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Wildlife Specialist Report

Jack Smith-Schultz Fuels Reduction and Forest Health Project

Peaks Ranger District, Coconino National Forest
Coconino County, Arizona

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Wildlife

Introduction

The following report summarizes existing conditions and effects from all alternatives to threatened, endangered, and Forest Service sensitive species (TES), management indicator species, and migratory bird priority species that may occur or may have habitat within the project area, wildlife cover and key habitat components such as snags and downed logs. This specialist report was developed in consideration of the best available science.

Regulatory Framework

The Forest Service is legally required to comply with a number of federal regulatory requirements associated with various sections of the Endangered Species Act of 1973, as amended (ESA), the Bald and Golden Eagle Protection Act of 1940, as amended, Forest Service Manual (FSM), FSM 2620, 2630, 2670, 2672, Migratory Bird Treaty Act of 1918 (as amended), Executive Order 13186 (migratory birds), National Environmental Policy Act, 1969, National Forest Management Act, 1976 (as amended), and Coconino National Forest Land and Resource Management Plan, 1987 (as amended).

<u>The Endangered Species Act</u>

The Endangered Species Act of 1973, as amended, provides that all Federal agencies utilize their authorities to carry out programs for the conservation of listed species. It prohibits any Federal agency from carrying out any action that is likely to jeopardize the continued existence of any listed species. It further requires federal agencies to consult with the Fish and Wildlife Service (FWS) on actions that are authorized, funded, or carried out by such agencies, that may affect listed species and/or their designated critical habitat. The Act mandates conference with the Secretary of the Interior whenever an action is likely to jeopardize the continued existence of any species proposed for listing as threatened or endangered, or whenever an action might result in destruction or adverse modification of critical habitat proposed for listing.

<u>Bald and Golden Eagle Protection Act</u>

The Eagle Act, originally passed in 1940, prohibits the take, possession, sale, purchase, barter, offer to sell, purchase, or barter, transport, export, or import, of any bald or golden eagle, alive or dead, including any part, nest, or egg, unless allowed by permit (16U.S.C 668(a);50CFR 22). “Take” is defined as “pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest, or disturb” a bald or golden eagle. The term “disturb” under the Eagle Act was recently defined via a final rule published in the Federal Register on June 5, 2007 (72 Fed. Reg. 31332). “Disturb” means to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior.

Forest Service Sensitive Species

Sensitive species are defined as "those plant and animal species identified by a Regional Forester for which population viability is a concern, as evidenced by: a) significant current or predicted downward trends in population numbers or density, or b) significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution (FSM 2670.5(19)). It is the policy of the Forest Service regarding sensitive species to 1) assist states in achieving their goals for conservation of endemic species, 2) as part of the National Environmental Policy Act process, review programs and activities, through a biological evaluation, to determine their potential effect on sensitive species, 3) avoid or minimize impacts to species whose viability has been identified as a concern, 4) if impacts cannot be avoided, analyze the significance of potential adverse effects on the population or its habitat within the area of concern and on the species as a whole (the Line Officer, with project approval authority, makes the decision to allow or disallow impacts, but the decision must not result in loss of species viability or create significant trends toward federal listing), and 5) establish management objectives in cooperation with the state when projects on National Forest system lands may have a significant effect on sensitive species population numbers or distributions. Establish objectives for federal candidate species, in cooperation with the U.S. Fish and Wildlife Service and Arizona State (FSM 2670.32). The Regional Forester's Sensitive Species list was updated September 2007 and provided the list of species analyzed for this report.

Management Indicator Species (MIS)

A working draft forest-wide assessment entitled "Management Indicator Species Status Report for the Coconino National Forest" (USDA 2002) summarizes current knowledge of population and habitat trends for management indicator species on the Coconino National Forest. Additional site specific (GMU) population information was provided by Arizona Game and Fish Department with their annual survey results. Trends in snag populations were updated using recent research conducted on the Forest (Ganey 2007).

Migratory Bird Treaty Act

Executive Order 13186 (January 10, 2001) requires federal agencies to consider management impacts to migratory birds. Birds considered for these analyses were selected from species of concern as listed by Partners in Flight (Latta, et al. 1999) and the determination of possible impacts that would occur if any one of the alternatives were implemented is disclosed.

Coconino National Forest Plan

The Forest Plan determines standards and guidelines for snags and downed logs, wildlife cover, raptor nest buffers, old growth, turkey nesting and roosting habitat, and bear habitat. It also incorporates the Mexican Spotted Owl Recovery Plan and Northern Goshawk Management Recommendations.

THREATENED AND ENDANGERED SPECIES

Mexican Spotted Owl (*Strix occidentalis lucida*)

Analysis Methods

The following evaluation criteria were used to compare environmental consequences for the alternatives:

- Protected and Restricted Habitat Quality – Measures are primary constituent elements as identified for critical habitat which include; basal area of large diameter trees, canopy closure/cover, tree sizes suggestive of uneven-aged management, multi-layered canopy with large overstory trees.
- Prey Habitat – Measures are primary constituent elements as identified for critical habitat which include; volumes of fallen trees and other woody debris, plant species richness, including hardwoods, residual plant cover to maintain fruits, seeds, and regeneration to provide needs of MSO prey species.
- Disturbance associated with project implementation.
- Fire hazard rating to MSO habitat by acres and fire hazard to PACs from acres outside PACs.

Existing Conditions

The project area contains four dominant vegetation types – ponderosa pine (9,747 acres 83%) of which a small percentage is ponderosa pine/gambel oak (355 acres, .04%) and mixed-conifer (1,618 acres, 14%). There is a smaller percent of pinyon-juniper (103 acres, <1%), aspen (62 acres, <1%) and grassland/meadows (27 acres, <1%).

Table 1. Existing acres of MSO habitat within the project area

Habitat Type	Acres
Protected Outside of PACs	628
PAC	1727
Restricted Habitat	462
Threshold Habitat	0
Total	2,817
Critical Habitat	2,708*

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

Protected Habitat

Protected habitat includes 628 acres of mixed conifer with slopes greater than 40% within the project boundary. Additionally, four Mexican spotted owl (MSO) Protected Activity Centers (PACs) are located partially within the project boundary (Weatherford #040208, Orion Spring #040207, Jack Smith #040209 and Pipeline #040201). There are approximately 1,727 MSO PAC acres within the project boundary. Fire hazard rating for the portion of the PACs within the project area is low to extreme. Fire hazard ratings for protected habitat on slopes greater than 40 percent are high to very high with 44% high and 56% very high. See Fire and Fuels section for ratings and clarification.

The Orion Spring PAC overlaps with the Orion northern goshawk PFA on 106 acres (Location 267, Sites 18, 21) within the project. Protected habitat overlaps with northern goshawk (Pipeline II) nest stands on approximately 60 acres (Location 269/Site14, Location 259/Site10). This overlap of habitat is displayed in Figure 1. Within MSO protected or restricted areas, the Mexican spotted owl standards and guidelines will take precedence over the northern goshawk standards and guidelines (USDA 1987a). Beyond the project boundary, there are four PACs within one mile of the project boundary. Two of these are north and west of the project. The remaining two PACs are in the Dry Lake Hills south and southwest of the project area.

The protected habitat is 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 (a.k.a. Challenger Trail) which is used by motorized and non-motorized users and transects protected habitat throughout the Jack Smith portion of the project.

Restricted Habitat

Restricted habitat exists in mixed conifer and pine oak habitat with slopes less than 40 percent. Restricted habitat within pine oak is defined as an area that could attain the type of forest structure sought by spotted owls for roosting and nesting habitat and having at least 10% of the site basal area consisting of oak greater than 5" in diameter at root collar (DRC). There are approximately 462 acres of restricted MSO habitat within the project area that are located primarily northeast of Orion PAC (between Orion and Aspen Spring PACs) and north of Little Elden Spring. Of those 355 acres are pine/oak and 107 acres are mixed conifer.

About one-quarter (23%) of the restricted habitat is mixed conifer, multi-storied with a wide range of tree sizes. The remaining 355 acres of the restricted habitat (77%) is pine oak. The restricted habitat has an open (0-39%) to closed (60-100%) canopy with few openings one-quarter acre of larger. Understory production and diversity are limited. Fire hazard ratings are low to very high with most (57%) high/very high, 20% moderate with the remainder (23%) low.

Oak and pine snags have been harvested for fuelwood and are in low numbers. Dead and down logs have also been reduced by past timber sales and fuelwood harvesting and are in low levels. The restricted habitat is easily accessible from the Forest Service road system and there are a large number of user-created trails developing and present within it.

Target and threshold habitats are managed for future nesting and roosting habitat, and are subsets of restricted habitat. The Forest Plan directs that target threshold habitat will be identified in restricted areas outside of the Urban Rural Influence Zone (URIZ). No sites meet threshold habitat values. The proposed action identifies four stands as target/threshold: C267/S12 and 13, C278/S14A, C259/S10, which accounts for 33% of restricted habitat.

Designated Critical Habitat
Critical habitat is designated by U.S. Fish and Wildlife Service (FWS) to provide for the survival and recovery of listed species. For the MSO, critical habitat includes areas within mapped boundaries that are protected or restricted habitat and include one or more of the primary constituent elements as listed in the Federal Register (USDI 2004).

Critical habitat is in Upper Gila Mountains (UGM) Recovery Unit 14. Critical habitat within the project consists of 2,708 acres with 2,355 acres of protected habitat, 353 acres of restricted habitat and the remainder is other forest and woodland.

Sites Proposed for Thinning and/or Burning

Protected Habitat
Approximately 377 acres of protected habitat (16%) is proposed for hand thinning or burning. All stands will maintain canopy closure of 50% or greater with an average canopy closure of 60% after treatment.

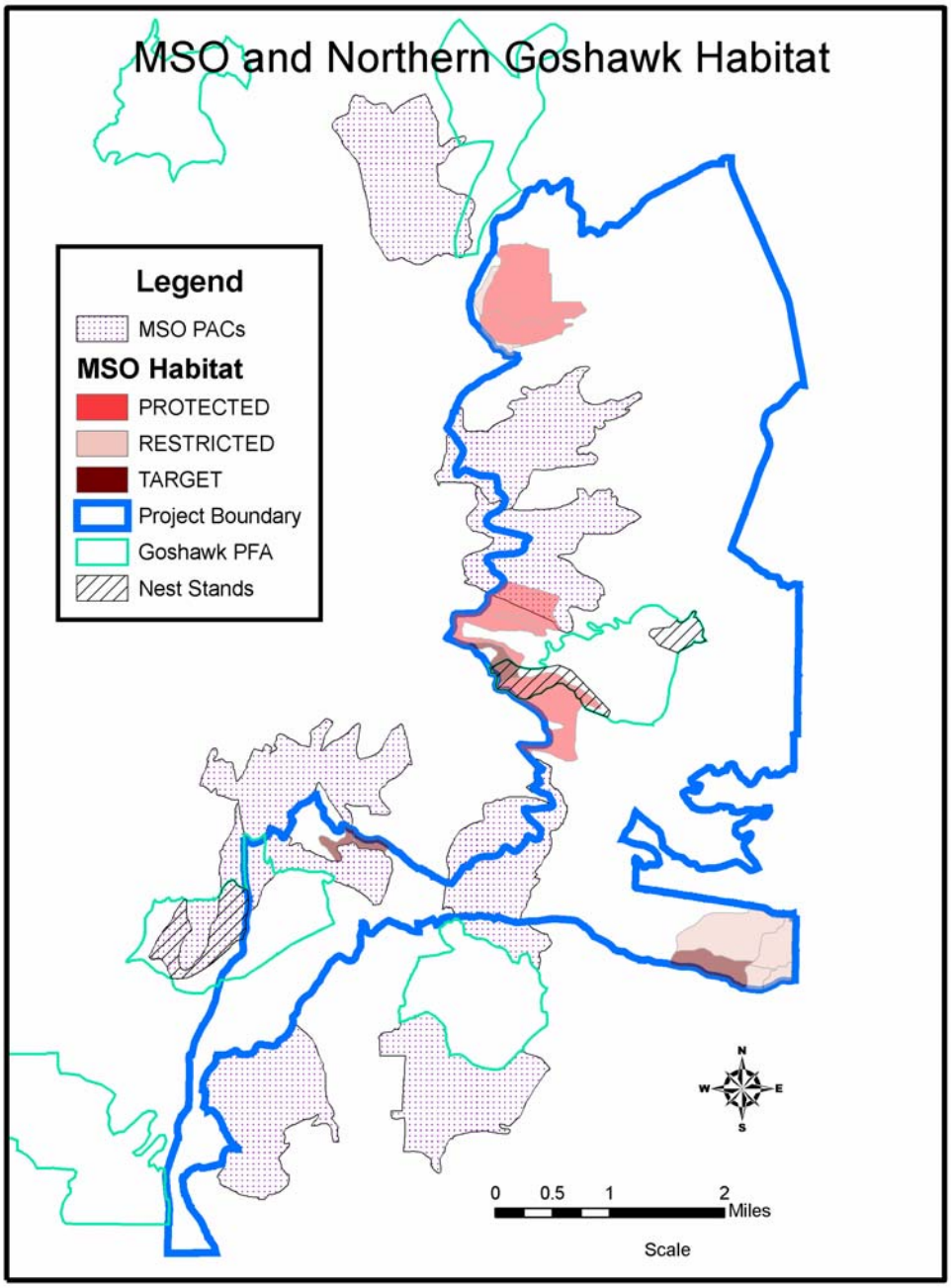
Restricted Habitat
Approximately 303 acres of restricted habitat (66% of MSO habitat, within the project area) will be uneven-aged thin with a resource emphasis to a canopy closure of 40 to 50% and basal area of 70-92 sq. ft./acre and approximately 424 acres of restricted habitat (92% of MSO habitat, within the project area) will be broadcast burned for fire risk reduction.

No temporary roads will be needed within restricted or protected habitat in order to accomplish thinning treatments.

Table 2. Acres of treatments proposed in MSO habitat

	PROTECTED HABITAT	RESTRICTED HABITAT
9” THIN/BURN	308	0
12” THIN/BURN	0	31
UNEVENAGED THIN RESOURCE OBJECTIVE	0	272
UNEVENAGED THIN FIRE REDUCTION OBJECTIVE	0	0
BURN ONLY	70	121
NO TREATMENT	1,978	38
TOTAL	2,355	462

Figure 1. MSO and Northern Goshawk Habitat



Direct and Indirect Effects

No Action
Habitat conditions for wildlife would remain in their current condition, not withstanding natural processes. No action would have no direct effect on MSO. However, dense forest conditions would still occur and the high fire hazard potential would continue to place spotted owl 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. Wildfire-induced mortality of key habitat components such as large ponderosa pine and oak trees would range from 71 to 98 percent (Fire and Fuels Specials Report). If a ground fire occurred, it is likely that ladder fuels would carry fire into the dense canopies and turn into a passive or active crown fire.

Tree densities would continue to be high slowing their growth into larger diameter classes. Habitat for MSO prey would continue to be limited by high tree densities with closed canopies. Ponderosa pine would continue to compete with oak for moisture, nutrients and sunlight resulting in reduced tree growth, vigor and longevity of oak. This alternative would not move to develop or maintain MSO habitat components.

High road densities would continue to provide access into sensitive MSO habitats increasing the potential for habitat alteration or direct disturbance of owls.

Alternative 1 – Proposed Action and Alternative 2
Direct effects to MSO would be from smoke created from broadcast burning. Smoke tends to settle into low-lying areas during the nighttime, and could potentially affect owls adjacent to the project. Due to prevailing winds from the southwest it is generally PACs to the northeast of burning activities that are impacted by smoke. There are two PACs (Schultz Creek #040206 and Aspen Spring #040235) northeast of portions of the project. PACs are located so smoke may drift into PACs from burning and this could occur in the spring within the breeding seasons, but effects would be short-term (3-5 days) and low intensity (drift smoke). Mexican spotted owls 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 will be restricted during the breeding season in areas that may create smoke impacts to occupied PACs. Under the action alternative there would be no direct effects from thinning activities as no activities will occur in PACs or within one-half mile of nests or roosts during the breeding season. Activities associated with prescribed burning and thinning treatments conducted outside of the breeding season normally do not result in negative effects to the MSO. The project area has been surveyed according to approved protocols. Effects from proposed treatments to adult and young owls outside of PACs are unlikely.

