen Restoration</td>
<td>327</td>
</tr>
<tr>
<td>Bebb Willow Restoration</td>
<td>1</td>
</tr>
<tr>
<td>Burn Only</td>
<td>455</td>
</tr>
<tr>
<td>Meadow Restoration</td>
<td>45</td>
</tr>
<tr>
<td>Ponderosa Pine Restoration</td>
<td>215</td>
</tr>
<tr>
<td>Thin from Below</td>
<td>19</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1,062</strong></td>
</tr>
</tbody>
</table>

Mechanized thinning would be performed with logging/shearing equipment, which fells and skids logs to landings. This is expected to occur on all of the ponderosa pine and mixed conifer restoration sites (approximately 4,040 acres). BMP monitoring on the Mogollon Rim Ranger District has shown that ground disturbance (skidded to mineral soil) and compaction may occur on the approximately 10-15% of the thinned area when mechanized skidding and harvesting occurs (Jagow 1994, Fleishman 1996, 2005). Therefore, approximately 400- 606 acres of ground disturbance and compaction is expected to occur on the vegetation removal treatment area.
Chapter 3 – Affected Environment and Environmental Consequences

Aspen restoration treatments consist of a variety of treatments to attempt to regenerate aspen, including ripping and creating jackstraws of downed trees. It is expected that 30-50% of the aspen treatment sites would disturb the ground to mineral soil; therefore approximately 970 - 1,600 acres of soil would be disturbed as a result of these treatments.

The remaining areas where thinning is proposed are expected to have minimal ground disturbance (meadow restoration with limited mechanized impact about 1-5% of the area or approximately 15 to 76 acres).

Combined, all the fencing proposed for springs, water tanks/catchments, and Bebb willow restoration, as well as the relocation of Turkey Tank and the gate on FR 518B, would disturb a total of approximately 2 acres of ground. Of all of those, relocating Turkey Tank (a metal tank) is anticipated to result in the greatest amount of ground disturbance, which would be approximately 0.2 acres. The development of the borrow source at Curly Pit would result in approximately 15 acres of long-term ground disturbance.

Machine piling of slash from thinning activities disturbs the greatest amount of ground through the re-arrangement of the soil surface. Compaction would be limited because of the use of track equipment, but could occur if machine piling is done under wet soil conditions. The amount of acres of ground disturbance would vary by the type of harvesting method and piling method. Conventional logging and skidding would result in more acres of ground disturbance than mechanized logging with whole-tree skidding.

As a general rule of thumb, hand thinning and conventional skidding would leave the greatest acreage of user created slash that would need to be machine piled. This is the least likely type of harvest because local operators use mechanized harvest only, however, this possibility is still analyzed. Under this scenario, there are two means to machine pile: strict machine piling of all material which would disturb approximately 50-60% of the harvested area, and rough piling, which just piles accumulated slash (but not all of the slash is piled), which would disturb approximately 25-30% of the harvested area. Under this alternative, if the mechanized harvest is done with hand falling and limbing, there would be a maximum of approximately 8,000 acres of harvest area, which is expected to disturb approximately 2,000-2,400 acres ground from rough piling on these acres if hand felling and limbing is used as the harvest method. If total machine piling of all created slash is undertaken, than approximately 4,000 to 4,800 acres of ground disturbance could occur. However, since none of the local contractors use this method, the total acres disturbed by conventional logging and machine piling would not be discussed further, nor displayed in the effects summary.

Prescribed burning would occur on approximately 9,500 acres under this alternative. Prescribed burning can affect soil resources through reduction of course woody debris, damage to the soil’s physical structure, and damage to the soil’s biological features (Graham et al. 1994, Neary et al. 2005), but can also provide beneficial effects through nutrient flushes (Covington and Debano 1990). The effects to soil from fire are directly related to fire intensity, with greater burn intensity resulting in greater amount of soil damage (Neary et al. 2005).

For the Proposed Action, the prescribed burning impact on soils depends on soil and fuel moisture regimes and fuels distribution, however, duff/litter portions of the prescribed burn would have the least adverse impact on soil properties, while allowing for release of nutrients for a one to two year period. Burning of larger woody material increases fire intensity which would increase the risk to soil properties.

Under the Proposed Action, the majority of the prescribed burned area would be in the duff/litter portion, which would result in a beneficial impact by increasing soil nutrients. A smaller percentage of the burned

Environmental Assessment for the Hart Prairie Fuels Reduction and Forest Health Restoration Project
Coconino National Forest
area (approximately 1-5% of the treated sites, or approximately 80 to 478 acres) would contain moderate sized woody material, and could have an adverse impact to soil biotic material through higher soil temperatures, however, soil temperatures are not expected to be high enough to do damage to soil physical structure; See Table 35. The larger sized woody material (10” dbh + size material) would have the greatest adverse impact to soil properties, similar to the pile burning affects.

With the implementation of the BMP’s listed in the Design Features in Chapter 2, the impacts to soil resources from burning would be minimized. Under the Proposed Action, only slash would be piled and burned, so the existing course woody debris would remain on-site, resulting in no long-term impact to soil productivity.

### Table 35. Summary of direct soil effects for the Proposed Action (acres are approximate).

<table>
<thead>
<tr>
<th>Measure</th>
<th>Acres</th>
<th>% of analysis area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acres of Higher Intensity Burn effects</td>
<td>80-478 acres</td>
<td>1-3%</td>
</tr>
<tr>
<td>Acres of Disturbance (all non-burn activities)</td>
<td>1,590-2,790 acres</td>
<td>12-22%</td>
</tr>
<tr>
<td>Total acres from burn effects and disturbance (from mechanized logging, machine piling of landings, slope stabilization, riparian protection, tank protection, pit development, and existing roads and areas of heavy fuels)</td>
<td>1,670-3,270 acres</td>
<td>13-25%</td>
</tr>
</tbody>
</table>

### Revegetation Potential

There are approximately 2,100 acres that have low potential to produce grasses after treatment. BMP’s implemented during harvesting operations would reduce the acres disturbed and would minimize the amount of acres that would have difficulty in establishing natural ground cover.

### Table 36. Revegetation potential by treatment types (acres are approximate)

<table>
<thead>
<tr>
<th>Treatment Type</th>
<th>Low</th>
<th>Low-Moderate</th>
<th>Low-High</th>
<th>Moderate</th>
<th>Moderate-High</th>
<th>High</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aspen Restoration</td>
<td>414</td>
<td>50</td>
<td>4</td>
<td>22</td>
<td>78</td>
<td>2,647</td>
<td>3,216</td>
</tr>
<tr>
<td>Bebb Willow Restoration</td>
<td>0</td>
<td>14</td>
<td></td>
<td></td>
<td>8</td>
<td>22</td>
<td></td>
</tr>
<tr>
<td>Burn Only</td>
<td>740</td>
<td>0</td>
<td>0</td>
<td>31</td>
<td>9</td>
<td>186</td>
<td>966</td>
</tr>
<tr>
<td>Meadow Restoration</td>
<td>33</td>
<td>2</td>
<td>23</td>
<td>132</td>
<td>44</td>
<td>1,282</td>
<td>1,516</td>
</tr>
<tr>
<td>Mixed Conifer Restoration</td>
<td>154</td>
<td>76</td>
<td></td>
<td>17</td>
<td>247</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ponderosa Pine Restoration</td>
<td>646</td>
<td>6</td>
<td>357</td>
<td>415</td>
<td>2,367</td>
<td>3,791</td>
<td></td>
</tr>
<tr>
<td>Thin from Below</td>
<td>26</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>27</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2,013</strong></td>
<td><strong>52</strong></td>
<td><strong>48</strong></td>
<td><strong>618</strong></td>
<td><strong>546</strong></td>
<td><strong>6,508</strong></td>
<td><strong>9,785</strong></td>
</tr>
</tbody>
</table>

### Natural Regeneration Potential

The natural regeneration potential refers to the probable success in the establishment and survival of trees under inherent site conditions (Miller et al. 1995). Table 37 summarizes the natural regeneration potential for each of the treatment types. The aspen restoration treatment type may have difficulty in naturally
regenerating on only a very small amount of the overall treatment acres (ca. 10%); however a large percent is anticipated to have high natural regeneration potential. The ponderosa pine restoration treatments also have a large potential to regenerate with ponderosa pine seedlings, which would necessitate maintenance of the site over the long-term, either with burning or with future thinning treatments, however the maintenance burning proposed may be sufficient to maintain the sites.

Table 37. Natural regeneration potential by treatment types (acres are approximate)

<table>
<thead>
<tr>
<th>Treatment Type</th>
<th>None</th>
<th>Low</th>
<th>Moderate</th>
<th>High</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aspen Restoration</td>
<td>32</td>
<td>184</td>
<td>288</td>
<td>2,712</td>
<td>3,216</td>
</tr>
<tr>
<td>Bebb Willow Restoration</td>
<td>22</td>
<td>0</td>
<td></td>
<td></td>
<td>22</td>
</tr>
<tr>
<td>Burn Only</td>
<td>4</td>
<td>736</td>
<td>35</td>
<td>191</td>
<td>966</td>
</tr>
<tr>
<td>Meadow Restoration</td>
<td>1,272</td>
<td>12</td>
<td>38</td>
<td>194</td>
<td>1,516</td>
</tr>
<tr>
<td>Mixed Conifer Restoration</td>
<td>11</td>
<td>51</td>
<td>103</td>
<td>82</td>
<td>247</td>
</tr>
<tr>
<td>Ponderosa Pine Restoration</td>
<td>58</td>
<td>645</td>
<td>28</td>
<td>3,060</td>
<td>3,791</td>
</tr>
<tr>
<td>Thin from Below</td>
<td>1</td>
<td>19</td>
<td>8</td>
<td></td>
<td>27</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>1,399</td>
<td>1,646</td>
<td>499</td>
<td>6,240</td>
<td>9,785</td>
</tr>
</tbody>
</table>

Cumulative Effects

The geographic setting and the timeframe for cumulative effects analysis is the same as described in the No Action alternative. In summary, the Proposed Action would disturb approximately 6-9% of the ground within the cumulative effects boundary area (See Table 38). No threshold for ground disturbance occurs within the Coconino National Forest Plan. However, Forest Service Manual 2509.18 recommends a guideline of a 15% reduction in inherent soil productivity potential as a basis for setting threshold values for measurable or observable soil properties or conditions. The 15% threshold of ground disturbance where soil productivity crosses a negative threshold would not be exceeded with this project in the cumulative effects area. Further protection of soil resources is provided by the use of BMPs that minimize the potential for soil disturbance. In addition to the use of BMPs, the completion and implementation of the future Travel Management Rule EIS would further reduce the number of acres disturbed by closing and decommissioning roads within the cumulative effects boundary. This could create some short-term ground disturbance if roads are physically closed, but could potentially have long-term beneficial impact. However, this has not been determined as the analysis has not been completed yet.

Table 38. Summary of cumulative ground disturbance soil effects for Proposed Action (acres are approximate)

<table>
<thead>
<tr>
<th>Measure</th>
<th>Acres</th>
<th>% of analysis area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acres of High Intensity Burns</td>
<td>102-588 acres</td>
<td>&lt;1-1%</td>
</tr>
<tr>
<td>Acres of Disturbance (all non-burn activities)</td>
<td>3,015-4,310 acres</td>
<td>6-8%</td>
</tr>
<tr>
<td>Total High Intensity Burns and Disturbance</td>
<td>3,117-4,878 acres</td>
<td>6-9%</td>
</tr>
</tbody>
</table>
Chapter 3 – Affected Environment and Environmental Consequences

Water Resources

The following information has been summarized from the Soil and Water Specialist’s Report, located in the project record.

Affected Environment

WATERSHEDS
This project occurs within six watersheds, but only two of them contain any significant acreage; the others contain less than 2% of the total watershed. The pertinent watersheds include the Upper Deadman Wash and Volunteer Wash, and for the purposes of this analysis represent the cumulative effects boundary (approximately 54,500 acres). More detailed information on watersheds can be found in the Soil and Water Specialist Report in the Project Record.

WATER QUALITY
No running water occurs within the project area, therefore there is no water quality data for the project area.

STREAMCOURSES
Approximately 7.6 miles of streamcourses occur within the analysis area. The Coconino National Forest database indicates there are no riparian reaches; however, field review results indicate that the upper reach of Volunteer Wash contains woody riparian Bebb’s willow, suggesting that there are .6 miles of riparian stream within the analysis area.

WETLANDS and SPRINGS
Two wetlands occur within the project boundary: Bismark Lake and Crater Lake. Bismark Lake is a seasonal wetland located on Forest Service Land and is classified as functional at-risk. Crater Lake is located entirely on private land. Three springs occur within the analysis area and are all non-functional. Figure 6 displays the streams that are designated as protected stream courses for the project, as well as the wetlands and spring locations.

Alternative 1: No Action

Direct and Indirect Effects
There are no direct effects to water quality within this alternative. Under the No Action Alternative, fuels would remain untreated, which increases the risk of high intensity fires. This has the potential to result in unquantifiable indirect adverse impacts.

Cumulative Effects
Cumulative effects for the No Action Alternative to water are the same as described in No Action Alternative for soils. The geographic setting and the timeframe for cumulative effects analysis for this Alternative is the same as described in the No Action Alternative. The No Action Alternative would not add any additional ground disturbing activities within the cumulative effects analysis area; therefore, there would be no direct cumulative effect from this alternative.
Figure 6. Protected streamcourses, springs and wetlands in the project area
Chapter 3 – Affected Environment and Environmental Consequences

Alternative 2: Proposed Action

Direct and Indirect Effects
Under the Proposed Action, direct effects to water quality include sediments produced through ground disturbance and acres of higher intensity burns (areas with high fuel loading) where sediments may detach. Indirect effects to water quality include hazardous material used and potential human-created waste from contractors camping within the project area. An additional indirect effect could include the spraying of noxious weeds as a mitigation measure prior to proposed treatments that may affect water quality; however, as there is no running/live water in the analysis area, this would have limited direct effects. An analysis of spraying noxious weeds is covered in the Final Environmental Impact Statement for Integrated Treatment of Noxious or Invasive Weeds (USDA 2005).

As discussed in the Soils section, the total acres disturbed from ground disturbance under the Proposed Action would range from approximately 1,670 to 3,270 acres. These disturbed acres have the potential to detach sediments and move them off-site, however, the application of BMP’s are designed to limit sediment production through designated filter strips and limiting the operation of equipment within filter strips. Additional BMP’s are prescribed to minimize sediment production from upland, non-filter strip sites as well by limiting ground disturbance through designation of skid trails, strategic felling to minimize disturbance, erosion control methods, road drainage and maintenance, limiting the slopes where mechanized fuel treatments can occur, and by limiting the timing of operations. Refer to the Design Features in Chapter 2 for a list of BMP’s that would be incorporated as design features.

The construction of exclosures around springs would improve riparian condition of riparian grasses and woody vegetation by removing grazing pressure and trampling. Foraging would continue to occur from small mammals, but should not affect woody species. No water quality data currently exists at the sites proposed for exclosures, however, the lack of trampling would minimize sediment production at these sites, and the improved riparian vegetative community would filter sediments more efficiently than current conditions, resulting in direct and indirect beneficial effects.

An indirect effect includes contractors camping within the project area during thinning operations, which could result in adverse impact to water quality. The effects include hazardous materials spills and controlling sanitation facilities, which would be mitigated through the use of BMP’s.

Cumulative Effects
Cumulative effects for this alternative to water are the same as described under the Proposed Action for soils. The geographic setting and the timeframe for cumulative effects analysis for this alternative is the same as described under the No Action Alternative.

The cumulative effects summary listed in the Soil section describes the past, present, and future or foreseeable projects that occur in the cumulative effects boundary, which is germane to water resources. Table 38 above summarizes the total acres of expected cumulative ground disturbance. The total acres of ground disturbance would be less than 6-9% of the entire cumulative effects boundary. All of the proposed activities are designed with sediment reduction BMP’s in place. Therefore, the Proposed Action is not expected to detrimentally impact water quality in either the Volunteer Wash or the Upper Deadman watershed drainage system.
Air Quality

The following information has been summarized from the Fire and Fuels Specialist’s Report, located in the project record.

Affected Environment

The project area is located within the Rio De Flag air shed. The community of Flagstaff is southeast of the project area. Suburbs of Flagstaff are within 10 miles of the project area. There is a high level of recreation activity, especially in the summer and winter months, within the vicinity of the analysis area.

The prevailing winds are out of the southwest. However, as fronts pass winds can arrive from any compass direction for a period ranging from a few hours to 3 days, and atmospheric inversions can prevent smoke from dispersing. Within the project area inversions typically occur between October and December. Stagnant atmospheric conditions result from low mixing heights and light transport winds. These conditions when they occur, may last from 12 hours to 7 days (Arizona Department of Environmental Quality, Fort Collins Weather Database).

Smoke from prescribed fire must meet federal, state, and local air quality regulations. The basic framework for controlling air pollutants in the United States is mandated by the 1970 Clean Air Act (CAA), as amended in 1990 and 1999. The EPA has established National Ambient Air Quality Standards (NAAQS) for specific pollutants emitted in certain quantities throughout the country that may be a danger to public health and welfare. All forest burning activities are regulated and administered by Article 15, Forest and Range Management Burn Rules (10/8/96). The Arizona Department of Environmental Quality (ADEQ) models emissions/pollutants from all prescribed burning within the state. Any prescribed burn planned by the Forest Service must be approved by ADEQ on a daily basis. ADEQ will not allow more acres burned per day, per air shed, than is acceptable with current air quality forecasts.