Prescribed burning or thinning 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. There is the potential for owls to relocate. Ganey (2003) concludes that in some cases, it may be necessary to manage for lower basal areas

and provide openings in the canopy to provide adequate sunlight to maintain oaks in well-developed sites. 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 and harm from fire, the proposed treatments may increase the diversity of vegetative conditions, which in turn would provide for a diverse prey base. Empirical models of factors that influence availability of Mexican spotted owls five common prey species indicate that microhabitat manipulation can influence abundance of the Mexican vole, followed by the long-tailed vole, Mexican woodrat, deer mouse and lastly the brush mouse (Ward 2001). Ward (2001) found that the total available biomass (kg) of mice and voles provided the strongest correlation with reproductive output. Model results indicated that abundance (g/ha) of the two vole species could be influenced by manipulating grass-forb height, whereas abundance of Mexican woodrats, the preferred prey, might be influenced by promoting shrub diversity and increasing large log cover. Block et al. (2005) concluded downed logs were not a strong predictor of habitat use by any of the three prey species studied, including the woodrat, in ponderosa pine/Gambel oak habitat, but found them closely associated with rocks and shrub cover.

All treatments follow Forest Plan standards and guidelines and the Mexican Spotted Owl Recovery Plan (USDI 1995b) in restricted habitat and protected habitat. Approximately 377 acres of *protected* habitat (16%) is proposed for hand thinning or burning. All stands will maintain canopy closure of 50% or greater with an average canopy closure of 60% after treatment. Average canopy closure in areas proposed for hand thinning will increase to 67% in 20 years and to 72% in 40 years. Currently the average diameter at breast height of trees in stands proposed for hand thinning is 7.0. This average will increase to 11.5 immediately after treatment and will increase to 13.4 in 20 years and 14.9 in 40 years.

Approximately 303 acres of *restricted* habitat (11% of MSO habitat, within the project area), including 76 acres of target threshold, will be an uneven-aged thin with a resource emphasis to a canopy closure of 40 to 50% and basal area of 80-150 sq. ft./acre and approximately 424 acres of restricted habitat (15% of MSO habitat, within the project area) will be broadcast burned for fire risk reduction. It is anticipated that this thinning treatment will be maintained over time. A change in the number of 18-inch diameter trees would not be detectable from existing conditions. Of the 152 acres of developing target threshold 76 acres of pine oak habitat will be treated to develop into nesting roosting habitat. Modeling shows the stand will meet *target threshold* conditions 50 years after treatment (Silviculture Report). Of the remaining 76 acres, 38 acres will be treated with a burn only treatment and the remaining 38 acres will be deferred from treatment. These stands are primarily mixed conifer and are expected to move toward target conditions without thinning treatments.

Throughout the project, during broadcast burning activities, torching may occur within treatment areas, however a change in the stand structure from this type of event would not be detectable on a stand basis. Torching would mimic gap processes that occur under

natural conditions. Broadcast burning would decrease woody debris by approximately 50% of existing volume, and decrease number of snags by 20% across all acres burned (Randall-Parker and Miller 2000). Woody debris and snags are habitat for small mammals. Indirect effects of reducing woody debris due to broadcast burning will decrease prey base abundance on a short-term basis for approximately one year (Jenness 2000). This decrease in small mammal prey base could be compounded during drought years when the prey base is lower due to a lack of food for these animals. However, herbaceous vegetation typically responds favorably to broadcast burning, and an increase in forage for small mammals is expected, outside of drought conditions. This in turn will have a corresponding increase in the small mammal prey base (Jenness 2000). Lining of snags and logs in combination with burning techniques and vegetation treatments designed to protect snags will reduce the number of snags burned. Recruitment snags will be identified from live trees that exhibit defects ideal for wildlife. For example, trees with forked or spiked tops, lightning strikes, mistletoe brooms, or fading crowns.

By treating restricted habitat with a prescribed burn wildfire-induced mortality of key habitat components in restricted habitat will be reduced. For ponderosa pine 8-14" diameter breast height (dbh) wildfire-induced mortality would not be expected to exceed 31%, ponderosa pine ≥16"dbh 9% and for oak ≥10" diameter at root collar (drc) could reach 41% , but would not be expected to exceed 19% (Fire and Fuel Specialist Report).

Under the action alternative the fire hazard potential within restricted habitat is reduced. Although fire hazard is not reduced in all treated stands there is an increase in crown base height and a reduction in fire intensity. The following table reflects the change in fire hazard rating by acres within restricted and protected habitats:

Table 3. Fire hazard change to MSO protected and restricted habitat for the alternative 1 and 2

Fire Hazard Rating	Existing Protected Acres	Post-treatment Protected Acres	Existing Restricted Acres	Post-treatment Restricted Acres
Extreme	54	50	0	0
Very High	612	516	14	0
High	738	570	249	14
Moderate	820	1,005	93	342
Low	129	212	106	106

Table 4 displays the miles of road existing within MSO habitat, the miles of roads proposed for obliteration or closure and the resulting road density within owl habitat. Road densities are reduced within MSO habitat by 7.52 miles. This reduction will limit access into all four PACs within the project boundary potentially reducing habitat alteration and direct disturbance to owls using these habitats.

Table 4. Proposed closed and obliterated roads in MSO protected and restricted habitat for Alternative 1 and 2

Habitat Type	Existing Miles of System and Non-system Roads	Miles System Road Closed or Obliterated	Total Remaining Open
Protected (steep slope)	.20	.20	0.0
Restricted (target threshold)	1.2	.90	.30
Protected (PAC)	9.75	6.42	3.33
Total	11.75	7.52	3.63

Alternative 2

All treatments within MSO habitat are the same as in Alternative 1.

Cumulative Effects

Historical silviculture practices of removing large-sized trees and suppression of fires created the current forest structure. 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 fuels management specialist concluded that smoke from broadcast and pile burning in the Fort Valley and Eastside Project areas would have similar short-term direct (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. 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 the Jack Smith-Schultz Fuels Reduction and Forest Health project could occur simultaneously with burning activities on portions of the Fort Valley and Eastside projects. While there are numerous burning operations planned in areas adjacent to the Jack Smith-Schultz Fuels Reduction and Forest Health 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.

There is a slight chance that daytime drift smoke from the proposed Schultz Fuels Reduction and Forest Health project will reach the Orion Spring and Aspen Springs PAC. This would occur over a 1-2 day period of time per year. There is a greater chance that daytime drift smoke from Fort Valley project burning could move into the Orion and Aspen Spring PACs. This would occur over a 3-5 day per of time per year. Nighttime smoke would most likely move away from the slope of the San Francisco Peaks and into low-lying drainages moving away from PACs. Generally, within the urban interface smaller blocks are burned with early (9 am to 11 am) ignition and smoke production lasting until 3 pm. Smoke would not continue into the nighttime. Disturbances are localized and short-term in duration and will not affect the reproduction and overall distribution of the species.

Other cumulative effects come from activities such as recreation. Cumulative effects of vegetation treatments and recreation are not expected, as no new roads or trails will be designated as part of the Jack Smith/Schultz project. All temporary roads will be obliterated after implementation.

Treatments in owl habitat can affect the prey base immediately by impacting individuals of prey species due habitat disturbance of prey species' habitat and harm from mechanical operations or from fire. Conversely, prey species diversity will increase with increased diversity of vegetation structural stages and improvement of understory vegetation. Over time, a more diverse prey base would enable different prey species to prosper during variable climatic conditions, thus improving food availability. In addition, vegetation treatments in adjacent projects will help improve tree vigor and growth, and vegetative structural stage diversity, thus promoting the growth of larger trees and habitat components for MSO. Cumulatively, these adjacent project activities combined with this project's activities will not affect the reproduction or overall range of the MSO.

Black-footed Ferret

Analysis Methods

The following evaluation criteria were used to compare environmental consequences for all alternatives:

- Removal or modification of potential habitat

Black-footed ferrets occurred historically in northern Arizona, where their range apparently overlapped that of their primary prey, the Gunnison's prairie dog (*Cynomys gunnisoni*). Wild populations of this species are believed to have been extirpated from the state early in the 20th century as a result of prairie dog control programs. (AGFD 1996, Hoffmeister 1986). The only records from the regions listed by Hoffmeister (1986) are one from the Baca's Ranch, 16 miles northeast of Springerville, Arizona and another record 7 miles northeast of Williams in 1929. Cockum (1960) also reports a documented occurrence form Government Prairie near Parks and another from 12 miles west of Winona. Ferrets have been reintroduced as an experimental nonessential population in the Aubrey Valley near Seligman since 1996 (USDI 1996). The USFWS believes that undiscovered wild populations of black-footed ferrets may still exist where prairie dogs persist (USDI Fish and Wildlife Service 1998). Habitat for black-footed ferrets in northern Arizona is described as medium to large (>80 acres) prairie dog towns or complex of towns (>200+ acres). A complex consists of two or more neighboring prairie dog towns each less than 4.3 miles (7 km) from each other (Mikesic and Nystedt 2001).

Existing Conditions

There are no records of black-footed ferret in the project area or vicinity. There are no recorded Gunnison's prairie dog towns within the project.

Direct and Indirect Effects

No Action

There are no direct effects to black-footed ferrets as none occur in the project area. No action will not treat meadows or meadow edges and will continue to have trees encroach these habitats over time reducing potential habitat in meadow habitats for Gunnison's prairie dog, a primary prey species.

Alternative 1 – Proposed Action and Alternative 2

There are no direct effects to black-footed ferret as none occur in the project area. Indirect effects to the black-footed ferret include effects to ferret habitat, ferret prey species, or prey species habitat. There are no anticipated adverse effects to prey species or prey species habitat.

Meadow restoration treatments would improve and increase available habitat for Gunnison's prairie dog, a primary prey species. Both alternatives will increase available habitat for prairie dogs with 27 acres of meadow enhancement treatments.

Cumulative Effects
The area for analysis is the project area boundary. For both action alternatives there is no effect to the numbers, distribution or reproduction of the black-footed ferret so there is no added effect from past, present or foreseeable future projects.

SENSITIVE WILDLIFE SPECIES

Table 5. Sensitive wildlife species that are present or have habitat in the Jack Smith-Schultz action area

SPECIES NAME	SCIENTIFIC NAME
Birds	
Bald eagle	*Haliaeetus leucocephalus*
Northern goshawk	*Accipiter gentilis*
American peregrine falcon	*Falco peregrinis anatum*
Mammals	
Navajo Mogollon vole	*Microtus mogollonensis navaho*
Long-tailed vole	*Microtis longicaudus*
Merriam's shrew	*Sorex merriami leucogenys*
Allen's lappet browed bat	*Idionycteris phyllotis*
Pale Townsend's big-eared bat	*Corynorhinus townsendii pallescens*
Spotted bat	*Euderma maculatum*
Greater western mastiff bat	*Eumops parotis californicus*
Amphibians	
Northern leopard frog	*Rana pipiens*
Invertebrates	
Blue-black silverspot butterfly	*Speyeria nokomis nokomis*
Mountain silverspot butterfly	*Speyeria nokomis nitocris*
Spotted skipperling	*Piruna polingii*

Table 6 lists Forest Service sensitive species that were considered but dropped from detailed analysis because habitat does not exist in the analysis area.

Table 6. Sensitive wildlife species that were considered but eliminated from detailed analysis

SPECIES NAME	SCIENTIFIC NAME
Birds	
Clark's grebe	*Aechmophorus clarkii*
Ferruginous hawk	*Buteo regalis*
Western burrowing owl	*Athene cunicularia*
Mammals	
Wupatki Arizona pocket mouse	*Perognathus amplus cineris*
Dwarf Shrew	*Sorex nanus*
Amphibians	
Narrow-headed garter snake	*Thamnophis rufipunctus*

Bald Eagle

Analysis Methods

The following evaluation criteria were used to compare environmental consequences for all alternatives:

- Removal of potential habitat
- Disturbance from project implementation

Existing Conditions

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, the Migratory Bird Treaty 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. They feed on fish, waterfowl, terrestrial vertebrates, and carrion. 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 inches diameter that occur in groups and are much larger than other trees in roost stands (Dargan 1991).

Nesting**:** A small, resident population of bald eagles breeds in Arizona and New Mexico. These eagles place their nests on cliff ledges and in live trees or snags along major rivers and reservoirs. In Arizona, eagles are known to breed along the Salt, Verde, and Bill Williams rivers, on Tonto Creek, at Roosevelt Lake in central Arizona (USDA Forest Service 2001) and recently documented at Lower Lake Mary in northern Arizona. There are no nesting bald eagles within the Jack Smith-Schultz project. The only known nesting eagles on the Coconino National Forest are along north Lower Lake Mary, south Lower Lake Mary and the Verde River 8, 10 miles and 30 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. Another important habitat factor is the presence of large trees, snags, or ledges for foraging perches. There are no wetlands in the project area and it is unlikely that this 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 (Cinder Lake) approximately 2.5 miles east of the project boundary. This is a night roost on the northeast side of a small cinder cone approximately one mile north of Old Caves Crater. The project area provides north and northeast facing slopes consisting

primarily of mixed conifer with some ponderosa pine drainages and slopes. Highway 89N provides limited daytime foraging.

Foraging: Eagles forage widely and opportunistically on carrion, waterfowl or fish on the Forest. Waterfowl and fish distribution are driven by amount and timing of precipitation and fish stocking by the Arizona Game and Fish Department. Eagles are expected to use any open water that would support waterfowl. There are no significant water bodies in the project vicinity, although eagles may feed on mammalian prey in project area. Schultz Tank provides marginal foraging opportunities for eagles. Bald eagles have been observed perching in snags and dead-topped trees within and at the fringes of the Jack Smith-Schultz project area.

Direct and Indirect Effects

No Action
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 bald eagle roosting and foraging habitat at risk with respect to stand-replacing fire.

Tree densities would continue to be high slowing their growth into larger diameter classes and thereby limiting the development of larger diameter ($\geq$ 18-inch) trees important for roosting and perching.

Alternative 1 – Proposed Action and Alternative 2
Direct effects to the bald eagle would be from activities that cause disturbances (smoke, auditory or visual) to eagles within or adjacent to the project. There would be no direct effects to nesting eagles.

Burning activities are not expected to affect breeding or roosting eagles because there would be no activities within 2 miles of a nest or roost site. During the daytime the smoke would travel upward 1000-2000 feet above the ground. Generally, within the urban interface, smaller blocks are burned with early (9 am to 11 am) ignition and smoke production lasting until 3 pm. Smoke would not continue into the nighttime. Disturbances are localized and short-term in duration and will not affect the reproduction and overall distribution of the species.

Mechanical thinning activities are not expected to affect breeding eagles because there will be no activities within 2 miles of a nest site during the breeding season thus there would not be auditory effects to nesting eagles. There will be no direct effects to roosting eagles from thinning activities as there will be no activities within 2 miles of winter roost sites during the wintering season thus there would not be auditory effects to roosting eagles.

Under the action alternative, proposed mechanical treatments, broadcast 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 affect individual birds but would not affect the overall distribution or reproduction of the species.

Indirect effects to the bald eagle include affects to eagle habitat, eagle prey species, or prey species habitat. There are no anticipated adverse effects to prey species or prey species habitat. The main effects are more likely to occur when project treatments 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.

Thinning would improve old tree longevity. Lining of yellow pines and snags will reduce potential mortality to these components from burning activities. The action alternative includes recruitment of trees into developing old-growth stands over 20% of the area that may be used as future winter roost sites for bald eagles.

Cumulative Effects

The area for analysis includes the area that is within one mile of eagle nests, roosts, and high use winter foraging areas (Interstate 89N). Reviews of all projects (past, present and reasonably foreseeable) that have the potential to impact bald eagles were analyzed.

Short-term disturbance to foraging or roosting bald eagles during thinning and broadcast burning activities may cause eagles to forage and roost in nearby areas for the duration of the activity. Short-term (the time it takes to complete implementation) impacts can be considered cumulatively with similar impacts in the Fort Valley Forest Restoration, and Eastside projects however, implementation of these burns is not likely to occur simultaneously and do not combine to cause a negative effect. These effects combine with APS hazard tree removal for powerlines and ADOT and County hazard tree removal for highways that have reduced the number of snags and large trees for perching along winter foraging areas in the analysis area.

Cumulatively, these activities combined with this project's activities will not affect reproduction or the overall range of the bald eagle.

Northern Goshawk

Analysis Methods

The following evaluation criteria were used to compare environmental consequences for all alternatives:

- Disturbance
- Canopy cover within post-fledgling family area (PFA) and outside PFA's
- VSS distribution within PFA's and outside PFA's
- Road density

The Vegetation section evaluates the distribution of habitat structures at the ecosystem management area level, at the mid-scale level and at the small scale level.

Existing Conditions

Two northern goshawk post-fledgling family areas (PFA) are located within the project boundary, Orion #040205 and Pipeline II #040211. The Orion PFA is 781 acres (472 acres within the project) and within the PFA 185 acres have been designated as nest areas which include known existing and historic nest sites. The Pipeline II PFA is 634 acres and within the PFA 190 acres have been designated as nest areas. The nest stands for Orion PFA were previously designated and are outside of the project area; the nest stands are designated within the project area for the Pipeline II PFA (Figure 2). The PFAs were monitored in 2006 and 2007 with one, the Orion PFA, active and the Pipeline II PFA not occupied. All of the project area and one-half mile beyond the boundary, with the exception of wilderness that was inaccessible, was surveyed for northern goshawks in 2004 and 2005 according to Region 3 protocol. No goshawk sightings were documented during that survey period. Areas that were inaccessible for survey will be managed as occupied.

Canopy Cover

For ponderosa pine the Forest Plan states that outside PFAs canopy cover should average 40+% in VSS 4, 5 and 6. Areas within PFAs average canopy cover in VSS 4 should be 60+% (1/3) and 50+% (2/3), VSS 5 and 6 should average 50+%. Nesting areas should be VSS 5 and 6 and average 50-70% canopy cover. Although canopy cover is met for the existing VSS condition, the desired condition is more clumped and grouped spatial arrangement of trees, uneven-aged forest structure with high canopy cover. Snags and down woody debris are retained within groups. Openings are scattered throughout within PFAs and outside PFAs. Rare VSS classes and ages (VSS 1, 2, 5 and 6) are emphasized within clumps and groups and fuel reduction is focused on the most common VSS class (VSS 3).

Vegetative Structural Stage (VSS)

The Forest Plan states that the desired Vegetative Structural Stage (VSS) for spruce-fir, mixed conifer, and ponderosa pine forests, within and outside PFAs is 10%, 10%, 20%, 20%, 20%, 20% for VSS 1-6, respectively. The existing VSS distributions within the PFA and outside the PFA do not meet recommended Forest Plan guidelines. VSS distribution of sites still lacks optimal nesting stands (VSS 5 and 6) and grass, forb, shrub and seedling/sapling classes (VSS 1 and 2) are also lacking. Currently there is a lack of optimal nest sites across the project area due primarily to low densities within these VSS classes. Vegetative structural stage distribution in the areas outside the PFAs is lacking in VSS 1, 2 and 5, 6.

Road Density

There are approximately 7.2 miles of system and non-system roads within post-fledgling family areas (3.4 miles in Orion Springs PFA and 3.8 miles within Pipeline II PFA) in the project. Areas outside PFAs have approximately 91.3 miles of existing roads within the project.

Direct and Indirect Effects

No Action
Habitat conditions for wildlife would remain in their current condition, not withstanding natural processes. This 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. High road densities would continue to provide access into sensitive goshawk habitats increasing the potential for habitat alteration or direct disturbance of northern goshawks. Vegetative structural stage distributions as outlined in the Forest Plan and Management Recommendations for the Northern Goshawk in the Southwestern United States would never be attained.

Alternative 1 – Proposed Action
Disturbance
Noise from mechanical treatments are not likely to *directly effect* nesting goshawks as no thinning will occur within the nest stands, PFAs, or un-surveyed habitat (inaccessible wilderness) during the breeding season. There are potential direct effects from smoke. Smoke could affect nesting and feeding behavior. Goshawk 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. These smoke disturbances would be short-term and will not affect the overall distribution of northern goshawk.

Project implementation will avoid burning near goshawk nesting areas during critical periods in the goshawks life cycle. Smoke accumulation during times when goshawks are incubating eggs and tending nestlings and fledglings could cause adults to leave the area; this in turn could cause reproductive failure for the year. Smoke effects are short-term (1-3 days) and of low intensity (drift smoke). 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. Burn plans will avoid burning the entire home range of a northern goshawk pair in a single year.

It is estimated that there may be up to 20% loss of snags and 50% loss of downed logs during broadcast burning (Randall-Parker and Miller 1999) although many will be

protected using appropriate ignition and piling techniques, and lining of most snags and large logs. In addition, after burning, trees will be felled to replace logs burned up during prescribed fire to meet forest plan guidelines. Recruitment snags will be identified from live trees that exhibit defects ideal for wildlife. For example, trees with forked or spiked tops, lightning strikes, mistletoe brooms, or fading crowns.

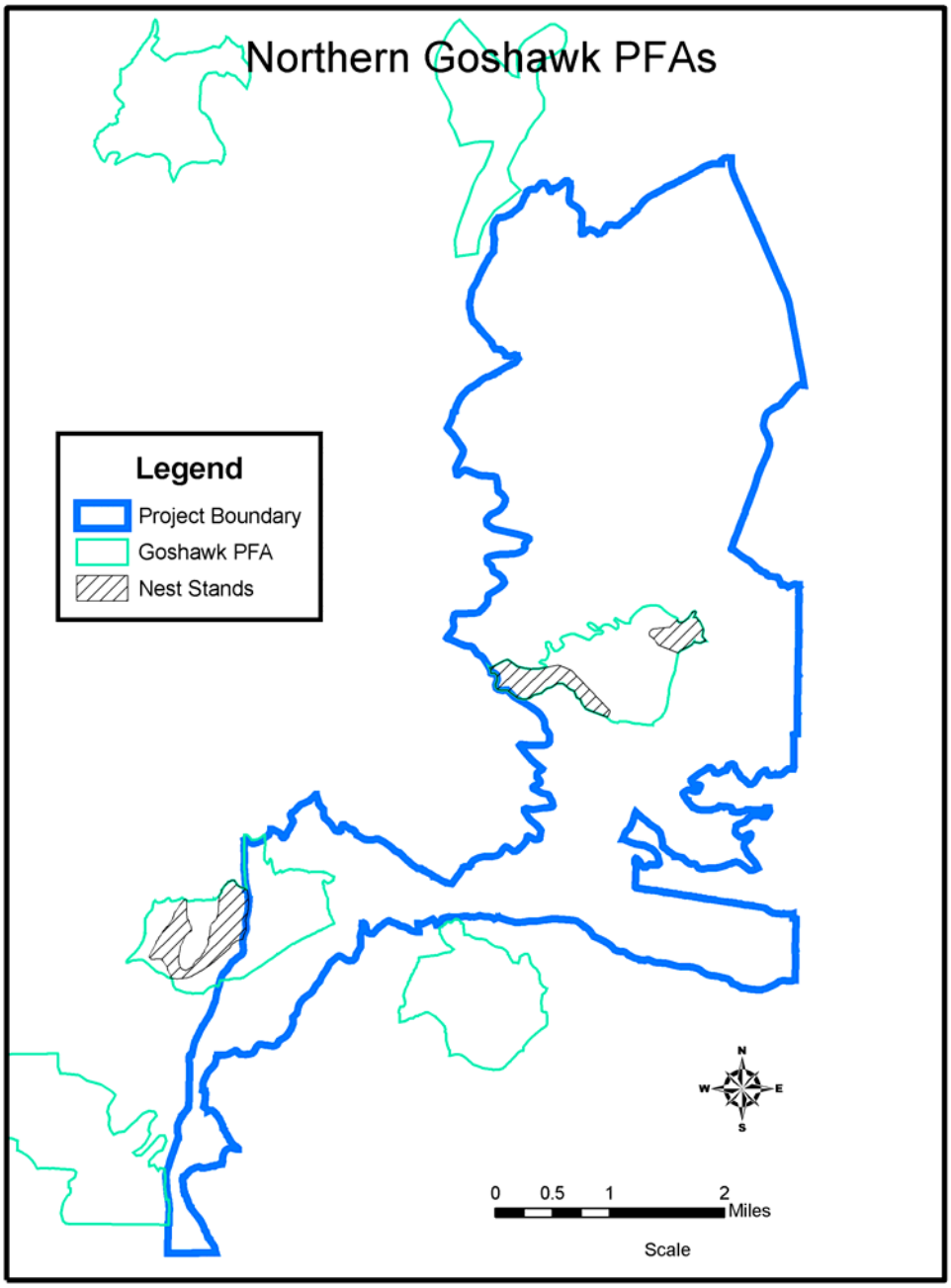
Reduction of snags and logs would have a negative impact on numbers of prey items, thus prey availability, for northern goshawk. The impact of this effect is expected to lessen in the short-term as snags fall and become logs. The number of snags would continue to be in short supply, due to an existing shortage of snags. The number of snags is expected to increase in the future as other trees grow, age, and die. Under the action alternative the resiliency of the area to withstand wildfire will improve due to the increase in crown base height and the reduced ground fuels. Fire hazard potential outside the PFAs is reduced.

Canopy Cover

Table 7 through Table 11 display how Alternative 1 will meet Forest Plan guidelines for canopy cover. Alternative 1 will maintain canopy cover values as identified in desired conditions in areas outside PFAs (Table 7 and 8). Nest stands will be treated with a burn only having a potential reduction in canopy cover of 5-7 percent (Table 11). The existing condition for canopy cover was determined by averaging canopy cover across stands within VSS 4, 5, and 6. Post treatment canopy cover is measured at the group and clump level and is a percentage of the fixed area (group) covered by the crowns of plants delimited by a vertical projection of the outermost perimeter of the spread of foliage. When measured as noted above, Alternative 1 will meet Forest Plan guidelines by maintaining a range of 50% to 60% canopy cover in Zone 1 and 2 and 50% to 100% in Zone 3 within VSS 4 while maintaining a minimum of 1/3 of the VSS 4 at 60% canopy cover. Alternative 1 will maintain 60% or greater canopy cover in 5 and 6 classes where existing. Existing low average canopy cover levels in these VSS classes will continue to be low. Post-treatment canopy cover will maintain groups and clumps of trees with variable canopy cover to allow for wildlife and prey species habitat, tree regeneration, and understory diversity. Groups of trees will be located in areas where historical evidences exist or where best group/clump structure exists at the time of implementation. A diverse age and size class and interlocking crowns will occur in clumps. Openings will be scattered within the PFAs and outside the PFAs. Openings will not be greater that two acres in PFAs and four acres outside PFAs.

Alternative 1 canopy cover calculations do not include between group interspaces. Interspaces will maintain up to 30 to 50 percent of the project area in a forested condition with 50 to 70 percent of the project in openings or interspace. When canopy cover is

Figure 2. Northern Goshawk Post-fledgling Family Areas in the Jack Smith Project and Vicinity.



averaged across the stand and includes openings and interspaces Forest Plan standards and guidelines are not met for canopy cover for any of the VSS classes except for VSS 2 in areas outside PFAs. For areas within PFAs guidelines are met for VSS 2, 5 and 6 as well as within all of the nest stands. Mixed conifer stands will maintain a canopy of 57-83 percent.

Vegetative Structural Stages (VSS)

Table 12 and Table 13 display how Alternative 1 proposed treatments will meet Forest Plan guidelines for VSS. Treatments described in the action alternative would alter VSS class distribution, changing the project area from one dominated by VSS 3 more toward the desired future condition, although still not meeting the desired future condition. The no action nor Alternative 1 will result immediately in the desired VSS class distribution as outlined in the Forest Plan for the northern goshawk. Trees will grow into the larger diameter classes at a faster rate with implementation of Alternative 1. The proposed action would offer higher quality foraging habitat over time due to improved habitat conditions for most prey species. There are no thinning treatments proposed in mixed conifer resulting in a continued lack of smaller VSS classes (VSS 1 and 2).

Road Density

For both alternatives road density within post-fledgling family areas is reduced by 6.7 miles. In the Orion Springs PFA all roads are either closed or obliterated and for the Pipeline II PFA all but .45 miles of road are closed or obliterated. Road density within one of the Pipeline II nest stands will be reduced by 0.5 mile. Road densities in areas outside PFAs will be reduced by fifty-nine miles across the project. This reduction in road density will limit access into goshawk habitat and reduce potential for habitat alteration or direct disturbance to goshawks using these habitats.

Alternative 2

Disturbance

Effects would be the same as Alternative 1.

Canopy Cover

Table 7 through Table 11 display how Alternative 2 will meet Forest Plan guidelines for canopy cover. Canopy cover is averaged across the stand both within the PFA and outside the PFA. Alternative 2 will meet Forest Plan guidelines by maintaining a range of 50% canopy cover within VSS 4 with 2/3 50+% canopy cover and 1/3 60+% canopy and maintaining a 52 to 78 percent canopy cover in 5 and 6 classes within PFAs. Nest stands will be treated with a burn only treatment. During broadcast burning activities, torching may occur within nest stands. Torching would mimic natural gap processes that occur under natural conditions. Canopy cover could be reduced by approximately 5-7 percent. This will not reduce the canopy cover below 50% in any of the nest stands. Nest stands will meet Forest Plan guidelines for canopy cover. Alternative 2 will maintain a 46 to 50 percent canopy cover in VSS 4, 5, and 6 outside PFAs. Post-treatment canopy cover will maintain groups and clumps of trees with variable canopy cover to allow for wildlife and prey species habitat, tree regeneration, and understory diversity. A diverse age and size class and interlocking crowns will occur in clumps.

Openings will be scattered throughout inside the PFAs and outside the PFAs in foraging areas. Openings will not be greater that two acres in PFAs and four acres outside PFAs. Alternative 2 does not incorporate interspaces and will maintain up to 80 percent of the project area in a forested condition with 20 percent in openings. Mixed conifer stands will maintain a canopy of 57- 83 percent.

Vegetative Structural Stages (VSS)

Table 12 and Table 13 display how Alternative 2 proposed treatments will meet Forest Plan guidelines for VSS. Treatments described in Alternative 2 would alter VSS class distribution in ponderosa pine, changing the project area from one dominated by VSS 3 more toward the desired future condition, although still not meeting the desired future condition. Alternative 2 will not result immediately in the desired VSS class distribution as outlined in the Forest Plan for the northern goshawk. Trees will grow into the larger diameter classes at a slower rate than Alternative 1. Both alternatives would offer higher quality foraging habitat over time due to improved habitat conditions for prey species although Alternative 2 will provide 30 to 50 percent less forage than Alternative 1. There will be no thinning treatments in mixed conifer resulting in a continued lack of smaller VSS classes (VSS 1 and 2).

Tables 7-11 best display the effects of treatments on canopy cover as it pertains to the goshawk guidelines. All proposed treatments in the project are unevenaged. Because vegetative structural stages are best used to display effects for even-aged management in the following tables the larger VSS classes tend to overshadow the smaller VSS classes because they account for more basal area. A stand which has met the VSS distribution at the stand level would be classified as a VSS 6. The higher percentage of stands classified in greater VSS size classes the closer the project is to meeting the goshawk guidelines.

Table 7. Ponderosa pine canopy cover by VSS, outside PFAs, within the project area. VSS classes 1= grass/forb/shrub, 2=1-4.9 inches DBH, 3= 5-11.9 inches DBH 4= 12-17.9 inches DBH, 5=18-23.9 DBH, 6=24+inches DBH

VSS	Acres	Pre-Treatment % of VSS	Pre-Treatment Canopy Cover	Alternative 1 – Post Treatment Canopy Cover in Forested Areas Only	Alternative 1 – Post Treatment Canopy Cover across the whole stand	Alternative 2 – Post Treatment Canopy Cover across the whole stand	Post Treatment VSS Acres for Alt. 1 & 2	Post Treatment % of VSS
1	231	2	16	16	16	16	231	2
2	554	6	54	43	41	43	52	1
3	3993	41	56	43	29	47	1911	20
4*	2887	30	60	42	26	49	3557	36
5	1131	12	51	40	30	46	2774	28
6	984	10	56	49	46	50	1255	13

Table 8. Mixed conifer canopy cover by VSS outside PFAs, in the project area. VSS classes 1= grass/forb/shrub, 2=1-4.9 inches DBH, 3= 5-11.9 inches DBH 4= 12-17.9 inches DBH, 5=18-23.9 DBH, 6=24+inches DBH

VSS	Acres	Pre-Treatment % of VSS	Pre-Treatment Canopy Cover	Alternative 1 – Post Treatment Canopy Cover in Forested Areas Only	Alternative 1 – Post Treatment Canopy Cover across the whole stand	Alternative 2 – Post Treatment Canopy Cover across the whole stand	Post Treatment VSS Acres for Alt. 1 & 2	Post Treatment % of VSS
1	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0
4	61	8	57	57	57	57	61	8
5	594	81	73	73	73	73	594	81
6	76	10	73	73	73	73	76	10

Table 9. Ponderosa pine canopy cover by VSS within PFAS (includes nest stands) in the project area. VSS classes 1= grass/forb/shrub, 2=1-4.9 inches DBH, 3= 5-11.9 inches DBH 4= 12-17.9 inches DBH, 5=18-23.9 DBH, 6=24+inches DBH

VSS	Acres	Pre-Treatment % of VSS	Pre-Treatment Canopy Cover	Alternative 1 – Post Treatment Canopy Cover in Forested Areas Only	Alternative 1 – Post Treatment Canopy Cover across the whole stand	Alternative 2 – Post Treatment Canopy Cover across the whole stand	Post Treatment VSS Acres for Alt. 1 & 2	Post Treatment % of VSS
1	0	0	0	0	0	0	0	0
2	51	5	51	43	43	43	13	1
3	369	39	64	43	28	51	191	20
4*	429	46	56	42*	24*	50*	213	23
5	77	8	80	78	78	78	190	20
6	17	2	69	45	63	52	336	36

*1/3 of the VSS 4 groups will have a minimum of 60% canopy cover and the remaining 2/3 VSS 4 groups will maintain a minimum 50% canopy cover. The 50% average shown might indicate this standard is not being met, however the average number is due to the high occurrence of VSS 1, 2, and 3 groups, which have open canopies, within the VSS 4 stands and as a result brings the overall canopy cover down within these VSS 4 stands.