Alternative 1: No Action

Direct and Indirect Effects

Under the No Action Alternative, there would be no direct effects to air quality as prescribed burning would not occur. However, emissions from a wildfire occurring within the project area would have indirect adverse effects (see Table 34). There would be a large amount of smoke generated by a wildfire occurring under the No Action Alternative and it would spread wider and farther than it would under prescribed burning. Nighttime smoke would reach farther and impact the nearby communities more severely. Smoke from a wildfire under the No Action Alternative would exceed air quality standards in both volume and duration.

Cumulative Effects

The area analyzed for the cumulative effects for air quality include the Rio De Flag air shed. Smoke generated from past, present and future fuel reduction projects within this air shed were considered. Most of the project area has not experienced fire in over 70 years. Consequently, fuels have accumulated at a level that would result in adverse smoke impacts if and when a wildfire occurs. Smoke from a wildfire occurring under modeled conditions would exceed air quality standards. As more area is left untreated, smoke from a wildfire occurring under the No Action alternative could accumulate with emissions from other wildfires and further exceed air quality standards.
Alternative 2: Proposed Action

Direct and Indirect Effects
Under the Proposed Action, there would be short-term direct effects to local air quality from prescribed burning. These effects come from three sources: 1) pile burning of slash generated from thinning trees, 2) initial prescribed-burning the forest floor in small blocks, and 3) maintenance-burning of the forest floor. Emissions generated by these actions have been modeled for the project area. Table 39 compares emissions from wildfires, pile burning, and prescribed burning.

Pile-burning is a relatively efficient combustion and would produce fewer emissions than both wildfires (pre-treatment) and initial-entry prescribed-burning. Piles can be burned during rain and snowstorms with excellent smoke dispersion and little diurnal smoke flow into the canyons or basins. It is possible that some smoke from pile burning would drift into neighborhoods in and around the project area, which would result in short-term (1-3 day) smoke impacts. However, the public would be notified prior to prescribed burning.

The initial prescribed-burning of the forest floor would produce more emissions than pile-burning, but less than most wildfires. The initial burning of each block in the project area would generate smoke for as long as 72 hours after ignition, however, the emissions would generally meet air quality standards because ideal weather conditions would be selected.

Successive maintenance burns would generate far less smoke volume and be shorter in duration and have virtually no smoke after sunset of ignition day. Hence there would be minimal nighttime smoke impacts from maintenance burning. The emissions from implementing the Proposed Action would generally meet air quality standards.

The high level of recreation activity that occurs in the summer months would not likely to be impacted by smoke because very little prescribed-burning would be conducted during those times. However, hunters and other people recreating in the project area in the fall and spring could be impacted by smoke from prescribed burning. Impacts could last for as long as 72 hours during the initial prescribed burning, but only last 6 hours during the maintenance prescribed burning.

Table 39. Emissions comparison

<table>
<thead>
<tr>
<th>Ground fuel consumed (tons per acre)</th>
<th>Existing condition wildfire</th>
<th>Post-treatment wildfire</th>
<th>Pile-burn</th>
<th>Initial prescribed burn</th>
<th>Maintenance prescribed burn</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total emissions (tons)</td>
<td>8</td>
<td>2</td>
<td>Not applicable</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>Air quality standards</td>
<td>Exceeded</td>
<td>Unlikely to exceed</td>
<td>Unlikely to exceed</td>
<td>Rarely exceeds</td>
<td>Would not exceed</td>
</tr>
</tbody>
</table>
Smoke plume trajectories indicate that the communities within and adjacent to the project area and Highway 180 may be impacted by smoke when burning. Short-term air quality degradation and reduced visibility may be experienced in the smoke plume trajectories. After sunset, cooling atmospheric conditions would carry smoke down drainages like water flows. Under the Proposed Action, these down canyon flows would reach communities around the project area in the early morning hours, which could reduce visibility along Highway 180. Appropriate warning signs would be posted to warn motorists of reduced visibility. Ignition would be timed to limit impacts. Broadcast burning would not violate air quality standards.

**Cumulative Effects**

The area analyzed for the cumulative effects for air quality include the Rio De Flag air shed. Smoke generated from past, present and future fuel reduction projects within this air shed were considered. Smoke from pile-burning may combine with smoke from wood-burning stoves and automobile smoke on some days when inversions are strongest during the winter. Although smoke from a wildfire occurring after treatment under the Proposed Action would be unlikely to exceed air quality standards by itself if combined with the emissions of other wildfires the accumulation might exceed air quality standards. However, this cumulative effect is unlikely to occur, because fuel loading would be reduced, and wildfires would generally be smaller and burn fewer acres over fewer days, thus producing less smoke.

Cumulatively, the number of days per year in which prescribed burning would occur is likely to increase as projects are implemented; however, it is not anticipated to exceed air quality standards. Furthermore, the fuel reduction projects would actually reduce future smoke impacts, by reducing fuel loading and the potential for large wildfires.

**Cultural Resources**

The following information has been summarized from the Archeology Specialist’s Report located in the project record.

**Affected Environment**

The Hart Prairie area contains evidence of a variety of prehistoric and historic land uses. Prehistoric use of the area focused on seasonal hunting, gathering, and food processing activities. The presence of water probably supported a diverse vegetative and animal community, attracting people to the area to exploit these subsistence resources.

Historic uses and settlement of the area have been related to resource extraction such as timber, water harvest, ranching and dairy farming. The Hart Prairie area has been the subject of many scientific studies. In 1889, Dr. C. Hart Merriam located his base camp at Little Spring, from which he conducted his two and a half month long expedition to the San Francisco Peaks region. In addition, tourism has occurred extensively in the project area. The physical remains of these uses and activities are evident and have undoubtedly contributed to the existing condition of the area.

The San Francisco Peaks have been identified as a Traditional Cultural Property by a number of southwestern Indian Tribes including the Hopi Tribe, the Navajo Nation, the Pueblo of Acoma, the Pueblo of Zuni, the Havasupai Tribe, the Hualapai Tribe, the Yavapai-Apache Nation, the Yavapai-Prescott Tribe, the San Carlos Apache, the White Mountain Apache, the Tonto Apache Tribe, the Fort McDowell Yavapai Nation, and the Southern San Juan Paiute. The San Francisco Peaks have been
determined eligible for the National Register of Historic Places. The Hart Prairie area is used by tribes for traditional gathering of plant, animal, and mineral resources, as well as for ceremonial and other cultural uses.

While the project area has been used extensively during prehistoric and historic times, leaving behind many isolated features across the landscape, this area has a very low archaeological site density. Within the project area, there are 12 known archaeological sites located on National Forest System lands. The fuel loads on and around these archaeological sites have been evaluated, and currently only five sites are considered “fire sensitive” while the remaining seven sites are fire tolerant. Dead and dying ponderosa, pinyon pine and other fuels throughout the project area and adjacent to the sites have the potential to contribute to adverse fire effects on cultural resources from prescribed fire and wildfire, as well as potential ground disturbing fire suppression actions.

**Alternative 1: No Action**

**Direct and Indirect Effects**

Under the No Action Alternative, there would be no direct effects to cultural resources. Existing fuels in and around archaeological sites would remain as they are and continue to increase. Under the No Action Alternative, the risk of high intensity wildfires at these sites could result in possible subsurface artifact damage and potential ground disturbance from required fire suppression actions, resulting in indirect adverse effects. Fire suppression actions, particularly bulldozer operations, may damage or completely destroy surface and subsurface heritage resources resulting in the loss of those resources and their associated data. Intense wildfires may also contribute to increased erosion of sites leading to the loss of their research potential and eligibility for the National Register of Historic Places. Since the project area lies within the Wildland Urban Interface, aggressive suppression actions are likely to occur, and the possibility of damage to resources is possible through ground disturbing fire suppression actions.

**Cumulative Effects**

Cumulative effects to cultural resources would be the same as those discussed in the above paragraph. Effects include possible subsurface artifact damage and potential ground disturbance from required fire suppression actions in the event of a wildfire. Allowing the current forest condition to deteriorate could adversely affect archeological sites, and is inconsistent with direction provided in the Coconino National Forest Plan and other Forest Service directives. These effects are not compounded by other past, present, or foreseeable future actions in the project area because any potential effects are generally mitigated through avoidance of sites.