Table 10. Mixed conifer canopy cover by VSS, within PFAs, in the project area. VSS classes 1= grass/forb/shrub, 2=1-4.9 inches DBH, 3= 5-11.9 inches DBH 4= 12-17.9 inches DBH, 5=18-23.9 DBH, 6=24+inches DBH

VSS	Acres	Pre-Treatment Percent of VSS	Pre-treatment Canopy Cover	Alternative 1 – Post Treatment Canopy Cover **	Alternative 2 – Post Treatment Canopy Cover	Post Treatment VSS Acres for Alt. 1 and 2	Post Treatment % of VSS
1	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0
5	64*	100	83	83	83	64	100
6	0	0	0	0	0	0	0

*This is also a nest stand

Table 11. Ponderosa pine nest stands (burn only treatment) canopy cover by VSS in the project area. VSS classes 1= grass/forb/shrub, 2=1-4.9 inches DBH, 3= 5-11.9 inches DBH 4= 12-17.9 inches DBH, 5=18-23.9 DBH, 6=24+inches DBH

VSS	Acres	Pre and Post Treatment VSS	Pre Treatment Canopy Cover	Post Treatment Canopy Cover Alternative 1 and 2
1	0	0	0	0
2	12	13	52	47
3	19	20	70	63
4	35	36	61	55
5	13	14	63	57
6	17	17	69	63

Table 12. Alternative 1- VSS class for 12" thinning, uneven-aged fuels emphasis and uneven-aged resource emphasis. VSS classes 1= grass/forb/shrub, 2=1-4.9 inches DBH, 3= 5-11.9 inches DBH 4= 12-17.9 inches DBH, 5=18-23.9 DBH, 6=24+inches DBH

VSS	Pre-treatment Acres*	Pre-treatment % of VSS Acres	Post Treatment VSS Acres for Alt. 1	Post Treatment VSS Acres for Alt. 1
1 and 2	1990	24	1751	21
3	2815	34	1369	17
4	2230	27	1919	23
5	755	9	2069	25
6	398	5	1079	13

*VSS is calculated on a per acre average and is based on FSVEG modeling. Pre-treatment acres vary from Alternative 2 and this is a reflection of using sample data over different sized areas.

Table 13. Alternative 2 – VSS classes for 12" thinning, uneven-aged outside PFAs and uneven-aged within PFAs. VSS classes 1= grass/forb/shrub, 2=1-4.9 inches DBH, 3= 5-11.9 inches DBH 4= 12-17.9 inches DBH, 5=18-23.9 DBH, 6=24+inches DBH

VSS	Pre-treatment Acres	Pre-treatment % of VSS Acres	Post Treatment VSS Acres for Alt 2	Post Treatment VSS Acres for Alt. 2
1 and 2	1565	19	1741	21
3	2528	31	1728	21
4	2821	34	2103	26
5	888	11	1660	20
6	388	5	956	12

*VSS is calculated on a per acre average and is based on FSVEG modeling. Pre-treatment acres vary from Alternative 2 and this is a reflection of using sample data over different sized areas.

Road Density

The effects are the same as Alternative 1.

Cumulative Effects

The area of analysis is the project and a one-half mile area surrounding the project boundary. Reviews of all projects (past, present and reasonably foreseeable) that have the potential to impact northern goshawks were analyzed.

There is an added indirect effect regarding vegetation modification activities. Other projects where modification of goshawk habitat occurs within the Jack Smith-Schultz project area are: ADOT tree removal along North Highway 89 and APS hazard tree

removal. Projects adjacent to and within one-half mile of the project are Fort Valley Ecosystem Restoration and Eastside Fuel Reduction and Forest Health. Burn plans for Jack Smith Schultz will be coordinated with burn plans for Fort Valley Ecosystem Restoration and Eastside Fuel Reduction and Forest Health to avoid burning the entire home range of a northern goshawk pair in a single year. Cumulative effects are not expected to affect the reproduction or overall distribution of northern goshawks because generally, projects are designed to move toward the desired conditions for northern goshawks as identified in the Northern Goshawk Management Recommendations (Reynolds et. al., 1992).

American Peregrine Falcon

Analysis Methods

The following evaluation criteria were used to compare environmental consequences for all alternatives:

- Prey species habitat
- Disturbance from project implementation

Existing Conditions

The peregrine falcon was removed from the Federal List of Endangered and Threatened Wildlife in August 1999 (USDI 1999a) and is now a Forest Service Sensitive species. The essential habitat for peregrine falcon includes rock cliffs for nesting and a large foraging area. Suitable nesting sites on rock cliffs have a mean height of 200 to 300 feet. Peregrine occur state wide as a migrant, transient and/or wintering individual. The subspecies anatum breeds here on selected isolated cliff ledges and is a permanent resident on the Coconino National Forest. There are two eyrie locations on Mt. Elden both over two miles south of the project area. Peregrines forage throughout the Dry Lake Hills and likely forage in the project area. Peregrines prey mainly on birds found in wetlands, riparian areas, meadows, parklands, croplands, mountain valleys, and lakes within a ten to twenty mile radius from the nest site. Prey items include 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 eyries and mortality from encounters with powerlines.

Direct and Indirect Effects

No Action

There are not direct effects from no action. There would be no change to the prey species, and no change in falcon hunting patterns within associated forest structure. This is not a negative effect.

Alternative 1 – Proposed Action and Alternative 2
No direct effects from thinning are expected since no thinning will take place within two miles of eyrie locations. There are no potential direct effects from smoke as no burning will take place within two miles of eyrie locations and winds are not expected to drift smoke south of the project area over Mt. Elden.

Indirect effects from vegetation modification would occur. Thinning can 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. Conversely, prey species diversity will increase with increased diversity of vegetative structural stages and improved understory vegetation. A more diverse prey base enables different prey species to prosper during variable climatic conditions thus food availability improves. Thinning of the forest would increase sight distance for foraging peregrine falcons which facilitates hunting conditions.

Cumulative Effects
Cumulative effects were based on the likelihood of disturbance (smoke, visual, auditory) to impact peregrine falcons 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 peregrine falcons were analyzed.

There is an additive indirect effect regarding vegetation modification activities. Other projects where thinning occurs can 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. Projects are implemented at different times and/or different locations, thus disturbances to the prey base are minimized. Smoke from adjacent projects may have an additive effect on foraging birds. Activities of these projects do not affect the reproduction or overall distribution of peregrine falcons.

Navajo Mogollon Vole

Analysis Methods
The following evaluation criteria were used to compare environmental consequences for all alternatives:

- Amount and distribution of habitat
- Disturbance from project implementation

Existing Conditions
There are no documented populations of voles in the project area. Suitable habitat exists within the 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. They rely on grasses and other herbaceous vegetation for food or cover. Suitable habitat within the project area is currently less than 16% of the project area (twenty-eight acres of grassy opening and meadows, and 1,892 acres of forested stands of less than 40% canopy closure).

Direct and Indirect Effects

No Action
There would be no disturbance under no action and no direct effects.

No action will continue to provide habitat for this species. Currently 84% of the project area is in a moderately closed to closed condition. Dense forest stands provide low quality habitat for the Mogollon vole. Meadows would not be rehabilitated, thus there would not be any benefits to these species. Favorable habitat would decrease over time as conifers encroach into meadows and canopy closure increases.

Under no action the high fire hazard potential would persist; a large crown wildfire event would have the potential to affect many individuals.

Alternative 1 – Proposed Action and Alternative 2
Disturbance during thinning and broadcast burning activities may occur to individual voles; some individuals may be lost. Such activities would occur across the project area at different times; therefore, activities would be temporally and spatially separated which reduces impacts to this species. Effects would be short-term. There would be no effects to population viability of voles.

Broadcast burning removes cover and food of Navajo Mogollon vole. Meadows and open areas would rebound after broadcast burning; herbaceous vegetation would be more vigorous, and meadow and understory habitats would be healthier.

Benefits to voles would occur due to the reduction of dense forest canopy and increased growth in the herbaceous vegetation on the forest floor in treatment areas for the action alternative. The resulting groups of trees interspersed with openings and interspaces will improve habitat across the project.

Benefits to voles would occur due to the closure or obliteration of sixty-six miles of roads within potential habitat. Of the sixty-six miles, thirty-eight miles will be obliterated and twenty-eight will be closed. Over time obliterated roads would heal and herbaceous vegetation would increase improving habitat for the vole.

Alternative 2
Alternative 2 would have less grassy openings and no between group interspaces providing a slightly less benefit overall to vole habitat compared to Alternative 1.

Cumulative Effects
The area for cumulative effects analysis is the project area. Reviews of all projects (past, present and reasonably foreseeable) that have the potential to impact Navajo Mogollon voles were analyzed.

Recreational activities will occur, such as hiking, biking, and camping, thereby eliminating these areas as habitat for voles. Recreation and road travel at current levels

continues to pose an adverse affect to voles due to soil and vegetation disturbance and soil compaction. The Travel Management Rule (TMR) and the associated Coconino National Forest TMR process proposes to close the Forest to cross-country vehicle travel further reducing adverse affects to voles due to soil and vegetation disturbance. Forest and range management practices that promote herbaceous growth could lead to increased vole populations. Cumulatively, these projects and activities do not affect the overall distribution of Navajo Mogollon vole.

Long-tailed vole

Analysis Methods
The following evaluation criteria were used to compare environmental consequences for all alternatives:

- Amount and distribution of habitat
- Disturbance from project implementation

Existing Conditions
There are no documented populations of voles in the project area. Suitable habitat exists within the area. Long-tailed voles occupy meadows, grassy valleys, grassy clearing in forests, sagebrush flats, and rocky slopes within coniferous forests. They are known to occur at Little Spring at about 8,000 feet in elevation as well as at a few places higher up the San Francisco Peaks (to 11,500 feet). They rely on grasses and other herbaceous vegetation for food or cover. Suitable habitat within the project area is currently less than 16% of the project area. (Twenty - eight acres of grassy opening and meadows, and 1,892 acres of stands of less than 40% canopy closure).

Direct and Indirect Effects

No Action
There would be no disturbance under no action and no direct effects.

No action will continue to provide habitat for this species. Currently eight-four percent of the project area is in a moderately closed to closed condition. Dense forest stands provide low quality habitat for the long-tailed vole. Meadows would not be rehabilitated, thus there would not be any benefits to these species. Favorable habitat would decrease over time as conifers encroach into meadows and canopy closure increases. High road densities would continue to fragment habitat.

Under no action the high fire hazard potential would persist; a large crown wildfire event would have the potential to affect many individuals.

Alternative 1 – Proposed Action and Alternative 2
Disturbance during thinning and broadcast burning activities may occur to individual voles; some individuals may be lost. Such activities would occur across the project area at different times; therefore, activities would be temporally and spatially separated which

reduces impacts to this species. Effects would be short-term. There would be no effects to population viability of voles.

Broadcast burning removes cover and food of long-tailed vole. Meadows and open areas would rebound after broadcast burning; herbaceous vegetation would be more vigorous, and meadow and understory habitats would be healthier.

Benefits to voles would occur due to the reduction of dense forest canopy and increased growth in the herbaceous vegetation on the forest floor in treatment areas for the action alternative. The resulting groups of trees interspersed with openings and interspaces will improve habitat across the project.

Benefits to voles would occur due to the closure or obliteration of sixty-six miles of roads within potential habitat. Of the sixty-six miles thirty-eight miles will be obliterated and twenty-eight will be closed. Over time obliterated roads would heal and herbaceous vegetation would increase improving habitat for the vole.

Alternative 2
Alternative 2 would have less grassy openings and no between group interspaces providing a slightly less benefit overall to vole habitat compared to Alternative 1.

Cumulative Effects
The area for cumulative effects analysis is the project area. Reviews of all projects (past, present and reasonably foreseeable) that have the potential to impact long-tailed voles were analyzed.

Recreational activities will occur, such as hiking, biking, and camping, thereby eliminating these areas as habitat for voles. Recreation and road travel at current levels continues to pose an adverse affect to voles due to soil and vegetation disturbance and soil compaction. The Travel Management Rule (TMR) and the associated Coconino National Forest TMR process proposes to close the Forest to cross-country vehicle travel further reducing adverse affects to voles due to soil and vegetation disturbance. Forest and range management practices that promote herbaceous growth could lead to increased vole populations. Cumulatively, these projects and activities do not affect the overall distribution of log-tailed vole.

Merriam's Shrew

Analysis Methods
The following evaluation criteria were used to compare environmental consequences for all alternatives:

- Amount and distribution of habitat
- Disturbance from project implementation

Existing Conditions
There are no documented populations of shrews in the project area. Suitable habitat exists within the project area. Merriam's shrews occupy cool, grassy places. The shrews usually are found in dry places, often not far from water, near coniferous forests (Hoffmeister, 1986). They are insectivorous, feeding on an assortment of invertebrates such as, spiders, beetles, and crickets. Suitable habitat within the project area is currently less than sixteen percent of the project area (twenty-eight acres of grassy opening and meadows, and 1,892 acres of stands less than 40% canopy closure).

Direct and Indirect Effects

No Action
There would be no disturbance under no action and no direct effects.

No action will continue to provide habitat for this species. Currently eight-four percent of the project area is in a moderately closed to closed condition. Dense forest stands provide low quality habitat for the shrews. Meadows would not be rehabilitated, thus there would not be any benefits to these species. Favorable habitat would decrease over time as conifers encroach into meadows and canopy closure increases. High road densities would continue to fragment habitat.

Under no action the high fire hazard potential would persist; a large crown wildfire event would have the potential to affect many individuals.

Alternative 1 – Proposed Action and Alternative 2
Disturbance during thinning and broadcast burning activities may occur to individual shrews; some individuals may be lost. Such activities would occur across the project area at different times; therefore, activities would be temporally and spatially separated which reduces impacts to this species. Effects would be short-term. There would be no effects to population viability of shrews.

Broadcast burning removes cover and food for prey of Merriam's shrew. Meadows and open areas would rebound after broadcast burning; herbaceous vegetation would be more vigorous, and meadow and understory habitats would be healthier.

Benefits to shrews would occur due to the reduction of dense forest canopy and increased growth in the herbaceous vegetation on the forest floor in treatment areas for the action alternative. The resulting groups of trees interspersed with openings and interspaces will improve habitat across the project.

Benefits to shrews would occur due to the closure or obliteration of sixty-six miles of roads within potential habitat. Of the sixty-six miles, thirty-eight miles will be obliterated and twenty-eight will be closed. Over time obliterated roads would heal and herbaceous vegetation would increase improving habitat for the shrew and its prey.

Alternative 2
Alternative 2 would have less grassy openings and no between group interspaces providing a slightly less benefit overall to shrew habitat compared to Alternative 1.

Cumulative Effects
The area for cumulative effects analysis is the project area. Reviews of all projects (past, present and reasonably foreseeable) that have the potential to impact Merriam's shrew were analyzed.

Recreational activities will occur, such as hiking, biking, and camping, thereby eliminating these areas as habitat for voles. Recreation and road travel at current levels continues to pose an adverse affect to shrews due to soil and vegetation disturbance and soil compaction. The Travel Management Rule (TMR) and the associated Coconino National Forest TMR process proposes to close the Forest to cross-country vehicle travel further reducing adverse affects to shrews due to soil and vegetation disturbance. Forest and range management practices that promote herbaceous growth could lead to increased shrew populations. Cumulatively, these projects and activities do not affect the overall distribution of Merriam's shrew.

Allen's Lappet-browed Bat

Analysis Methods
The following evaluation criteria were used to compare environmental consequences for all alternatives:
- Amount and distribution of habitat
- Disturbance from project implementation

Existing Conditions
Allen's lappet-browed bats have been found in a variety of habitats in Arizona, including ponderosa pine, pinyon-juniper, Mexican woodland, white fir forests and Mohave desertscrub. They are often associated with water, whether for feeding or drinking, or both is unclear. There are no documented populations of Allen's lappet-browed bats in the project area. Hoffmeister (1986) documents Allen's lappet-browed bats occupying mine shafts or rocky areas and cliffs for roosts. A study conducted on the Coconino National Forest also documented lappet-browed bats using snags as roost sites. Suitable foraging habitat exists within the project area. The nearest historic locations are about one to two miles south of the project boundary at the base of Mount Elden, Rio de Flag, and at the Museum of Northern Arizona property. A more recent study (1993 to 1995) documented Allen's lappet-browed bats in the Fort Valley area near Big Leroux Spring and Bismarck Lake (both approximately four miles distance from the project boundary). Suitable habitat in the project would be large snags used for roosting and foraging habitat including areas with water and insects.

Direct and Indirect Effects

No Action
There would be no disturbance under no action and no direct effects. No action will continue to provide habitat for this species. Under no action the high fire hazard potential would persist; a large crown wildfire event would have the potential to affect individuals.

Alternative 1 – Proposed Action and Alternative 2
Disturbance could occur during thinning and broadcast burning activities if bats are roosting in snags within the project. There may be some losses of snags with the potential to directly affect roosting bats. All snags 18 inches in diameter and larger will be fire-lined prior to prescribed burning to reduce potential impacts to roosting bats. Both action alternatives are expected to result in a slight 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 temporarily removes cover and food of lappet-browed bats. Meadows and open areas would rebound after broadcast burning; herbaceous vegetation would be more vigorous, and meadow and understory habitats would be healthier.

Benefits to lappet-browed bats would occur due to the reduction of dense forest canopy and increased growth in the herbaceous vegetation on the forest floor in treatment areas for the action alternatives. The resulting groups of trees interspersed with openings and interspaces will improve habitat for this bats prey across the project.

Benefits to lappet-browed bats would occur due to the closure or obliteration of sixty-six miles of roads within potential foraging habitat. Of the sixty-six miles thirty-eight miles will be obliterated and twenty-eight will be closed. Over time obliterated roads would heal and herbaceous vegetation would increase improving habitat for insects that provide food for bats.

Alternative 2
Alternative 2 would have less grassy openings and no between group interspaces providing a slightly less benefit overall to bat habitat compared to Alternative 1.

Cumulative Effects
The area considered for cumulative effects is the project area. Reviews of all projects (past, present and reasonably foreseeable) that have the potential to impact Allen's lappet-browed were analyzed.

The reduction of understory vegetation by ungulate grazing within the project adds to the reduction of plant availability to adult insects. All of the area is currently not being grazed by livestock reducing the potential for cumulative impacts. Elk will continue to reduce vegetative understory in meadows and around waters.

Spotted Bat

Analysis Methods
The following evaluation criteria were used to compare environmental consequences for all alternatives:

- Amount and distribution of habitat
- Disturbance from project implementation

Existing Conditions
Spotted bats are found to occur mostly in the dry, desertscrub in Arizona, but range up to ponderosa pine. There are no data that document populations of spotted bats on the Forest or in the project area. Most localities where they are known to occur have nearby cliffs and water sources. They are thought to be dependant on large, isolated cliffs for roosting. Evidence suggests moths are the dominant food item with occasional prey items including June beetles and grasshoppers. There is no roosting habitat for spotted bats as there are no caves or cliffs in the project. Suitable roosting habitat occurs approximately one and one-half miles from the project on Mount Elden. Suitable foraging habitat within the project would be forest openings and meadows.

Direct and Indirect Effects

No Action
There would be no disturbance under no action and no direct effects. Under no action meadows would not be rehabilitated, thus there would not be any beneficial effect to this species prey. Favorable foraging habitat would decrease over time as meadows are encroached by conifers and canopy closure increases and understory productivity and diversity decreases. High fire hazard potential in the project area would persist.

Alternative 1 – Proposed Action and Alternative 2
There would be no direct disturbance to roosting bats as no roosting habitat occurs within the project.

Foraging habitat will be managed to maintain adequate insect populations. Broadcast burning temporarily removes food for insects which spotted bats feed on. Meadows and open areas would rebound after broadcast burning; herbaceous vegetation would be more vigorous, and meadow and understory habitats would be healthier.

Benefits to spotted bats would occur due to the reduction of dense forest canopy and increased growth in the herbaceous vegetation on the forest floor in treatment areas for the action alternatives. The resulting groups of trees interspersed with openings and interspaces will improve habitat for this bats prey habitat across the project.

Benefits to spotted bats would occur due to the closure or obliteration of sixty-six miles of roads within potential habitat. Of the sixty-six miles thirty-eight miles will be obliterated and twenty-eight will be closed. Over time obliterated roads would heal and

herbaceous vegetation would increase improving habitat for insects that provide food for bats.

Alternative 2
Alternative 2 would have less grassy openings and no between group interspaces providing a slightly less benefit overall to bat habitat compared to Alternative 1.

Cumulative Effects
The area considered for cumulative effects is the project area. Reviews of all projects (past, present and reasonably foreseeable) that have the potential to impact the spotted bat were analyzed.

The reduction of understory vegetation by ungulate grazing within the project adds to the reduction of plant availability to adult moths and other insects that spotted bats feed on. All of the area is currently not being grazed by livestock reducing the potential for cumulative impacts. Elk will continue to reduce vegetative understory in meadows and around waters.

Pale Townsend's Big-eared Bat

Analysis Methods
The following evaluation criteria were used to compare environmental consequences for all alternatives:

- Amount and distribution of habitat
- Disturbance from project implementation

Existing Conditions
There are no documented populations of Pale Townsend's big-eared bats in the project area. Pale Townsend's big-eared bats occupy mostly caves or mine tunnels, but at night they often rest in abandon buildings. There is no suitable roosting habitat for this bat as there are no caves or mines in the project. Suitable habitat in the project would be foraging habitat including areas with water and insects.

Direct and Indirect Effects

No Action
There would be no disturbance under no action and no direct effects. No action will continue to provide foraging habitat for this species. Under no action the high fire hazard potential would persist; a large crown wildfire event would have the potential to affect many individuals.

Alternative 1 – Proposed Action and Alternative 2
Disturbance during thinning and broadcast burning activities is highly unlikely to occur. There would be no direct effects to roosting Townsend's big-eared bat from project implementation.

Broadcast burning removes cover and food for insects which bats feed on. Meadows and open areas would rebound after broadcast burning; herbaceous vegetation would be more vigorous, and meadow and understory habitats would be healthier. 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 insects. These are short-term effects and will be minimized due to activities being temporally and spatially separated. In contrast, reducing the canopy closure, removing trees in and at edges of meadows, restoring meadows and broadcast burning will encourage the development of understory vegetation, increasing availability of food for these species over the long-term.

Benefits to bats would occur due to the closure or obliteration of sixty-six miles of roads within potential foraging habitat. Of the sixty-six miles thirty-eight miles will be obliterated and twenty-eight will be closed. Over time obliterated roads would heal and herbaceous vegetation would increase improving habitat for insects that bats feed on.

Alternative 2
Alternative 2 would have less grassy openings and no between group interspaces providing a slightly less benefit overall to insect habitat compared to Alternative 1.

Cumulative Effects
The area considered for cumulative effects is the project area. Reviews of all projects (past, present and reasonably foreseeable) that have the potential to impact pale Townsend's big-eared bat were analyzed.

The reduction of understory vegetation by ungulate grazing within the project adds to the reduction of plant availability to insects that these bats feed on. All of the area is currently not being grazed by livestock reducing the potential for cumulative impacts. Elk will continue to reduce vegetative understory in meadows and around waters.

Greater Western Mastiff Bat

Analysis Methods
The following evaluation criteria were used to compare environmental consequences for all alternatives:

- Amount and distribution of habitat
- Disturbance from project implementation

Existing Conditions
The only documented location of greater western mastiff bats potentially on the Forest is one specimen collected after death near Flagstaff in December 1992 (Noel 1993 in AZGD 2002). There are no documented populations of greater western mastiff bats in the project area. Based on records in the Heritage Data Management System, elevation ranges from 240 – 8,475 feet. The greater western mastiff bats use cliff habitats for roosting. They regularly use roosts which allow the bats a vertical drop of ten or more

feet. They feed on a variety of insects (moths, crickets, grasshoppers, dragonflies, leaf bugs, true, bugs, beetles and especially bees, wasps, ants and sawflies). Greater western mastiff bats are known to forage at least fifteen miles from their roosting site. There is no suitable roosting habitat for this bat as there are no cliffs in the project. Suitable habitat in the project would be foraging habitat including areas with water and a variety of insects.

Direct and Indirect Effects

No Action
There would be no disturbance under no action and no direct effects. No action will continue to provide foraging habitat for this species. Under no action the high fire hazard potential would persist; a large crown wildfire event would have the potential to affect many individuals.

Alternative 1 – Proposed Action and Alternative 2
Disturbance during thinning and broadcast burning activities is highly unlikely to occur. There would be no direct effects to roosting habitat for the greater western mastiff bat from project implementation.

Broadcast burning removes cover and food for insects which bats feed on. Meadows and open areas would rebound after broadcast burning; herbaceous vegetation would be more vigorous, and meadow and understory habitats would be healthier. 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 insects. These are short-term effects and will be minimized due to activities being temporally and spatially separated. In contrast, reducing the canopy closure, removing trees in and at edges of meadows, restoring meadows and broadcast burning will encourage the development of understory vegetation, increasing availability of food for these species over the long-term.

Benefits to bats would occur due to the closure or obliteration of sixty-six miles of roads within potential foraging habitat. Of the sixty-six miles thirty-eight miles will be obliterated and twenty-eight will be closed. Over time obliterated roads would heal and herbaceous vegetation would increase improving habitat for insects that bats feed on.

Alternative 2
Alternative 2 would have less grassy openings and no between group interspaces providing a slightly less benefit overall to insect habitat compared to Alternative 1.

Cumulative Effects
The area considered for cumulative effects is the project area. Reviews of all projects (past, present and reasonably foreseeable) that have the potential to impact the greater western mastiff bat were analyzed.

The reduction of understory vegetation by ungulate grazing within the project adds to the reduction of plant availability to insects that these bats feed on. All of the area is currently not being grazed by livestock reducing the potential for cumulative impacts. Elk will continue to reduce vegetative understory in meadows and around waters.

Northern Leopard Frog

Analysis Methods

The following evaluation criteria were used to compare environmental consequences for all alternatives:

- Impacts to potential habitat

Existing Conditions

There are no known existing or historic locations of northern leopard frogs within or adjacent to the project. The nearest historic location is at Veit Spring over three miles northwest of the project boundary. Best potential habitat is tanks and springs within the project boundary. 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 livestock grazing, and predation and competition by introduced bullfrogs and potential introduction of the pathogen *Batrachochytrium dendrobatidus* (Bd).

Direct and Indirect Effects

No Action

Habitat conditions for wildlife would remain in their current condition, not withstanding natural processes. This alternative would have no 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 destruction of 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.

Alternative 1 – Proposed Action and Alternative 2

All of the springs within the project are developed eliminating the potential for leopard frogs to survive in these areas. Most tanks in the project are not dependable and have the potential to dry up during dry years with low precipitation. There are no direct or indirect effects to northern leopard frog eggs, larvae, or adults from mechanical treatment and/or prescribed burning.

Under the proposed action a 200 feet wide buffer around all dependable waters would be maintained and would greatly reduce the amount of sediment and ash introduced to potential frog habitat.

Cumulative Effects
The area considered for cumulative effects is the project area. No cumulative effects to northern leopard frogs would occur from implementation of any of the alternatives, when added to past, present and reasonably foreseeable future activities. Implementation of Best Management Practices curtails soil erosion and minimizes the potential for inflow into potential northern leopard frog habitat.

Invertebrates

Analysis Methods
The following evaluation criteria were used to compare environmental consequences for alternatives:

- Quality and quantity of meadow habitat
- Disturbance from project implementation

Three sensitive species of invertebrates have potential habitat within the project. They are spotted skipperling, mountain silverspot butterfly and blue-black silverspot butterfly. All three of the 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. The two silverspot butterfly species have life cycles where they utilize *Viola* species, adults feed on thistles.

Existing Conditions
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 the several tanks within the project boundary as all springs within the project have been developed.

Direct and Indirect Effects

No Action
Under no action meadows would not be rehabilitated, thus there would not be any benefits to these species. Favorable habitat would decrease over time as meadows are encroached by conifers and canopy closure increases and understory productivity and diversity decreases. High fire hazard potential in the project area would persist.

Alternative 1 – Proposed Action and Alternative 2
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.

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. These are short-term effects and will be minimized due to activities being temporally and spatially separated.

In contrast, reducing the canopy closure, removing trees in and at edges of meadows, restoring meadows and broadcast burning will encourage the development of understory vegetation, increasing availability of food and reproductive sites for these species over the long-term.

Improvement to meadows in the action alternatives will be beneficial to these butterfly species. Reducing the canopy closure, removing encroaching trees in and at the edges of meadows will be beneficial to these species.

Alternative 2
Alternative 2 would have less grassy openings and no between group interspaces providing a slightly less benefit to overall invertebrate habitat compared to Alternative 1.

Cumulative Effects
The area considered for cumulative effects is the project area. Reviews of all projects (past, present and reasonably foreseeable) that have the potential to impact spotted skipperling, mountain silverspot butterfly and blue-black silverspot butterfly were analyzed.

The reduction of understory vegetation by ungulate grazing within the project adds to the reduction of plant availability to adult butterflies and/or caterpillars. All of the area is currently not being grazed by livestock reducing the potential for cumulative impacts. Elk will continue to reduce vegetative understory in meadows and around waters.

SNAGS AND LOGS

Snags and logs are important elements of the structure and function of ponderosa pine and mixed conifer and are important to bird and small mammal communities. The Forest Plan standards and guidelines for ecosystem management in northern goshawk habitats apply to all of the forest and woodland communities within the project. In ponderosa pine forests, standards and guidelines are to manage for a minimum of 2 snags per acre, 3 downed logs per acre, and 5-7 tons of woody debris per acre. In mixed conifer forests, standards and guidelines are to manage for at least 3 snags per acre, 5 downed logs, and 10-15 tons of woody debris per acre.

Analysis Methods
The following evaluation criteria were used to compare environmental consequences for alternatives:

- Snag and log densities
- Snag and log location

Existing Conditions
Landscape Level
In 2002 the Forest estimated that trends for snags in ponderosa pine habitats were probably declining (USDA Forest Service 2002a). However, a recent study by Ganey

and Vojta (2007) conducted on the Coconino and Kaibab National Forests within ponderosa pine and mixed conifer habitats, indicates at least in the short term, snag numbers are increasing and will continue to increase and densities of large snags will increase (Ganey and Vojta 2007). Despite these increases, densities of large snags, > 18" dbh, would remain below Forest Plan guidelines. The models used by Ganey and Vojta provide a useful tool for modeling snag dynamics at a landscape scale but are not suitable for modeling snag dynamics at the stand level (Ganey and Vojta 2007).

Project Level

Snag and log data were collected for the project area. Snags and logs are deficit across the Jack Smith-Schultz project area particularly in the ponderosa pine. The average density of snags greater than 18 inches in diameter per acre is .12 and the average density of logs greater than12 inches in diameter is .64 per acre.

Site/Stand Level

Of the stands inventoried none met the Forest Plan standard of two snags per acre and 3 logs per acre.

Direct and Indirect Effects

No Action

With no action, there are no treatment effects. Under no action, the high fire hazard potential in the project area would persist. In the event of a large crown-wildfire, widespread loss of snags and logs would occur. Generally, snags remaining after a crown-wildfire would have decreased longevity and value to wildlife. High tree densities would remain limiting growth of large diameter trees and thereby limiting replacement snags and logs. Within both the ponderosa pine and mixed conifer habitats snag numbers are expected to continue to increase and densities of large snags are expected to increase similar to landscape level trends.