**Alternative 2: Proposed Action**

**Direct and Indirect Effects**

Under the Proposed Action, all archeological sites would be treated with hand-thinning, and fire-tolerant sites would receive low intensity burning, resulting in negligible direct effects. However, reducing the threat of fire damage to these resources in the event of a wildfire would result in indirect beneficial effects. Fire intolerant sites would be excluded from burning activities. Mechanical thinning and prescribed fire in areas adjacent to archaeological sites would also assist in the reduction of fire threats to cultural resources.
Under the Proposed Action, the fuel loading would be reduced in and around National Register eligible archaeological sites, resulting in potentially indirect beneficial effects. Impacts from wildfires and associated suppression actions along with post fire erosion would be reduced through thinning and low to moderate intensity prescribed burning. Allowing low intensity prescribed fires to burn through prehistorically/historically burned archaeological sites along with thinning would reduce current fuel loads in and around those sites. This treatment would prevent extensive heat damage during any future wildfire event thus lowering fire damage to heritage resources. Increased visibility/vandalism resulting from loss of ground cover can be mitigated through archaeological monitoring, public education and law enforcement patrols. Additionally, ground cover would recover more quickly after a low intensity prescribed fire than after a high intensity wildfire. Reduction of fuels around and within the site and future maintenance burning of fire tolerant sites are considered beneficial.

Under the Proposed Action, potential for ground disturbing activities like bulldozer fire-line construction for emergency fire suppression would be reduced, protecting National Register eligible heritage resources per the 1966 National Historic Preservation Act as amended, the 2001 Region 3 WUI Programmatic Agreement, and the 1987 Coconino National Forest Plan. Erosion from high intensity fire and complete loss of ground cover would be reduced through selective thinning and low intensity burning that would not sterilize soil and leave large portions of the existing ground cover. To reduce any potential threat of erosion from prescribed burning, post fire archaeological monitoring over the next 10 years, especially on slopes, drainages, and other high probability areas, would be implemented. Fire intolerant sites would be excluded from burning and ground disturbing actions unlike in an emergency wildfire situation.

Consultations with the tribes who consider the San Francisco Peaks a Traditional Cultural Property resulted in no specific concerns about the effect of the Proposed Action on the San Francisco Peaks. Specific non-ground disturbing treatment measures would be allowed within archaeological sites that would contribute to the accomplishment of project objectives without impacting the site. Tribal access would not be affected by the Proposed Action, and any effects to tribal use are expected to be temporary and short-term. In addition, prescribed burning may enhance viability of plants that are currently used by tribes.

Proposed fencing and interpretation signage at Little Spring, a National Historic Landmark, would be considered a direct and indirect beneficial effect to the spring and its surrounding landscape by enhancing and protecting its resources.

Cumulative Effects

Cumulative effects to cultural resources would be the same as those discussed in the above paragraph. Fire damage, suppression actions, and erosion are the primary concerns for archaeological sites in the project area. Cumulative effects from this project and other fuel reduction projects are minimal and can be reduced and/or mitigated. There would be no change in the current status or treatment of archaeological sites resulting from the project.

Because the project area is within a WUI, the Forest Service uses aggressive fire suppression actions, and life and property take precedence over all other values. If the Proposed Action were to be implemented, the proposed activities would reduce the need for emergency suppression actions, and even in the event that suppression actions are necessary, the impacts would be minimal. These effects are not compounded by other past, present, or foreseeable future actions in the project area because any potential effects are generally mitigated.
Recreation
The following information has been summarized from the Recreation, Scenic Management and Transportation Specialist’s Report located in the project record.

Affected Environment
The project area is a popular destination for recreationists, as it is within close driving distance to Flagstaff and contains well-groomed roads. Popular winter sports include cross-country skiing, backcountry skiing, snowmobiling, and snowshoeing. Spring and fall activities include camping, hiking, backpacking, horseback riding, trail running, mountain biking, motorized trail riding, hunting, and scenic driving. A popular tourist attraction is the changing color of the aspen leaves in the fall, and many people travel from the southern part of the state to view them. In addition, Arizona Snowbowl and the trails on the San Francisco Mountains are a popular recreational destination.

Resource damage is evident within the project area from user-created trails and off-road driving. Damage includes trampling of vegetation, damaging habitat, and degrading scenery, which typically reduces the quality of the experience for other recreationists using system trails.

The Coconino National Forest Plan (1987, as amended) directs the use of Recreation Opportunity Spectrum (ROS) as a guide for recreation planning on the forest. ROS provides a framework to assist managers in identifying different outdoor recreation environments and settings, activities, and experiences desired by the public (USDA 1986). ROS defines an area as either Urban, Rural, Roaded Natural, Semi-Primitive Non-Motorized, Semi-primitive Motorized, and Primitive. Access, remoteness, naturalness, facilities and site management, social encounters, visitor impacts, and visitor management are setting indicators that help guide managers in understanding the relationship of how visitors view the Forest surroundings, their reasons for visiting the area, and the experiences they would like to have while recreating in the area.

Approximately 9390 acres of the Hart Prairie project area, excluding private land, is designated as Roaded Natural (RN) (see Figure 7). Under this designation,

- Access in the project area can range from full access via road or trail to only cross-country travel with neither road nor trail being an available opportunity.
- Individuals can experience either full remoteness where they perceive themselves as removed from the sights and sounds of human activity (more than 1 and ½ hour walk) or in other locations where they are not out of sight and sound of other humans.
- Recreationists may encounter very few other recreationists to experiencing moderate to high contact with other recreationists in developed sites when on roads and trails.
- Some locations will offer on-site information that is noticeable but is presented in a manner that harmonizes with the natural environment, where other locations will offer no on-site information.
- Recreationists will find some sites in the area that offer no facilities for user comfort while other sites may offer some facilities that are rustic and built out of native materials. These facilities offer some on-site protection from the natural elements.
- Visitors impacts can range from unnoticeable and no site hardening to subtle site hardening.

This area is managed under a visual quality objective (VQO) of retention and partial retention. Retention indicates that deviations or alterations to the landscape created by actions may be present but should not be evident. Partial retention allows for landscape alterations but these deviations must be visually subordinate to the surrounding landscape character.
Approximately 1929 acres in the project area are designated as Semi-primitive Motorized (SPM) (see Figure 7). Under this designation,

- Access can include cross-country travel, non-motorized and motorized trails, and primitive roads.
- Remoteness is more evident as compared to that experienced in Roaded Natural.
- Human encounters can range from less than 6 to 15 parties met per day or less than 3 to 6 parties seen at a campsite.
- No to very limited information or information facilities are provided on-site.
- No facilities to rustic and rudimentary facilities can be offered for site protection.
- SPM directs that no to limited hardening occurs at/on recreation sites/locations within this designation.

The VQO for this area is also retention. VQOs and the impacts of fuel management on visual quality will be discussed further in the Scenery Management section of the report.

Trails
The project area encompasses official trails and many user-created trails that have been illegally developed. The official trails include the Arizona Trail, the northwestern sections of the Aspen Loop Trail, and the Bismarck Lake Trail. The Arizona Trail when completed will stretch from the Mexican border to the Utah border, and was designated a National Scenic Trail in March 2009 (www.aztrail.org). 6.1 miles of the Arizona Trail is located within the project area. It receives thousands of visits annually by hikers, backpackers, equestrians, mountain bikers, and cross-country skiers. Less than a mile of the Aspen Loop Trail is located within the project area, and mostly receives traffic from hikers. The approximately 1 mile long Bismarck Lake Trail is located centrally within the project area, east of FSR 151. The current trail was constructed in the late 1980s from the FSR 627(Bismarck Lake Road) roadbed.

Recreationists use FSR418B as a trail to access Little Spring, which is closed to motorized vehicle use. The Little Spring area is visited by both hikers and equestrians.

The Flagstaff Nordic Center is located on the western boundary of the project area and its entrance is approximately one mile north of FSR 794. It contains 24 miles of trails which are groomed for cross-country skiing. During the summer, recreationists use the trails for hiking, trail running, horseback riding, and mountain biking. Motorized use of the trails is not encouraged. The Flagstaff Nordic Center has attempted to increase aspen regeneration within aspen stands located within the Center to increase user experience.

Many private inholdings reside within the project area. Usually, many user-created social trails can be found within areas where private inholdings are adjacent to National Forest System lands, however, there are surprisingly very few social trails leading into National Forest System lands from these private properties in the project area. The majority of the non-system trails within the project area appear to be wildlife trails or old, closed two track roads rather than social trails leading from private residences.

Recreational Driving
Most of the recreational driving in the project area starts on system roads which include FSR 151, 794, and 418. However, new two-tracks and unplanned social roads continue to appear within the project area and surrounding areas as recreational drivers have ventured off the main system roads. This use has led to heavy resource damage in the form of low-spots and washouts, “road” widening, and deep ruts. Off-road vehicle use has also caused rut damage in many meadows in the project area.
Figure 7. Recreation Opportunity Spectrum in the project area

Motorcycle/ATV Use
There are many non-system motorized trails within the project area, used by ATVs and off-road motorcycles, and are often linked to Forest Service roads. Driving off of Forest Service roads is not
currently illegal, although it is not encouraged as it has proven to cause resource damage (e.g., meadows, steep slopes) and/or conditions that are more prone to resource damage (e.g., wet, muddy roads).