Alternative 1 – Proposed Action and Alternative 2

Losses of snags and logs from prescribed burning will occur and is estimated to be 20% loss of snags and 50% loss of logs (Randall-Parker and Miller 2000). Randall-Parker and Miller (2000) also found that snags continue to fall and provide new logs on the forest floor at a rate of 2 logs/25 acres/year. There will be a *direct effect* of loss of snags and logs during broadcast burning, however these effects will be minimized since snags necessary to meet wildlife management objectives will be fire-lined. Loss of large logs will be minimized though ignition techniques and possibly fire-lining. Recruitment snags will be identified and retained from live trees that exhibit defects ideal for wildlife. For example, trees with forked or spiked-tops, lightning strikes, mistletoe brooms, or fading crowns. Felling trees between 12 and 16 inches after burning to replace logs consumed by prescribed burning will provide additional habitat.

Although fire can have a detrimental affect on pre-burn snags, it can cause live trees to die and become snags after fire. With the retention of yellow pine trees, retention of two trees 18 inches in diameter and greater where existing, recruitment snags and old growth

recruitment site management, some trees would in time naturally convert to snags. This natural conversion of live trees to snags and snags to logs would contribute to additional numbers of snags and logs. The less competition between trees for moisture, nutrients, and sunlight the larger they will grow prior to becoming snags. Larger diameter snags (≥18) are necessary to meet Forest Plan guidelines. Both action alternatives are expected to result in a short term loss of snags and logs followed by an increase over the long term.

The approximately sixty-six miles of road closures proposed for this project will reduce vehicular access in the area reducing access to woodcutters. This reduced access may allow for snags and logs to remain on the landscape and not be removed for fuelwood.

Both alternatives move toward the Forest Plan guidelines by mitigating shortages of snags and logs through designation and replacement efforts, treating stands to develop a larger percentage of the project area in VSS 4, 5, and 6 to develop recruitment for larger snags and logs, and both alternatives maintain two trees 18 inches in diameter or greater per acre where existing.

Cumulative Effects

The area considered for cumulative effects is the project area. Reviews of all projects (past, present and reasonably foreseeable) that have the potential to impact snags and logs were analyzed.

Past timber harvest and illegal fuelwood activities have reduced snag densities to below Forest Plan recommendations. Snags were removed during forest harvest because of potential fire and safety hazards, and many thought they had poor aesthetic value and were indicative of an unhealthy forest. Snags are especially vulnerable to bark beetle infestation, illegal fuelwood cutting, and ongoing projects that remove hazard trees such as APS hazard tree removal along powerlines and ADOT tree removal along Interstate 89N.

The past outbreak of bark beetle infestations has killed trees thus creating snags, therefore increasing snags in pockets across the landscape. However, insect attacks result in rapid deterioration of snags, decreasing their longevity and value to wildlife. Some bug-killed trees will topple over and become downed logs. Bug killed logs will compensate for a portion of the loss of large logs due to burning activities.

The proposed Travel Management Rule will further reduce cross country access to vehicles reducing access to fuelwood cutting in the Jack Smith project area. This would allow snags and logs to remain on the landscape.

WILDLIFE COVER

Hiding and thermal cover are important attributes of the forest for wildlife habitat. Hiding cover is defined as “vegetation capable of hiding 90% of a standing deer or elk from human view at a distance of 200 feet or less”. Tree trunks and foliage as well as shrubs and herbaceous vegetation offer hiding cover. Topographic features, such as rock

outcroppings and terrain breaks, also serve as hiding cover. Thermal cover is defined as "a stand of coniferous trees tall enough to allow animal movement and bedding with a high degree of crown closure". Thermal cover offers protection from heat and cold. High tree crown closure also provides hiding cover from aerial predators (Forest Plan pg. 124).

The Coconino Forest Plan requires 30% cover within a 10K Block outside the Urban Rural Influence Zone (URIZ) and Wildland Urban Interface 1U (FMAZ 1U) but does not apply the hiding and thermal cover guideline within the URIZ or the FMAZ 1U. Projects will attempt to retain 15% cover within a given section within the URIZ and the FMAZ 1U.

The following evaluation criteria were used to compare environmental consequences for all alternatives:

- Amount of cover
- Type of cover (thermal, hiding, and combination)
- Location of cover

Analysis Methods

Wildlife Cover for the Jack Smith-Schultz Fuels Reduction and Healthy Forest Project was determined with the following information:

- Wildlife cover was documented at points along goshawk survey transects across most of the project area. Points were mapped at most 1000 foot intervals along transect that was at most 850 feet apart. Points were offset along neighboring transects by 500 feet. At each point surveyors determined if there was hiding cover, thermal cover or a combination of both cover types at each point.
- Orthophoto quadrants were overlaid with transect cover data to determine if points provided a good representation of the stand vegetative structure.
- Topographic maps were reviewed to determine if there were cover effects from topographic features and to determine if slopes are inoperable due to steep or rocky terrain.
- Field examinations were conducted to evaluate cover distribution needs and to determine whether other factors contributing to effective cover were present.

Assumptions made to determine cover remaining after treatments:

- Uneven-aged with a fuel reduction emphasis will remove both hiding and thermal cover values.
- Uneven-aged thin treatments with a resource management emphasis will retain both hiding and thermal cover values.
- Thin from below to 9 inch treatments will retain thermal cover values and remove hiding cover values.
- Thin from below to 12 inch treatments will retain thermal cover values and remove hiding cover values.
- Burn only stands will maintain both hiding and thermal cover values.
- Stands will maintain hiding cover values where steep slopes are present and provide cover effects.

- Grassland restoration treatments will remove both hiding and thermal cover values.

Existing Conditions

The project falls within the area analyzed under the Flagstaff/Lake Mary Ecosystem Analysis (FLEA) (USDA FS 2002a). It is under that analysis where two zones were defined around Flagstaff and the Lake Mary areas, the Fire Management Analysis Zone (FMAZ) and the Urban/Rural Influence Zone (URIZ).

For the Jack Smith – Schultz project there are approximately 5797 acres (49%) outside the FMAZ and 5930 acres (51%) of Forest Service lands within the FMAZ project area. The area outside the FMAZ within the project boundary is within two 10K block's the Jack Smith and Elden 10K's. Wildlife cover was analyzed across the project as well as by the 10K block. Table 14 includes current, desired and projected values of thermal and hiding cover on a project level.

Key wildlife cover areas are along steep slopes and drainages across the project. Many of these areas are considered too steep to implement burning or mechanical treatments and will likely continue to provide cover. Movement of wildlife from the San Francisco Peaks area to the east is limited and wildlife corridors are fragmented by development.

Direct and Indirect Effects

No Action

Under no action there would be no change from existing conditions. Current conditions exceed Forest Plan direction. A surplus of thermal and hiding cover for wildlife will be maintained across the project area. However, dense forest conditions would still occur and the high fire hazard would continue to place wildlife cover at risk with respect to stand-replacing fire.

Alternative 1 – Proposed Action and Alternative 2

Horizontal and vertical diversity are both important components of cover. Both alternatives will maintain hiding cover at least 200 feet wide around dependable waters and along the travel corridors identified along the steep slopes and drainages across the project area. These areas provide cover for big game species as well as attributes for resident songbirds, raptors, turkey and other wildlife. These areas are considered too steep to implement mechanical treatments and will continue to provide cover. Both alternatives will still provide cover and vertical diversity for most species and will meet Forest Plan direction.

Both alternatives will reduce combination thermal and hiding cover across 3024 acres (26%) of the project area. There will be a reduction of approximately 2056 hiding or thermal cover acres within the FMAZ and a reduction of approximately 968 acres outside of the FMAZ. This reduction will still provide adequate cover for most species and meet Forest Plan direction.

Specifically, areas of VSS 4, 5 and 6 thinned to an un-even aged with moderately closed (41-60%) or closed (60%+) canopy cover will retain both hiding and thermal cover values. Areas in VSS 3 thinned to open (0 to 40%) canopy cover will lose thermal and hiding cover qualities. Sites will maintain hiding cover values where steep slopes are present and provide cover effects. Grassland restoration treatments will remove both hiding and thermal cover values. Sites treated with prescribed fire only (no thinning) will maintain both thermal and hiding cover qualities.

The entire Jack Smith 10K block includes two project areas, the Jack Smith - Schultz and the Eastside. Both projects meet or exceed Forest Plan direction for wildlife cover and therefore wildlife cover is met at the 10K block level for this 10K. The Elden 10K includes a portion of Jack Smith – Schultz project. Eighty-eight percent (12,659 acres) of the Elden 10K is within the FMAZ 1U and the Forest Plan does not apply the hiding and thermal cover requirements within the FMAZ 1U. Of the remaining twelve percent (1700 acres) of the Elden 10K the Forest Plan requires 30 percent cover within a 10K block. Using the same criteria as was used at the project level there would be 188 acres of thermal cover (11%), 39 acres of hiding cover (2%) and 305 acres of combination cover (18%) post treatment in areas outside the FMAZ 1U for a total of 31% (532 acres) of wildlife cover. Although there are no specific wildlife cover requirements for a large portion of the Elden 10K there are large tracts of wildlife cover on both Mount Elden and the Dry Lake Hills areas within this 10K block.

Table 14. Wildlife Cover for the Jack Smith Schultz Project Area.

Measure of Change	Existing Conditions	Forest Plan Direction	Alternative 1 and Alternative 2
% Cover Within FMAZ	Hiding 17% Thermal 2% Combination 76% Total 95%	Hiding 0-15% Thermal 0-15% Combination 0-15% Total 0-15%	Hiding 2% Thermal 7% Combination 19% Total 28%
% Cover Outside FMAZ	Hiding 16% Thermal 6% Combination 71% Total 93%	Hiding 10% Thermal 10% Combination 10% Total 30%	Hiding 1% Thermal 7% Combination 38% Total 38%

Alternative 2

The same stands will maintain cover for both alternatives although with the reduction of between group interspaces in Alternative 2 the quality of wildlife cover and the amount of cover within each stand will be greater in Alternative 2.

Roads and trails within cover sites provide access to recreation activities thereby reducing the effectiveness of that cover for some species due to human disturbance. Benefits to some wildlife would occur due to the closure or obliteration of sixty-six miles of roads within the project.

Cumulative Effects

The area considered for cumulative effects is the project area. Reviews of all projects (past, present and reasonably foreseeable) that have the potential to impact wildlife cover were analyzed. The Travel Management Rule (TMR) analysis has been initiated for the

Forest and a proposed action has been identified that prohibits cross-country travel. The Jack Smith-Schultz project area is included in this study, and the elimination of cross-country travel may benefit some wildlife by reducing potential disturbance within areas identified for wildlife cover.

MANAGEMENT INDICATOR SPECIES

A working draft Forest-wide assessment entitled "Management Indicator Species Status Report for the Coconino National Forest" (USDA 2002) summarizes current knowledge of population and habitat trends for species identified as MIS for the Coconino National Forest. Arizona Game and Fish Department provides annual population trend updates by Game Management Unit (GMU) for game species (i.e. elk, turkey, mule deer, and pronghorn). This information when available is used to augment the MIS report. Below are descriptions of each of the management indicator species identified for management areas (MA's) within the analysis area, and a discussion of the relationship of the effects of each project alternative on forest level population and habitat trends for each of these species.

Management indicator species (MIS) for this project are evaluated based on management area types located within the project area. The management areas (MA) listed immediately below, with associated indicator species, indicated to be present within the project boundary. Table 16 lists MIS that were considered but dropped from detailed analysis because habitat they are indicators for does not exist in the analysis area. These are a subset of the Forest-wide management areas and management indicator species. Refer to the Forest Plan for a complete list of management areas and associated management indicator species. Table 17 describes MIS and the habitat components they are indicators for.

Analysis Methods

The following evaluation criteria were used for MIS to compare environmental consequences for all alternatives:

- Indicator Habitat Quantity
- Indicator Habitat Quality

Table 15. Management areas within the Jack Smith-Schultz project with the associated MIS

MANAGEMENT AREA (MA)	MANAGEMENT INDICATOR SPECIES	ACRES WITHIN PROJECT AREA ON FS LANDS
MA 3 (Ponderosa Pine and Mixed Conifer with <40% Slopes)	Abert squirrel, red squirrel, Mexican spotted owl, elk, northern goshawk, pygmy nuthatch, turkey, and hairy woodpecker	9,465
MA 4 (Ponderosa Pine and Mixed Conifer with >40% Slopes)	Abert squirrel, red squirrel, Mexican spotted owl, elk, northern goshawk, pygmy nuthatch, turkey, and hairy woodpecker	1,292
MA 5 (Aspen)	Yellow-bellied sapsucker and mule deer	62
MA 6 (Unsuitable Timber Land in Ponderosa Pine)	Elk, mule deer, Abert squirrel, and hairy woodpecker	592
MA 9 (Mountain grassland)	Antelope, elk	28
MA 10 (Grassland and Sparse P/J above the Rim)	Antelope	196

Forest habitat acreage for MAs provided by FSVeg/RMRIS stand database. These acres may vary slightly from the Vegetation Section which identifies acres of cover types.

Table 16. Management indicator species considered but eliminated from detailed analysis

MA	MIS Species	Habitat
MA 12	Lincoln's Sparrow	Late seral, high elevation riparian (≥7000')
MA 12	Lucy's Warbler	Late seral, low elevation riparian (<7000')
MA 12	Yellow-breasted Chat	Late seral, low elevation riparian (<7000')
MA 12	Macroinvertebrates	Late seral, high and low elevation riparian
MA 12	Cinnamon Teal	Wetlands/aquatic

Table 17. Summary of MIS habitats on the Jack Smith-Schultz HFRA project with forest trends.

MIS Species	Indicator Habitat	Forest Habitat Trend	Forest Population Trend	Acres Habitat in Project Area
Abert Squirrel	Mid seral PIPO	Stable	Inconclusive	4380
Red Squirrel	Late seral MC, S-F	Declining	Inconclusive	1659
Mexican spotted owl	Late seral MC, S-F	Declining	Inconclusive Declining	1659
Northern goshawk	Late seral PIPO	Declining	Variable	2208
Pygmy Nuthatch	Late seral PIPO	Declining	Stable	2208
Turkey	Late seral PIPO	Declining	Increasing	2208
Elk	Early seral P-J, PIPO, MC, S-F	P-J – Stable PIPO - Stable	Stable	P-J – 201 PIPO – 836 MC – 0
Hairy woodpecker	Snag component of PIPO, MC, S-F	Pipo and MC snags increasing	Stable-to-slightly increasing	PIPO - 2208 MC, S-F - 1659
Mule deer	Early seral aspen and P-J	P-J – Stable	Declining	Early-seral P-J- 0 Early-seral Aspen 0
Yellow-bellied Sapsucker	Late seral and snag component of aspen	Declining	Stable	62
Antelope	Early and late seral grasslands	Stable- to-declining	Declining	224 (Mt. Meadow and Sparse P-J

Table 18. Effects to MIS habitat quantity by alternative (Acres*/% of Forest-wide)

MIS Species	Current Forest-wide Habitat	No Action	Alternative 1	Alternative 2
Abert Squirrel	490,000	0	-1446 / -0.3	-800 / -0.2
Northern Goshawk	193,812	0	1,995 / 1.0	1,342 / 0.7
Pygmy Nuthatch	193,812	0	1,995 / 1.0	1,342 / 0.7
Turkey	193,812	0	1,995 / 1.0	1,342 / 0.7
Elk	22,188	P-J – 0 PIPO – 0 MC – 0	P-J – 0 PIPO – -239/-1.1 MC – 0	P-J –0 PIPO – 127/0.6 MC – 0
Hairy Woodpecker	231,812	PIPO - 0 MC, S-F - 0	PIPO - 1,995/0.9 MC, S-F - 0	PIPO - 1,342 /0.6 MC, S-F - 0
Yellow-bellied Sapsucker	Undetermined	0	0	0
Mule Deer	31,500+Aspen	0	0	0
Juniper (plain) Titmouse	598,500	0	0	0
Antelope	161,000	0	27/0.02	27/0.02
Mexican Spotted Owl	42,000	0	0	0
Red Squirrel	42,000	0	0	0

Abert Squirrel

The Forest Plan designates the Abert squirrel as a management indicator species for early seral stage ponderosa pine forests. However, Abert squirrels use a variety of age classes and research from several locations has shown strong habitat associations with mature ponderosa pine. Recent research indicates that this species' best habitat is the intermediate to older aged forest (trees 9-22 inches dbh), where groups of trees have crowns that are interlocking or in close proximity (Dodd et al. 1998). Squirrels favor scattered large trees and multi-storied stands mixed with poles. Abert squirrels select and use broomed ponderosa pine trees (Garnett 2004). The project area currently exhibits areas of good quality habitat for Abert Squirrel.