**Dispersed Camping**
Camping is very popular within the project area. Areas with the heaviest concentrations of dispersed camping include at the southern end of FSR151, near U.S. Highway 180 and along, around and off roads branching from FSR 794 and 151E.

**Other Recreational Uses**
The Hart Prairie Preserve is centrally located within the project area, east of FSR151, and is owned by The Nature Conservancy. Visitors come to the Preserve to learn about local ecology and see the Bebb’s willow trees. The Preserve also offers retreat facilities and leads guided nature walks during the summer and fall. Visitors to the Preserve also recreate, usually by hiking, in adjacent National Forest Service lands.

The Flagstaff Nordic Center hosts special events during the spring, summer, and fall such as weddings, holiday weekend events, and running races. The Center also manages cabin and yurt rentals. Visitors staying at the cabin and/or yurt also tend to recreate, usually hiking or mountain biking, within the project area.

**Alternative 1: No Action**

**Direct and Indirect Effects**
The No Action Alternative would not have any direct effects on current recreational opportunities and uses within the project area and recreational uses would continue to occur in the same fashion as they do today. However, not implementing fuel reduction treatments within the project area would increase the risk of high intensity, stand replacing fires during hot, dry conditions, resulting in an indirect adverse effect. High intensity, stand replacing fires most likely would create a blackened and charred forest that would be displeasing and unappealing for many recreationists (Ryan 2005). Furthermore, high intensity fires could lead to erosion of soils within severely burned stands, which could compromise the integrity and sustainability of trails. Eroding trails would cause an indirect adverse effect on recreation experience of visitors in the area. Under the No Action Alternative, aspen stands would not be treated, which could result in further decline of the scenic attractiveness of the area. A decrease in scenic attractiveness would decrease scenic quality over time, which in turn would adversely affect recreational user experience.

**Cumulative Effects**
Travel Management Rule, when implemented in the foreseeable future, may have impacts to recreational uses and opportunities in the area. The Proposed Action of TMR would close and/or decommission some roads within the project area, which could impact the amount and pattern of dispersed camping and motorized travel and recreation in the project area. This could displace recreationists and increase the amount of new camp sites (and thus compaction) in areas with open system roads. However, the areas that would be impossible to access by motorized use would rehabilitate over time as soils begin to loosen and vegetation grows back.

The implementation of the No Action Alternative may add to the reduction of recreational use and opportunities within the project area. As aspen populations continue to decline, the decrease in scenic attractiveness would affect recreational user experience within the project area.
Alternative 2: Proposed Action

Direct and Indirect Effects

Under the Proposed Action, the reduction of fuels within the project area would reduce the risk of stand replacing fires that would otherwise have the potential to change the character of the landscape and affect recreational experience for visitors in the area. Timber harvest, temporary road construction, and fuels treatments could impact the appearance of a forested landscape due to contrasts created between natural appearing landforms and vegetation and those modified by management activities. However, these activities are considered short-term impacts to recreational experience and opportunity. Reducing the risk of stand-replacing fire and promoting forest restoration and health would create an aesthetic landscape, possibly enhancing recreational experience and opportunity, resulting in long-term beneficial effects. Also, the treatments are designed to follow the direction of the Coconino National Forest Plan (1987, as amended). Stand treatments could result in short-term impacts to the naturalness ROS setting indicator, but would not result in long-term effects or changes to ROS within the project area.

Regenerating aspen stands through aspen restoration treatments would enhance the scenery of, and most likely wildlife diversity within, the project area, resulting in an indirect beneficial effect on the recreation experience. This is because many recreationists visit the area to view wildlife and aspen colors during summer and fall.

Under the Proposed Action, ground disturbing activities such as mechanical thinning, timber hauling, and prescribed burning could have short-term direct adverse effects on Arizona Trail and Bismarck Lake Trail. However, mitigation measures outlined in Chapter 2 would minimize ground disturbing impacts to these trails.

Smoke produced from prescribed burning would result in short-term direct adverse effects to recreation activities occurring in and around the project area. Prescribed burning could potentially occur throughout the year depending on weather and fuel moisture conditions in the project area. Recreation users at Arizona Snowbowl may be impacted by prescribed burning, depending on wind and ventilation conditions. However, the Forest Service typically burns on days in which ventilation is rated as good or excellent and transport winds are in a direction that carries smoke away from populated areas. Thus, smoke impacts should be minimal to the ski area. The Flagstaff Nordic Center may be impacted by mechanized thinning operations and prescribed burning activities; however coordination would aim to address and mitigate these effects.

Under the Proposed Action, fencing would be constructed around Little Spring to protect and restore the spring from damage and degradation from continued current use, which could result in long-term direct effects to recreational uses of the spring by equestrians. The fencing would inhibit access by horses and other large ungulates. However, fencing around the spring would promote the restoration of native vegetation, which should improve scenic attractiveness and thus enhance future user experience of and around the spring. Interpretation and educational signage at Little Spring would help promote the restoration activities of the spring, with the intent of improving visitor experience.

The gate on FR418B (which leads to Little Spring) would be moved to the intersection of FR 418B and FR 151. A small parking area near the junction of FR 418B and FR 151 would allow recreationists to continue to access Little Spring and the surrounding area via FR 418B by non-motorized travel (foot, horse, and/or mountain biking). Moving the gate to the junction of FR 418B and FR 151 would prevent recreationists from getting their vehicles stuck during wet soil conditions, and would improve parking accessibility.
**Cumulative Effects**

Travel Management Rule, when implemented in the foreseeable future, may have impacts to recreational uses and opportunities in the area. The Proposed Action of TMR would close and/or decommission some roads within the project area, which could impact the amount and pattern of dispersed camping and motorized travel and recreation in the project area. This could displace recreationists and increase the amount of new camp sites (and thus compaction) in areas with open system roads. However, the areas that would be impossible to access by motorized use would rehabilitate over time as soils begin to loosen and vegetation grows back.

Aspen regeneration activities under the Proposed Action would likely compliment the aspen regeneration attempts within the Flagstaff Nordic Center, if these treatments result in greater aspen regeneration and vigorous aspen health.

**Scenery Management**

The following information has been summarized from the Recreation, Scenic Management and Transportation Specialist’s Report located in the project record.

**Affected Environment**

The Scenery Management System (SMS), formerly known as the Visual Management System (VMS), provides an overall framework for the orderly inventory, analysis, and management of scenery. SMS in conjunction with ROS, helps guide recreation planners and resource managers in providing high quality recreation settings, experiences, and opportunities to visitors and users. Both systems recognize the importance of aesthetics in the management of recreation settings.

Although the US Forest Service started implementing SMS in 1995, after the agency decided that it would supersede VMS, the Coconino National Forest Plan (1987, as amended) outlines scenery quality objectives for the Forest using old VMS terminology. The majority of visual quality measures coincide (or there is cross-walk compatibility for) with SMS scenic quality measures. The Plan is currently undergoing revision and SMS terminology and practices will replace VMS terminology in the future revised LMP. For all intents and purposes, VMS terminology is interchangeable with that of SMS.

SMS describes scenic quality in terms of landscape character, scenic attractiveness, landscape visibility in relation to viewer sensitivity/concern and distance zone of observation, scenic integrity, and scenic class (USDA 1995). Scenic class is the only scenic quality measure or designation that does not have crosswalk compatibility or is not addressed in VMS and for this reason, will not be addressed in this report.

The Coconino National Forest uses VQOs to define the acceptable degree of alteration of the natural landscape (USDA 1987, as amended). VQOs are determined by landscape variety class or scenic attractiveness class, viewer sensitivity or concern level (levels 1-3), and distance from the viewer (immediate foreground, foreground, middleground, and background) (Bacon 1979, USDA 1974, 1995).

Scenic attractiveness classifies the combination of valued landscape elements of landform, water characteristics, vegetation, and cultural features by ranking the combination of these elements according to the amount of variety, unity, vividness, mystery, intactness, coherence, harmony, uniqueness, pattern, and balance that the combination displays over the landscape. The three scenic attractiveness classes are A-distinctive, B-typical, and C- indistinctive (USDA 1995).
Viewer sensitivity or concern level is determined by the level of interest in the surrounding landscape that people are likely to have (USDA 1974, 1995). Landscape visibility will depend on the context of the viewers, duration of the view, degree of discernable detail, seasonal variations, and the number of viewers (USDA 1995). The location or distance zone in which a viewer(s) is observing the landscape will affect his or her concern or sensitivity level of the viewed landscape. Viewers from primary travelways and use areas will most likely have a high interest in scenery. Therefore, the landscape that can be viewed from these high use areas will most likely receive a level 1 designation. Those areas that are not visible or seen often by a large number of people will most likely be classified as level 3, indicating low interest in scenery.