Existing Conditions

Population trend. Forest-wide population trend is inconclusive since there is little Forest-specific data. Statewide information indicates a stable trend for hunter harvest of squirrels. Abert squirrels are currently found throughout the project area. Abert squirrel nesting habitat includes high canopy cover with interlocking canopies, multi-storied stands, and high basal area with 18" diameter trees distributed throughout.

Habitat trend, early seral stage ponderosa pine. Forest-wide 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.

Direct and Indirect Effects

No Action

Habitat conditions for wildlife would remain in their current condition, not withstanding natural processes. This alternative would have no 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. The project area would continue to be lacking in the higher basal areas that provide high quality nesting habitat. Foraging habitat would continue to be limited as tree basal areas will remain lower and densities higher reducing tree growth rates and limiting cone production.

Alternative 1 – Proposed Action

The proposed action will reduce best quality nesting habitat to lower quality nesting habitat. Canopy closures and basal areas will be reduced overall with 41% or greater canopy cover over 30% of the treated acres but will continue to average 50% canopy cover and maintain higher basal areas within MSO habitats, PFAs, steep slopes and most areas with a resource emphasis. There will not be a noticeable difference in the number of 18" trees across the landscape. Low quality nesting habitat ($\geq$ 90 BA and $\geq$ 30 CC) will be met at the group level over 30% of the landscape in Zone 1 and 2 and over 85% of Zone 3. Group sizes will vary across the landscape with smaller groups (.05 or larger up to 0.7 acres) in Zone 1 and 2 and larger groups (.05 to 5 acres) in Zone 3 providing nesting and foraging habitat for squirrels. Tree basal area and canopy cover will be reduced although within 40 years after treatment basal areas will range from 87 – 159, canopy cover will range from 52-72% and average diameter will increase 4.3 -7.9 inches providing high quality nesting habitat over time. Habitat quality will be reduced in the proposed action although the project area will continue to provide recruitment, nesting and foraging habitat for Abert squirrels. This reduction in habitat quality is too small to alter the Forest-wide habitat or population trends.

Alternative 2

Alternative 2 will reduce best quality nesting habitat to lower quality nesting habitat. Alternative 2 proposes eighty percent of the area will be in a forested condition with twenty percent in openings. There will be no between group interspaces resulting in larger groups in all zones. Canopy cover will range from 43-73% providing nesting habitat throughout. This alternative will maintain higher basal areas within MSO habitats, PFAs, and steep slopes. There will not be a noticeable difference in the number of 18" trees across the landscape. Habitat quality will be reduced in Alternative 2 although the project area will continue to provide recruitment, nesting and foraging habitat for Abert squirrels. This reduction in habitat quality is too small to alter the Forest-wide habitat or population trends.

Cumulative Effects

There is no effect to Forest-wide habitat or population trends and there is no added effect from past, present or foreseeable projects. Past fuel reduction treatments in the urban - interface has reduced habitat quality due to resulting low tree densities and lack of

interlocking crowns (USDA 2002). 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 thereby providing habitat for squirrels within these urban - interface projects and across the landscape. Urban – interface 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 important for Abert squirrels.

Elk

The Forest Plan designates elk 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. Elk are associated with the deciduous thickets and early-seral stages of forests that contain an interspersion of the grass/forb vegetation type. Forest-wide population trend is essentially stable. There was an increase in elk numbers in the early to mid 1990's with a gradual decline back to late 1980's levels.

Existing Conditions
The analysis area provides summer range for elk and is located within Arizona Game and Fish Department's Game Management Unit (GMU) 7E. Game Management Unit 7 shows a generally increasing trend in elk numbers.

Population trend. The Forest-wide trend is stable. Elk numbers on the Forest increased in the early to mid 1990's, with a gradual decline through 2001 to roughly the 1980's level.

Elk are found throughout the project area. Elk are known to calve north of Sugarloaf Mountain and winter west of 89 Mesa within the project area. Elk were documented to occur on 89 Mesa within the project area.

Habitat Trend; early seral ponderosa pine. The Forest-wide 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.

Direct and Indirect Effects

No Action
Habitat conditions for wildlife would remain in their current condition, not withstanding natural processes. This alternative would have no effect on the forest-wide habitat or population trends for elk. However, dense forest conditions would still occur and the high fire hazard potential would persist. Dense forest conditions would do nothing to reduce grazing pressure to aspen, oak meadows and riparian habitats which are documented to be impacted by elk grazing.

Alternative 1 – Proposed Action
The action alternative will decrease the amount of early seral stage ponderosa pine. Open canopy areas in ponderosa pine would increase throughout the project increasing the habitat quality and distributing elk foraging throughout the project. This will have the added benefit of reduce grazing pressure to aspen and oak. There would be a slight decrease in VSS 1 and 2 although this will be compensated with between group interspaces. This decrease in habitat quality is too small to alter Forest-wide population and habitat trends.

Alternative 2
Open canopy areas in ponderosa pine would increase throughout the project increasing the habitat quality and distributing elk foraging throughout the project. There would be a slight increase in VSS 1 and 2 although Alternative 2 does not incorporate between group interspaces resulting in a less open landscape than Alternative 1. Alternative 2 will maintain up to 80 percent of the project area in a forested condition with 20 percent in openings. This increase in habitat quality is too small to alter Forest-wide population and habitat trends.

Cumulative Effects
The area of analysis is the project area. Roads and trails within elk habitat provide access to recreation activities thereby potentially disturbing elk. The Travel Management Rule (TMR) and associated Coconino National Forest TMR process proposes to close the Forest to cross-country vehicle travel further reducing adverse affects to elk from potential disturbance.

Hairy Woodpecker

The Forest Plan designates the hairy woodpecker a MIS for snags in ponderosa pine, mixed conifer, and spruce-fir forests for suitable nesting and feeding habitat. Hairy woodpeckers are most abundant in mature forests with large old trees suitable for cavity nesting and are also common in medium-aged forests. Hairy woodpeckers prefer forests with dense canopies (Bushman and Therres 1988). They use tree cavities for roosting and winter cover and may excavate new cavities in fall to be used for roosting (Sousa 1987). This species is experiencing loss of suitable breeding habitat in the form of snags, both range-wide and in Arizona. According to Latta et al. (1999), hairy woodpeckers are uncommon throughout their range yet common in their preferred habitat in Arizona.

Existing Conditions
Data from the Coconino National Forest, as well as statewide data, indicate that hairy woodpecker populations are stable, or slightly increasing on the Forest. Hairy woodpeckers are fairly common in conifer forest types within the project area.

Population trend. The Forest-wide trend is stable, or slightly increasing. Minor population decreases occur on a short-term scale of 1-3 years, but are generally followed by a recovery (USDA 2002). Hairy woodpeckers were documented to occur throughout the project area.

Habitat trend; snag component of ponderosa pine, mixed conifer, and spruce fir. In 2002 the Forest estimated that trends for snags in ponderosa pine habitats were probably declining (USDA Forest Service 2002a). However, a recent study by Ganey and Vojta conducted on the Coconino suggest that within ponderosa pine and mixed conifer habitats, model projections suggest that, at least in the short term, snag numbers will continue to increase and densities of large snags will increase (Ganey and Vojta 2007). Despite these increases, densities of large snags, > 18" dbh, would remain below Forest Plan guidelines in the project area.

Direct and Indirect Effects

No Action

Habitat conditions for wildlife would remain in their current condition, not withstanding natural processes. This alternative would have no effect on hairy woodpecker. However, dense forest conditions would still occur and the high fire hazard potential would persist.

Alternative 1 – Proposed Action and Alternative 2

Management of old growth, target/threshold, Mexican spotted owl habitats, northern goshawk PFAs and snags will provide habitat for the hairy woodpecker. The action alternatives progress stands to larger VSS classes providing for more recruitment snags. There may be some losses of snags in areas treated with prescribed fire slightly reducing habitat quality in the short term although snag densities are expected to increase over the long term. This short term loss of snags will not alter the habitat quality enough to render it unusable and will have no effect to the Forest-wide habitat or population trend for the hairy woodpecker.

Cumulative Effects

The area of analysis is the project area. Removal of hazard trees for powerlines and highway safety will reduce snags and reduce habitat for snag dependant species. These projects combined with the either alternative are not expected to reduce habitat quality enough to alter Forest-wide population or habitat trends.

Northern Goshawk

The Forest Plan designates this species a MIS for late seral stages of ponderosa pine forests. Goshawks are relatively abundant and widespread, and although population trends are difficult to determine, there is no hard evidence of a considerable decline overall, but populations could be declining in some areas (NatureServe 2007). On the Coconino National Forest, northern goshawk territories have been monitored every year since 1989, with an average of 43 territories monitored from 1991 to 2001. The occupancy rate of territories has declined over these last 11 years; however, this does not signify a corresponding trend in population numbers. It is likely that nonbreeding goshawks would not be observed. During the later years of this time period, precipitation amounts have been below average. Climate may very well play an important role in whether or not northern goshawks breed in a given year, and would also influence nesting success of northern goshawks. Although the forest has some information on territory occupancy and reproduction, these data are not designed to detect changes in population

trend. Total number of territories has increased and the statewide BBS data indicates a significant increase, but some indicators of occupancy and productivity appear to be declining on the forest, although year-to-year variability is high.

Existing Conditions

Population trend. The Forest-wide trend is inconclusive. Although the 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 statewide BBS data indicate a significant increase, but some indicators of occupancy and productivity appear to be declining on the Forest. Monitoring and surveys are ongoing on the forest. There are two Post-fledgling Family Areas (PFA) delineated within the Jack Smith-Schultz project area.

Habitat trend. Late seral –stage ponderosa pine. 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.

Direct and Indirect Effects

No Action

Indicator habitat conditions for goshawks would remain in their current condition, not withstanding natural processes. This alternative would have no 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. The desired conditions for sustaining and developing late seral ponderosa pine habitat would never be attained.

Alternative 1 - Proposed Action

This alternative will increase the quantity and quality of late-seral (VSS 5 and 6) goshawk indicator habitat from the existing condition. Alternative 1 progresses potential nesting habitat to larger VSS classes and will provide an increase in goshawk nesting habitat quality and quantity over time (Table 12). The increase in the quantity of late-seral VSS 5 immediately after treatment is more a reflection of the younger trees being reduced to a point where the larger trees are dominate. Alternative 1 is expected to have a beneficial effect to the Forest-wide habitat with no effect to population trends for the northern goshawk.

Alternative 2

This alternative will increase the quantity and quality of late-seral (VSS 5 and 6) goshawk indicator habitat from the existing condition. Alternative 2 progresses potential nesting habitat to larger VSS classes and will provide an increase in goshawk nesting habitat quality and quantity over time (Table 13). The increase in the quantity of late-seral VSS 5 immediately after treatment is more a reflection of the younger trees being reduced to a point where the larger trees are dominate. Alternative 2 is expected to have

a beneficial effect to the Forest-wide habitat with no effect to population trends for the northern goshawk.

Cumulative Effects
Treatments in the Jack Smith-Schultz Project area will provide protection from stand replacing crown fires to predicted high quality northern goshawk nesting habitat not only within the project boundary but also in areas northwest of the project.

There is no effect to Forest-wide habitat or population trends therefore there is no added effect from past, present or foreseeable projects.

Pronghorn Antelope

Pronghorn antelope is designated a management indicator species for early and late seral grassland type, which is represented by Management Areas (MA) 9, 10 and 11 in the Coconino National Forest Plan.

A number of factors have been identified that affect pronghorn including severe weather, amount and timing of precipitation, long-term climatic trends, habitat fragmentation, diet overlap with other grazers, reductions in fawn hiding cover, woody vegetation encroachment, fences, human disturbance and development, water availability, predators, parasites and diseases, and nutritional concerns (Nelson 1925, Neff 1986, Neff and Woolsey 1979, O'Gara 1986, Smith et al. 1986, Le Count 1987, Lee et al. 1998, AGFD 2002, Dubay 2002, Ockenfels 1996 in USDA 2002).

Forest-wide population estimates of pronghorn were made in the 1980's and ranged from around 1005-1700; populations were thought to be increasing (USDA Forest Service and Arizona Game and Fish Department (AGFD) 1981, USDA Forest Service and AGFD 1990, USDA Forest Service 1982; USDA Forest Service 1987b in USDA 2002). The forest-wide pronghorn antelope trend is declining, although not equally on the Forest.

Existing Conditions
Population trend. The Forest-wide population trend is declining. Declining numbers of animals observed and fawn to doe ratios below a breakeven of 20-35 fawns per 100 does is documented for all GMUs on the Forest except GMU 7. The Jack Smith-Schultz project area is in GMU 7. Pronghorn have been reported to travel north of the project area. No fawning areas are documented in the project area.

Habitat trend; early and late seral grasslands. 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. There are 27 acres of grassland habitats within the project area. Meadows and openings have been negatively affected by pine encroachment fragmenting habitat for pronghorn.

Direct and Indirect Effects

No Action
Habitat conditions for wildlife would remain in their current condition, not withstanding natural processes. Meadows would not be rehabilitated, thus there would not be any benefit to this species. Favorable habitat would decrease over time as conifers encroach meadows. This alternative would have no effect on Forest-wide habitat or population trends. However, dense forest conditions would still occur and the high fire hazard potential would persist.

Alternative 1 - Proposed Action and Alternative 2
Restoration of meadows grasslands in the action alternative will be beneficial to this species. Vegetative species composition and diversity are increased and the distribution and diversity of vegetative ground cover is improved. The action alternative would result a small increase (224 acres) of habitat for pronghorn although there would be a small increase in habitat quality (<1% of Forest-wide habitat). This increase in habitat quality is too small to alter Forest-wide habitat and population trends.

Cumulative Effects
There is no effect to Forest-wide habitat or population trends therefore there is no added effect from past, present or foreseeable projects.

Pygmy Nuthatch

Existing Conditions
The Forest Plan designates the Pygmy nuthatch a 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. It is also found in dense pine forests, as long as large trees and snags are present. The pygmy nuthatch is also tied to old, large oak trees and cavities. This nuthatch requires dead trees or dead-top trees where it builds nests in cavities. Both in Arizona and North America, moderate threats exist on breeding and wintering grounds. Populations are thought to be stable on the Coconino National Forest and statewide. Ponderosa pine snags are a key component for this species.

Population trend. The Forest-wide 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 are documented to occur throughout the project area.

Habitat trend; late seral stage ponderosa pine. 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 in the ponderosa pine type on the Forest are thought to be increasing and will continue to increase and densities of large snags will increase (Ganey and Vojta 2007).

Direct and Indirect Effects

No Action
Habitat conditions for wildlife would remain in their current condition, not withstanding natural processes. This alternative would have no effect on pygmy nuthatch. However, dense forest conditions would still occur and the high fire hazard potential would persist.

Alternative 1 - Proposed Action and Alternative 2
Trees will grow into the larger diameter classes at a faster rate than the no action alternative. The action alternative would offer higher quality nesting habitat over time due to the increase in the acres of VSS 5 and 6 stands over the forty years following treatment. Management of old growth, target/threshold, Mexican spotted owl habitat, northern goshawk PFAs and snags in the action alternative will provide habitat for the pygmy nuthatch. There will be no effect to the Forest-wide habitat or population trend for the pygmy nuthatch.

Cumulative Effects
No effect to Forest-wide habitat or population trends therefore, there is no added effect from past, present or reasonably foreseeable projects.

Turkey

The Forest Plan designates turkey as a MIS for late seral stage ponderosa pine forests, based on roost habitat requirements. Although the age class distribution of ponderosa pine has remained dominated by mid-seral stage stands, there had been some loss of old growth and older trees, resulting in a decline in forest-wide habitat trend for late seral-ponderosa pine habitat. Turkey roosts and nesting habitat occur in steep drainages and on hills. Turkey populations on the CNF declined in the early 1990s and have increased since the mid 1990s in probable response to favorable overwintering conditions, changes in hunt design in the GMU, and contributions to overall mast production from trees from the 1919 seed year. The age class distribution of ponderosa pine has remained the same during Forest Plan implementation. Late seral stage trees have remained largely unchanged on slopes greater than 40 percent. The loss of large old trees occurred on slopes less than 40 percent during the early stages of Forest Plan implementation. The rate of loss due to timber harvest is now much reduced and harvest of trees over 24 inches dbh rarely occurs. Other factors affecting turkey populations are lack of cover in key areas (including travel corridors), water availability, and forage availability are important factors (USDA 2002).