Distance zone is another component that allows resource managers to characterize landscape visibility (USDA 1974, 1995). Immediate foreground, foreground, middleground, and background are the four zones that define the distance from the viewer of the landscape being characterized and are mapped for travelways and use areas. Immediate foreground is 0 to 300 feet from the viewer in which the viewer can distinguish details of individual trees and see and hear wildlife. In contrast, background is at least 4 miles or further away from the observer at which point the landscape has been simplified and it serves as a pleasantly distant vista for the observer.

Proper use and guidance of SMS includes inventorying existing scenic conditions before determining future desired scenic conditions (USDA 1995). During the scenic quality inventory process, the degree in which the landscape is altered is measured by comparing the modified landscape to the surrounding natural landscape. The resulting visual quality levels (VQL) are preservation, retention, partial retention, modification, and maximum modification. In SMS, these levels are known as scenic integrity levels (SIL). Scenic integrity level of very high is equivalent to the VQL of preservation just as an SIL of very low is equivalent to a VQL of maximum modification (USDA 1995).

Retention is the most stringent scenic integrity category after preservation in wilderness areas. It designates that deviations created by management practices and other activities are not visually evident and the landscape appears intact. In partial retention areas, landscape alterations due to management activities may be evident but remain visually subordinate to the characteristic landscape. Modification and maximum modification levels allow for the most alteration to occur over the landscape although requiring that management activities borrow from naturally established elements in a way that they appear to be natural occurrences within the surrounding area (USDA 1974, 1995). The Hart Prairie project area is viewed and considered as an area with high scenic beauty and quality.

The public’s concern for scenic quality of the project area viewed when traveling through the forest depends on the location in which the viewer is standing. The Arizona Snowbowl ski area is not included in the Hart Prairie project area but is located immediately to the southeast of the project area and is a high use recreation area. Visitors can view the most of the project area from the ski area and most of the project area is observed as middleground. There are other locations within the project area that one can view a majority of the project area. However, these areas, such as atop the Hochderffer Hills, are difficult to access as there are no maintained roads or trails leading to their summits. Because of these reasons, they are not often visited by recreationists. If one does access the summit of one of these higher topographical features, one can view different locations within the project area as middleground.

US Highway 180, FR 151, and FR 418 are major travelways within the project area that receive many visitors from which many parts if not all of the project area can be viewed. All, but approximately 1080 acres of the project area is assigned a concern level of 1 (see Figure 7). The 1080 acres do not receive many visitors due to lack of roads and trails within these locations and cannot be viewed from major travelways such as US Highway 180. Thus, the concern level for this area is 3.
According to the Coconino National Forest Plan (1987, as amended), the VQO for the majority of the project area is Retention (approximately 10,240 acres) with three areas designated for Partial Retention (approximately 1,080 acres) (see Figure 7). The Highway 180 travel corridor has its own management direction in which its VQO is foreground retention (approximately 1,620 acres) (see Figure 7). The reason for the VQO of US Highway 180 travel corridor is because the road is heavily used as a major route to the Grand Canyon from Flagstaff. More recent estimates place its use at more than 3,000 vehicles per day.

Users of the Arizona Trail will view the project area mostly as foreground as there are limited viewpoints of the project area along the trail at higher elevations due to heavily forested areas currently blocking views. A heavy density of trees also blocks most of the view from the Bismarck Lake Trail, except for a few meadow openings that occur along the trail. Both trails are used heavily. Thus, recreationists will have a high interest in scenery along the two trails.

The eastern boundary of the project area abuts a portion of the northside of the Kachina Peaks wilderness boundary. The project area is clearly seen from the Weatherford and Humphreys Trail above treeline on the saddle between Agassiz and Humphrey Peaks and these locations are designated as wilderness. The proximity of the project area to wilderness can affect how visitors who come to recreate specifically in the wilderness view the project area after implementation.

**Alternative 1: No Action**

**Direct and Indirect Effects**

The No Action Alternative would have no immediate direct effects on the current visual quality of the project area. However, by not implementing any aspen restoration treatments, aspen populations would most likely continue to decline at the current rate in the project area, resulting in decreased scenic integrity and quality of the landscape. This could have an indirect adverse effect. In addition, the absence of fuel reduction treatments within the project area would increase the risk of high intensity, stand replacing fires during hot, dry conditions, resulting in an indirect adverse effect. High intensity, stand replacing fires most likely would create a blackened and charred forest that would not meet scenic objectives and would be displeasing and unappealing for many visitors (Ryan 2005).

**Cumulative Effects**

Implementation of the No Action Alternative along with a past wildfire occurrence, may have a cumulative effect relative to visual quality in the project area. The Hochderffer fire that took place in 1996 impacted the northwest portion of the Hart Prairie project area. The stand replacing fire created a burn scar that is still visible today from all distance zones. Most people do not enjoy seeing or recreating in burned areas. Reasons include large areas of snags created by stand replacing fires compromise recreationist safety, and the large amount of dead, downed logs increase difficulty of maneuverability when hiking in the area. Also, severe burns impair scenery for most recreation users and forest visitors (Ryan 2005). The result is that they avoid recreating in burned areas and instead recreate in adjacent areas that have not been burned.

**Alternative 2: Proposed Action**

**Direct and Indirect Effects**

Under the Proposed Action, VQO of foreground Retention along system trails and roads (including Highway 180 and 70 acres of the project area that is in close proximity to the western boundary of the
Arizona Snowbowl ski area) would be maintained. Mitigation measures of retaining trees along trail corridors, around trailheads and parking areas, and at trail junctions, switchbacks and climbing turns, along U.S. Highway 180, and a portion of land just west of the Arizona Snowbowl ski area would help retain and/or enhance scenic quality at the foreground level for recreationists within the project area. More specifically, greater tree retention would occur along trail corridors of Bismarck Lake Trail, Arizona Trail, and Aspen Loop Connector Trail. Furthermore, the old road bed of Bismarck Lake Trail would not be used as a temporary road, thus avoiding the short term impact of disturbing scenic quality and recreation experience at the trailhead and on the first ½ mile of the trail.

Implementing a variety of stand treatments (ponderosa pine, aspen, and meadow restoration) that blend with the natural landscape would address the need for Retention at a middleground distance zone. The treatments would reduce fuel loading and restore forest health while still meeting the VQQO of Retention where vegetation removal repeats the form, line, color, and texture of the natural occurrences common to the surrounding areas. However, some of the vegetation treatments may create deviations on the landscape that would be evident from certain viewpoints. To reduce evidence of unnatural disturbance/alteration at the foreground distance zone, mitigations measures such as leaving a greater number and higher diversity (size, shape, and species) of trees along highways, and hand piling at least 500 feet off of the highway and out of view of the observer would be implemented. Additionally, special care would be taken by mechanized equipment working in the foreground views of FR 151 and FR 418 as to not dislodge large basalt boulders from the ground when constructing piles or performing other timber operations. Forest visitors may view dislodged, large boulders in the project area as “messy” and the landscape as less visually appealing. In addition, aspen restoration treatments may result in more vigorous regeneration of stands. Larger, healthier aspen stands would provide for a higher scenic integrity and quality of the landscape because visitors view and value aspen as a very important scenic component within the project area.

Leaving large, mature trees along the trails and constructing piles not in view from the trails would address foreground retention along the Arizona Trail and Bismarck Lake Trail. Additional mitigations for fuel management activities affecting the scenic quality around and functionality of trails are addressed in the Recreation section.

Log decks and logging landings should be built out of foreground view from trails and main travelways such as FR 151 and FR 418B, and as much as possible out of middleground view from higher elevation viewpoints, such as from Arizona Snowbowl. Leaving more trees along the wilderness boundary would help reduce a distinct division or fuel break between the wilderness and the project area.

The Forest Service would monitor post-harvest cleanup in order to ensure slash and large woody debris has been piled and/or removed to Forest Service specifications. Also, the number of visible tree stumps from foreground views, especially along major travelways and trails, would be limited during thinning and timber extraction operations.

Prescribed burning activities would produce mostly short-term effects on scenic quality until the forest has rebounded. Burns are expected to be low to moderate intensity over the majority of the project area thereby affecting mostly the foreground of landscapes. These effects include blackening of grass, shrubs and perennials and possible needle scorch on trees, especially those with ladder fuels. Scorch could be seen at all distance zones depending on the severity of the scorch. Some areas within designated burn units may receive unpredictably higher intensity fire that may result in some tree mortality. If heat and/or burn-induced tree mortality occurs, scenery would be impacted at foreground and middleground views. Mitigation measures as outlined in Chapter 2 would minimize these potential impacts. These include removing dead and downed woody debris around large, mature trees, constructing slash piles in openings and not directly under tree canopies. Prescribed burning in conjunction with thinning would clear out
some of the dense understory vegetation, open up views into the forest, and increase herbaceous ground cover in the project area. Thus, low intensity prescribed fires should help create forest conditions that increase scenic beauty ratings, especially one or two years after burning.

Temporary road construction would be evident from certain viewpoints but would have short-term effects on visual quality. These roads would create soil color contrasts on the landscape but once they are decommissioned and rehabilitated, the soil color contrast remained on the landscape would be reduced over time. Also, all roads would be fitted to the landform to achieve minimal cut and fill slopes thereby reducing the amount of soil color contrast seen over the landscape.

Scenic quality monitoring and inventory during and after treatment implementation would analyze impacts to scenic integrity classes. Inventory would help direct management so as to adapt and/or modify future planning efforts to minimize long-term effects of management activities on scenic quality within and around the project area. Also, providing information about fuels management through interpretive signs and brochures would help inform and educate the public about the short-term effects of stand treatments to landscape aesthetics and the long-term benefits of stand treatments to future ecosystem health and visual quality in the project area.

**Cumulative Effects**

No other projects are currently being planned to occur in and around the project area in the foreseeable future that would impact visual quality in the area. Prescribed burning implemented over time should reduce down and dead logs, vegetation, and snags in the burn only and aspen restoration areas of the Hochderffer Hills. In addition, aspen restoration treatments around the Hochderffer Hills may help rejuvenate the aspen population located on the northeastern slopes of the Hochderffer Hills, thereby improving scenic quality possibly creating an increase in recreation use and visitation in the area burned by the Hochderffer Fire. Thus, stand treatments within the wildfire burned area may result in improved scenic quality more visitors recreating in and around the treated area in the future.

**Transportation and Access**

The following information has been summarized from the Recreation, Scenic Management and Transportation Specialist’s Report located in the project record.

**Affected Environment**

The Coconino National Forest is currently finishing analysis for TMR, which identifies a desired road system for the entire forest. Under this rule, the roads designated as undesired and unneeded would be closed to motorized use and would be allowed to rehabilitate naturally over time (USDA 2007). The Hart Prairie project area is included in this study and the existing road system in the area is expected to change once the rule has been implemented. The implementation would most likely result in fewer miles of road being open to motorized use within the project area. The purpose for this reduction is to attain a manageable and sustainable roads system over time.

The road system within the project area consists of both planned system and unplanned non-system roads. There are approximately 15 miles of non-system roads and approximately 83 miles of system roads within the project area. Of the system roads, 3.5 miles are maintenance level 5, 6 miles are level 4, 1.5 miles are level 3, 23 miles are maintenance level 2, and 6 miles are maintenance level 1 roads. The remaining 43 miles of system roads are decommissioned.
The roads that receive the heaviest amounts of traffic through the project area are US Highway 180, FR 151, 151E, 418, and 794. These roads range from level 2 to 5 in maintenance level but for the most part, with the exception of FR151E, are pleasant for visitors to travel upon. FR 151 E is a level 2 maintenance road and is closed by forest order when enough snow is present for the Flagstaff Nordic Center to commence cross-country ski operations.

Some of the two track roads in the project area are remains of roads created by settlers that lived in the Hart Prairie area in the early 1900s. In addition, the public has created many unplanned roads within the project area over the years through repetitive cross-country use for recreational driving, firewood extraction, dispersed camping, and wildlife viewing and/or scouting. Most often, non-system roads are poorly located and lack proper drainage features resulting in erosion on these roads and the land surrounding these roads.

All roads within the project area are closed when winter conditions warrant their closure. However, not all roads accessing the project area have locking gates. Many users try to drive on snowy road conditions to access National Forest System lands farther east of US Highway 180. The results of these actions are that vehicles most often get stuck in the snow and/or mud and cause resource damage during wet, slushy, spring/early summer conditions. Unfortunately, in addition to non-system roads, system roads do not receive routine maintenance. Therefore, the road system degrades each year due to the continual occurrence of resource damage and chronic lack of maintenance due to budget constraints.

Private property owners within the Hart Prairie and White Horse Hills communities are allowed access to their properties during the winter when the roads are closed. However, the Forest Service does not plow or maintain roads during the winter. Most property owners access their lands using both access points of FR151 from US Highway 180.

**Alternative 1: No Action**

**Direct and Indirect Effects**
Under the No Action Alternative, there would be no direct effects to the road system. The system would continue to exist as it does today or at least until the TMR is implemented. Under the No Action Alternative, the road system would not receive improvement and maintenance, and would further experience degradations, resulting in an indirect adverse effect. Another indirect effect includes the risk of high intensity, stand replacing fire burning through untreated stands in the project area creating instable soil characteristics over the landscape, leading to further road damage from increased erosion and runoff.

**Cumulative Effects**
Continued use of roads by vehicles during wet and slushy conditions with chronic lack of maintenance would result in further resource damage and a more degraded road system in the future. However, if the current proposed action of TMR is implemented, fewer miles of road would be opened to motorized travel, leading to less resource damage and fewer miles of road within the project area needing to be maintained.
Alternative 2: Proposed Action

Direct and Indirect Effects
Under the Proposed Action, some of the main roads throughout the project area, such as FR 151, would be improved and maintained to implement forest health and restoration treatments, resulting in a direct effect. Where there is limited road access for stand treatments, some decommissioned roads would be temporarily used as haul roads for timber extraction operations. However, once operations have ended, these previously decommissioned roads would be reclosed again. The exception would be FR 627 at the Bismarck Lake Trailhead, which would remain closed during project implementation and would continue to be used as the trail to Bismarck Lake, and open only to non-motorized use.

Closed roads within the permitted area of the Flagstaff Nordic Center would be used for mechanized thinning operations and prescribed burning activities. These roads would be reclosed and normal recreational activities within the area would resume after stand treatments have been completed. Any ground disturbance impacts incurred by trails within the permitted area would be rehabilitated by the timber contractor after the completion of mechanized thinning operations. Coordination between the Forest Service and the Flagstaff Nordic Center would minimize impacts to the area during project implementation.

Under the Proposed Action, there would be direct effects to the road system. However, these impacts would be minimal and short-term as reopened roads would be reclosed after thinning operations have ended. Furthermore, the main road system would be improved and maintained during mechanized thinning treatments, making travel along these main routes for some recreationists less cumbersome and creating more sustainable road conditions for future use.

Cumulative Effects
Implementation of both TMR and Hart Prairie project would have a cumulative impact on the roads system within the project area. Improvement of the main routes such as FR151 within the project area for thinning operations, in conjunction with the implementation of TMR resulting in closing and/or decommissioning roads that are not maintained and create fragmentation and resource damage across the landscape, would most likely result in a more sustainable roads system within the project area in the future.
Chapter 4 - Consultation and Coordination

The Forest Service consulted the following Federal, state, and local agencies, and tribes during the development of this environmental assessment:

**Federal, State, and Local and Agencies**

- Arizona Game and Fish Department
- Arizona State Land Department
- City of Flagstaff
- Coconino County Board of Supervisors
- Coconino County Community Development
- Coconino County Parks and Recreation
- Natural Resources Conservation Service
- State Historic Preservation Office
- U.S. Fish and Wildlife Service
- Arizona State Land Department
- City of Flagstaff
- Coconino County Board of Supervisors
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- Coconino County Parks and Recreation
- Natural Resources Conservation Service
- State Historic Preservation Office
- U.S. Fish and Wildlife Service

A Biological Assessment and Evaluation for threatened and endangered species was submitted to the USFWS, with a determination that Alternative 2: Proposed Action “may affect but is not likely to adversely affect” Mexican spotted owl.

Cultural resource surveys within the project area were conducted in accordance with inventory protocols approved by the State Historic Preservation Officer. Native American tribes and communities were consulted during public scoping. No comments were received. It was determined under the Programmatic Agreement for Compliance with Section 106 of the NHPA that Alternative 2: Proposed Action will have no adverse effect to historic properties and values. In addition, implementation of Alternative 2: Proposed Action will not affect tribal access to Federal lands within the project area.

**Tribes**

- Fort McDowell Yavapai Nation
- Havasupai Tribe
- Hopi Tribe
- Hualapai Tribe
- Navajo Medicine Men’s Association
- Navajo Nation
- Navajo Nation Tolani Lake Chapter
- Navajo Nation, Cameron Chapter
- Navajo Nation, Coalmine Canyon Chapter
- Navajo Nation, Dilcon Chapter
- Navajo Nation, Gap-Broadway Chapter
- Navajo Nation, Leupp Chapter
- Navajo Nation, Tuba City Chapter
- Navajo Tribe of Indians, Dept of Agriculture
- Pueblo of Acoma
- Pueblo of Zuni
- San Carlos Apache Tribe
- Tonto Apache Tribe
- White Mountain Apache Tribe
- Yavapai-Apache Nation
- Yavapai-Prescott Indian Tribe
Chapter 5 - References


Davis, G.  2001.  Man and wildlife in Arizona.  Arizona Game and Fish Department, Phoenix, AZ.


Springer, J. 2004. E-mail communication to D. Crisp. Astragalus rusbyi on Ft. Valley Project.


# Chapter 6 – List of Preparers

**USDA Forest Service, Coconino National Forest**

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
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<tbody>
<tr>
<td>Michael T. Elson</td>
<td>Peaks/Mormon Lake District Ranger</td>
</tr>
<tr>
<td>Harmony Hall</td>
<td>ID Team Leader</td>
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<tr>
<td>Patricia Ringle</td>
<td>Silviculturist</td>
</tr>
<tr>
<td>Cary Thompson</td>
<td>Wildlife Biologist</td>
</tr>
<tr>
<td>Kristin Kolanoski</td>
<td>Recreation Specialist</td>
</tr>
<tr>
<td>Dick Fleishman</td>
<td>Soil Scientist/Hydrologist</td>
</tr>
<tr>
<td>Beale Monday</td>
<td>Fire and Fuels Planner</td>
</tr>
<tr>
<td>Angela Crossley</td>
<td>Archaeologist</td>
</tr>
<tr>
<td>Debra Crisp</td>
<td>Botanist</td>
</tr>
<tr>
<td>Amanda Roesch</td>
<td>Range Specialist</td>
</tr>
<tr>
<td>Frank Thomas</td>
<td>GIS Specialist</td>
</tr>
<tr>
<td>Joseph Luttman</td>
<td>Pre-sale Forester</td>
</tr>
<tr>
<td>Michael Bathen</td>
<td>Engineer</td>
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<tr>
<td>Yewah Lau</td>
<td>Forest Planner</td>
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<td>Fuels</td>
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<td>Mike Manthei</td>
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<tr>
<td>Cecilia Overby</td>
<td>Wildlife Biologist</td>
</tr>
<tr>
<td>James Beard</td>
<td>Landscape Architect</td>
</tr>
<tr>
<td>Barbara Phillips</td>
<td>Botanist</td>
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Appendix A – Management Areas

Note: The above map depicts management area boundaries that were created in the mid-1980's, with the exception of those MAs that were established at a later date (e.g., MA 17, MA 20). There may be differences between what is shown on this map compared to what is on the ground today. According to page 47 of the Coconino Forest Plan: “To apply management practices or activities, manager will locate the practices or activities on management and analysis area maps and field check the location to determine the applicable standards and guidelines to be met. Then the suitability of applying the practices or activities is determined for that specific location. ...The transition between vegetative zones is highly variable. The variability results in isolated parcels of individual analysis areas that do not match the Forest map of management areas for which the standards and guidelines were written. In these instances, proposed practices or activities are governed by standards and guidelines from the management area description that most accurately depict the real situation on-the-ground” (USDA 1987, as amended).
Appendix B – Cumulative Events Considered

Past, present, and future actions considered in the cumulative effects analysis for the Hart Prairie Fuels Reduction and Forest Health Restoration Project.

<table>
<thead>
<tr>
<th>Event</th>
<th>Year/Time</th>
<th>Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Livestock Grazing</td>
<td>1880s – Present</td>
<td>Reduced understory abundance and productivity. Removed surface fuel. Disrupted the natural, surface fire regime. Contributed to increased regeneration. Increase in water availability due to construction of stock tanks.</td>
</tr>
<tr>
<td>Railroad Logging</td>
<td>1880s</td>
<td>Reduced density of mature sawtimber and “yellow” pines. Decreased crown canopy closure. Contributed to increased regeneration and an even-aged forest structure.</td>
</tr>
<tr>
<td>Coconino National Forest formed</td>
<td>1908</td>
<td>Resulted in increased restrictions on logging and the beginnings of active, organized fire suppression</td>
</tr>
<tr>
<td>Rocky Mountain Elk Introduction</td>
<td>1913</td>
<td>Reduced aspen regeneration, Bebb willow regeneration, and understory abundance</td>
</tr>
<tr>
<td>Wildfire</td>
<td>1940s - Present</td>
<td>Reduced hazardous fuel accumulation in portions of burned area, stand-replacing fire within the majority of acres, affects visual quality (burned and charred forests), recreational experience, and wildlife habitat.</td>
</tr>
<tr>
<td>Commercial Aspen Harvests</td>
<td>1940s</td>
<td>Partial cuttings of trees 9-15 inches dbh for excelsior manufacture. Stimulated regeneration. Increased growth increment of residual trees. Created some two-storied stands. Small plots fenced to protect regeneration</td>
</tr>
<tr>
<td>Commercial Sawlog Harvests</td>
<td>1940s-1960s</td>
<td>Reduced density of mature sawtimber and “yellow” pines. Decreased crown canopy closure. Contributed to an even-aged forest structure.</td>
</tr>
<tr>
<td>Reforestation</td>
<td>1950s, 1970s, 1980s</td>
<td>Reforestation attempts after stand-replacing wildfires. Poor survival rates due to gopher and ungulate damage</td>
</tr>
<tr>
<td>Aspen Fuelwood Harvests</td>
<td>1986 - 1988</td>
<td>Fuelwood harvests to provide firewood to public and stimulate aspen regeneration. Intense browsing pressure by elk resulted in high regeneration damage and mortality.</td>
</tr>
<tr>
<td>Animal Control for Reforestation</td>
<td>1980s</td>
<td>Provided temporary protection to natural and artificial regeneration (aspen and pine) from gophers, elk, and deer.</td>
</tr>
<tr>
<td>Elk Exclosure Fencing</td>
<td>1986 - 2003</td>
<td>Provides long-term protection to aspen regeneration from ungulates, resulting in increased size class diversity, increased health, growth, and vigor, and increased biodiversity. Problems with repeated fence damage resulted in damage to regeneration. One large fence (160 acres) dismantled due to severe damage. Majority of aspen seedlings destroyed by elk.</td>
</tr>
<tr>
<td>Establishment of the Hart Prairie Preserve</td>
<td>1994</td>
<td>Bebb willow preservation, including improved water flow, willow enclosures, and monitoring.</td>
</tr>
<tr>
<td>Adopt an Aspen Fence Program</td>
<td>2004 - Present</td>
<td>Volunteer program for maintenance of elk exclosure fencing. Timely repair of fence damage has resulted in increased growth and vigor of aspen regeneration.</td>
</tr>
<tr>
<td>Event</td>
<td>Year/Time</td>
<td>Effects</td>
</tr>
<tr>
<td>--------------------------------------------</td>
<td>-----------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Hart Prairie Restoration Project</td>
<td>2001</td>
<td>Reduced density of pine encroachment and reintroduced fire within meadows. Improved watershed function. Increased health and vigor of Bebb willow community; however, some regeneration was impacted by browsing.</td>
</tr>
<tr>
<td>FR 794 Aspen Enhancement Project</td>
<td>2006</td>
<td>Reduced density of ponderosa pine encroachment within aspen clone. Increased sunlight and growing space for young aspen seedlings. Repaired fence. Improvement to forest health, vigor, structure, growth, visual quality, fire hazard, wildlife habit, and biodiversity.</td>
</tr>
<tr>
<td>Prescribed Fire</td>
<td>Ongoing</td>
<td>Reduced activity-created slash piles. Encouraged aspen and Bebb willow regeneration, however, regeneration was impacted by browsing. Emissions</td>
</tr>
<tr>
<td>Fuel Reduction Projects (including timber harvests)</td>
<td>Ongoing</td>
<td>Treatments reduce the risk of crown fire spreading to nearby forest and urban areas and improve the fire adapted ecosystem.</td>
</tr>
<tr>
<td>Dispersed Recreation</td>
<td>Ongoing</td>
<td>Affects localized soil conditions (compaction), visual quality (littering), and wildlife (user trails).</td>
</tr>
<tr>
<td>Arizona Trail</td>
<td>Ongoing</td>
<td>Provides recreational experiences for users. Increases use of area, affecting soil conditions, visual quality, and wildlife.</td>
</tr>
<tr>
<td>Road Maintenance on Forest Service Road</td>
<td>Ongoing</td>
<td>Disturbance to soils and vegetation</td>
</tr>
<tr>
<td>Automobiles and wood-burning stoves</td>
<td>Ongoing</td>
<td>Creates smoke and emissions, and reduces air quality.</td>
</tr>
<tr>
<td>Private land development</td>
<td>Ongoing</td>
<td>Affects wildlife habitat, creates disturbance (wildlife), affects visual quality (buildings), creates social trails from private land (recreation), expands the WUI (fire/fuels)</td>
</tr>
<tr>
<td>Removal of hazard trees for powerlines and highway safety</td>
<td>Ongoing</td>
<td>Reduces snags and habitat for snag-dependant wildlife species</td>
</tr>
<tr>
<td>Travel Management Rule</td>
<td>Future</td>
<td>Proposed Action would close and/or decommission some roads, and prohibit off-road driving. This would reduce crushing of plants, soil compaction, and disturbance to wildlife. This could also displace recreationists and increase the amount of new camp sites (and thus compaction) in areas with open system roads.</td>
</tr>
</tbody>
</table>