Existing Conditions
Turkey habitat in the analysis area consists of ponderosa pine forest with openings and small meadows for foraging during the summer months. Ponderosa pine and Gambel oak mast are the key habitat attributes and steep drainages and hillsides provide nesting and roosting habitat. Currently, there are no known turkey roosting areas in the project although hillsides and drainages are potential habitat.

Although late seral ponderosa pine habitat has declines some since the Forest Plan was initiated in 1987, and turkey population trends in the early 1990's probably declined, data from the last five years show that populations are increasing on the Coconino National Forest.

Population trend. The Forest-wide trend is increasing. The trend was variable in the early part of the Plan implementation period (late 80's and early 90's), although AGFD standard survey procedures did not provide good data due to low number of observations along survey routes. AGFD developed a better index of turkey populations in the mid 1990's. Data from 1997-2001 indicate a modestly increasing trend. For the last five years, GMU 7 shows a relatively stable trend, with all other GMUs showing a general increasing trend for both percent of archery elk hunters seeing turkeys and the number of turkeys seen per day (USDA 2002). Game Management Unit 7 showed a general increasing trend in 2006 and 2007 for both percent of archery elk hunters seeing turkeys and for hunt success.

Habitat trend; late seral ponderosa pine. 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.

Direct and Indirect Effects

No Action
Habitat conditions for wildlife would remain in their current condition, not withstanding natural processes. This alternative would have no effect on turkey. However, dense forest conditions would still occur and the high fire hazard potential would persist.

Alternative 1 - Proposed Action and Alternative 2
Turkey nesting and roosting habitat exists within the project. In these habitats, all yellow-barked ponderosa pine trees will be retained while old tree longevity is improved. Furthermore, old growth recruitment areas and target/threshold sites are identified within turkey habitat and will add to the potential of increasing numbers of turkey roost tree groups. Forest Plan standards and guidelines will be met for turkey.

Two turkey roost tree groups per section, in actual or potential turkey habitats will be retained. Trees will grow into the larger diameter classes at a faster rate than the no action. Both alternatives would offer higher quality roosting habitat over time due to the increase in the acres of VSS 5 and 6 sites over the forty years following treatment.

The Jack Smith-Schultz Project will have a beneficial effect to the Forest-wide trend for turkey indictor habitat with no effect to turkey population trends.

Cumulative Effects
There is no effect to Forest-wide habitat or population trends and there is no added effect from past, present or foreseeable projects.

Red-naped (Yellow-bellied) Sapsucker

The Forest Plan designates the red-naped sapsucker a 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. This species excavates a new hole each year. They extricate sap and soft cambium layer around willows, cottonwoods, aspen and walnuts. Nest trees are a minimum dbh of 10 inches with a minimum height of 15 feet. They favor groups of large aspens near heads of higher elevation canyons during the summer.

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. The forest-wide snag distribution of aspen has been declining through out the Forest Plan implementation period. 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.

Available population data on the Forest comes from Christmas bird count, Breeding Bird Surveys, and long-term research conducted along the Mogollon Rim. Collectively, these data indicate that red-naped sapsucker populations fluctuate overtime, but are stable overall on the Coconino National Forest (USDA 2002).

Direct and Indirect Effects

No Action
Habitat conditions for wildlife would remain in their current condition, not withstanding natural processes. This alternative would have no effect on Forest-wide trends population and habitat trends. However, pine encroachment and browsing by ungulates will continue to reduce the ability of sites to develop into mature aspen stands important to sapsuckers.

Alternative 1 - Proposed Action and Alternative 2
There are 150 acres of treatments proposed for aspen. The proposed action would slightly increase late seral stage aspen in the long term but will have no effect on Forest-wide trends population and habitat trends.

Cumulative Effects
No effect to Forest-wide habitat or population trends therefore, there is no added effect from past, present or reasonably foreseeable projects.

Mule Deer

The Forest Plan designates the mule deer as an MIS for early-seral stages of aspen and pinyon-juniper woodlands. 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. Mule deer populations have not done well on the CNF since Forest Plan implementation, due to many factors, such as disease, poaching, climatic conditions, and habitat changes resulting in a declining Forest-wide trend (USDA 2002). Winter mule deer habitat occurs at 89 Mesa in the north portion of the project.

Although age class distribution has remained relatively stable in pinyon-juniper, the vigor of understory components, such as grasses, forbs and browse species, continues to be affected in areas with numerous young pinyon-juniper trees. Creation of early seral aspen and pinyon-juniper through wildfire or management actions has not occurred at a sufficient enough scale to positively influence browse production that would benefit mule deer (USDA 2002). Consequently the Forest-wide habitat trend for mule deer has declined somewhat overall.

Population trend. The Forest-wide trend is declining. The number of deer seen per hour and the number of fawns per 100 does from 1985 through 2001 varies, but the 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.

Habitat Trend; early seral stages of aspen and pinyon-juniper woodlands.
Aspen: Forest-wide trend is declining. 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 en implemented to a level, or over enough area, to prevent loss of aspen patches and provide adequate aspen recruitment. Removal of invading ponderosa pine and/or fence protection is proposed on approximately 35 sites and 150 acres.

Pinyon-juniper: Forest-wide trend is stable. The age class distribution has remained relatively stable. Less than 5% of pinyon-juniper on the forest has been converted to grassland through wildfire or management actions. All pinyon-juniper within the project is late seral stage. There is no early seral stage pinyon-juniper habitat within the project area and therefore no indicator habitat for mule deer.

Direct and Indirect Effects

No Action
Habitat conditions for wildlife would remain in their current condition, not withstanding natural processes. This alternative would result in no loss of habitat for mule deer. This alternative would have no effect on Forest-wide trends population and habitat trends. However, dense forest conditions would still occur and the high fire hazard potential would persist.

Alternative 1 - Proposed Action and Alternative 2
There are 150 acres of treatments proposed for aspen. Some of these areas would eliminate use by mule deer in the short-term due to fencing but will improve foraging habitat for mule deer in the long-term by improving regeneration. There are no treatments proposed in pinyon-juniper habitat. The action alternative would have no effect on Forest-wide population and habitat trends.

Cumulative Effects
No effect to Forest-wide habitat or population trends therefore, there is no added effect from past, present or reasonably foreseeable projects.

Juniper (Plain) Titmouse

Population trend. The Forest-wide trend is stable to slightly decreasing. BBS trend data for Arizona indicate a slightly decreasing trend between 1996 and 2000. Christmas bird count data indicate a stable to slightly declining trend for wintering juniper titmice on the Forest.

Habitat trend; late seral and snag component of pinyon-juniper. The Forest-wide trend is stable. The age class distribution of pinyon-juniper has remained relatively stable throughout the Forest Plan implementation period. A very small portion of total pinyon-juniper acres has been converted to grasslands or early seral stage pinyon-juniper through wildfire or management actions. Older pinyon pine trees are dying out in many areas due to drought and insect outbreaks, but firewood cutting has probably reduced snag densities especially close to Flagstaff.

Direct and Indirect Effects

No Action
Habitat conditions for wildlife would remain in their current condition, not withstanding natural processes. This alternative would result in no loss of habitat for Juniper titmouse. This alternative would have no effect on Forest-wide population and habitat trends. However, dense forest conditions would still occur and the high fire hazard potential would persist.

Alternative 1 - Proposed Action and Alternative 2
There are no treatments proposed in pinyon-juniper habitat. This alternative would have no effect on Forest-wide population or habitat trends.

Cumulative Effects
No effect to Forest-wide habitat or population trends therefore, there is no added effect from past, present or reasonably foreseeable projects.

Mexican Spotted Owl

Population trend. The Forest-wide trend population trend is inconclusive. The Forest has monitoring data on territory occupancy and reproduction, and a demography study had a study area on the Forest from 1991-1998, but these data do 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 et. al. 2002).

Habitat trend; late seral mixed-conifer and spruce fir. The Forest-wide trend is declining. From 1989-2002, stand replacing fires have affected approximately 12% (6,000 acres) of mixed-conifer and spruce-fir on the Forest, resulting in a shift to early seral stage.

Direct and Indirect Effects

No Action
Habitat conditions for wildlife would remain in their current condition, not withstanding natural processes. No action would result in no loss of habitat for Mexican spotted owl. This alternative would have no effect on Forest-wide trends population and habitat trends. However, dense forest conditions would still occur and the high fire hazard potential would persist.

Alternative 1 - Proposed Action and Alternative 2
There are approximately 100 acres or less that are proposed to be thinned up to 12 inches in diameter in mixed-conifer habitat. Thinning trees up to 12 inches in diameter will reduce overall stand densities, which will result in greater individual tree vigor and increased resistance to insect and disease. This will have no impact to the indicator habitat, late seral component of mixed conifer. There would be no effect on Forest-wide population or habitat trends.

Cumulative Effects
There is no effect to Forest-wide habitat or population trends therefore there is no added effect.

Red Squirrel

The Forest Plan designates the red squirrel as an indicator for late-seral mixed-conifer and spruce-fir habitat. Red squirrels are found in Arizona where spruce, spruce with Douglas-fir, or white-fir with Douglas-fir occurs at elevations above 7,500 feet. Red squirrel nests are often in tree cavities. Preferred mean diameters are 14 inches. Red squirrels have also been documented to use dwarf mistletoe for nests (Hedwall 2006). Red squirrels must store and maintain a winter food supply in centralized caches. Large standing snags and large down logs are important sites for caches. Most cashes are centered within a group of trees containing at least one or more large dominant conifers. Hedwall (2006) documented red squirrel use of dwarf mistletoe for foraging and caching.

Red squirrels need adequate food supply, protective cover, and moisture and shade for cone storage (Vahle and Patton 1983).

Population trend. The Forest-wide trend is inconclusive since there is no Forest-specific data. The Heritage rating in Arizona is S5, indicating a secure population in the state. However, AGFD does not quantify squirrel populations, since breeding populations are unaffected by hunting, and because determining the size of game populations is very difficult. AGFD tracks only hunter harvest information, which shows a relatively stable number of squirrels killed per hunter day from 1988-1999. This includes both Abert squirrels and red squirrels, but the vast majority of tree squirrels harvested are tassel-eared squirrels.

Habitat trend; late seral mixed-conifer and spruce fir. The Forest-wide trend is declining. From 1989-2002, stand replacing fires have affected approximately 12% (6,000 acres) of mixed-conifer and spruce-fir on the Forest, resulting in a shift to early seral stage.

Direct and Indirect Effects

No Action
Habitat conditions for wildlife would remain in their current condition, not withstanding natural processes. Lack of action would not result in the loss of habitat for red squirrels. This alternative would have no effect on Forest-wide trends population and habitat trends. However, dense forest conditions would still occur and the high fire hazard potential would persist.

Alternative 1 - Proposed Action and Alternative 2
There are approximately 100 acres that are proposed to be thinned up to 12 inches in diameter in mixed-conifer habitat. Thinning trees up to 12 inches in diameter will reduce overall stand densities, which will result in greater individual tree vigor and increased resistance to insect and disease. This will have no impact to the indicator habitat, late seral component of mixed conifer. This alternative would have no effect on Forest-wide population or habitat trends.

Cumulative Effects
There is no effect to Forest-wide habitat or population trends therefore there is no added effect.

MIGRATORY BIRDS

Within the project area there are mixed conifer, ponderosa pine, ponderosa pine/gambel oak, Douglas fir, spruce-fir, aspen and grasslands habitat types. The nearest Important Bird Area (IBA) is Anderson Mesa located more than six miles distant. The Rio de Flag (approximately 3.5 miles distant) is recognized as an area important to birds and will be nominated in 2007 as an IBA. There are no important over wintering areas within the project.

Species of Concern Listed by Partners in Flight
Arizona State Partners in Flight lists priority species of concern by vegetation type. Ponderosa pine, ponderosa pine/gambel oak and mixed-conifer are the dominant vegetation types in the analysis area, accounting for approximately 97 % of the total project area. Five species have been identified as species of concern in these habitats. They are Mexican spotted owl, northern goshawk, olive-sided flycatcher, Cordilleran flycatcher, and purple martin. Mexican spotted owls and northern goshawks are discussed in detail under the Threatened, Endangered and Sensitive species section of this report and will not be discussed here.

High elevation grassland habitat types occur within the project area as well; this habitat is closely associated with the sub-alpine montane meadows community described in Latta et. al.(1999). Montane meadows make up less than 1% of the project. Four species have been identified as species of concern in this habitat. They are Ferruginous hawk, Swainson's hawk, burrowing owl, and grasshopper sparrow.

Aspen occurs is small patches throughout the project area and accounts for less than 1% of the project. One species, the red-naped sapsucker, has been identified as a species of concern for aspen habitat. Red-naped sapsuckers are discussed in detail under the MIS section of this report and will not be discussed here.

Analysis Methods
The following evaluation criteria were used to compare environmental consequences for all alternatives:

- Habitat Quality

The diversity of available habitats is expected to provide habitat for many species of songbirds. Table 18 is a list of species eliminated from detailed analysis because the habitat is not found within the project area. The following tables summarize each migratory bird species of concern by habitat, and special habitat factors for each species. Following the tables are descriptions of these species status within the project area.

Table 19. Migratory bird species considered but eliminated from detailed analysis

Bird Species	Habitat
Elegant Trogon	High Elevation Riparian
McGillivray's Warbler	High Elevation Riparian
Red-faced Warbler	High Elevation Riparian
Common Black-hawk	High Elevation Riparian
Water Pipit	Alpine
Swainson's Thrush	Spruce-fir
Pine Grosbeak	Spruce-fir
Golden-crowned Kinglet	Spruce-fir
Three-toed woodpecker	Spruce-fir

Table 20. Pine and mixed conifer priority migratory bird species and habitat needs (Latta 1999)

Priority Species	Vegetation Composition/Structure	Abiotic Factors	Special Factors	Status in the Project Area	No Action	Proposed Action
Olive-sided Flycatcher	-Douglas fir, ponderosa pine -Multi-level, mature forests, fairly open canopy, "clumpiness" -Dead branches for foraging -Live mature pines for nesting	-may occur on higher areas of slope -Often occur at edge of early post burned areas for foraging and singing -Most common in patchy areas of closed and open habitats; patch size does not seem to be important -Most common where tall conifers overlook ridges and canyon tops	-Prefers forest edges and openings -Arrival on breeding ground generally late (may be as late as June) -maintain large territories	Known to be declining throughout its range. BBS data indicates that this species exists in low numbers, but is stable to slightly increasing within the analysis area.	No Effect	Beneficial effects from the creation of interspace and openings and forest structure in groups and clumps, retention of snags and large trees. This flycatcher is a rare cowbird host, and its vulnerability level will remain the same due to its association with open areas. Burning will have short-term beneficial effects by increasing insect abundance post burn.
Cordilleran Flycatcher	-Ponderosa pine, -Douglas fir, maple, oak, aspen -Dense canopy closure -Mid-late successional	-drainages to create a cool microclimate	-Need snags & downed trees for nesting -Rare cowbird host	Considered to be on the increase, but at risk due to concerns about loss of habitat and habitat components such as snags, downed logs, and loss of canopy. Within the analysis area it is expected that this species is static to increasing.	No Effect	Implementation of Proposed Action will create more openings and interspaces with trees left in groups and clumps. Group and clump formations should favor cordilleran flycatcher habitat which favor mid to late seral successional habitats. Deferred stands with high stocking levels will favor this species.

Priority Species	Vegetation Composition/Structure	Abiotic Factors	Special Factors	Status in the Project Area	No Action	Proposed Action
Purple Martin	-Ponderosa pine -Open canopy -Open midstory cover -Open understory cover -High snag density	-Large snags, cavities -open space for flying	-Often prefers habitat near open water. -Prefers tall snags adjacent to open areas.	Openings created from thinning and burning would have beneficial effects for this species, however, the lack in number of snags would limit the distribution of the species.	No Effect	Within the project area large tall snags may be limiting for this species. Prescribed burning could reduce snags by 20% although large snags will be fire-lined. Thinning and burning activities designed to leave snags in groups adjacent to open areas may benefit this species

Table 21. – High elevation grassland habitat priority migratory bird species (Latta et al. 1999):

Priority Species	Vegetation Composition Structure	Abiotic/Landscape Factors	Special Factors	Status in the Project Area	No Action	Proposed Action
Ferruginous Hawk	-Grassland -Scattered, isolated junipers for nesting -Sparsely vegetated grassland -Nest on elevated areas	-Elevation 3,500 to 6,000 ft. -Nest sites in isolated junipers, ledges, knolls, rock outcrops or pillars, cliff faces -Nests are placed in open with grand view -Shows no preference for shading	-Occur where larger populations of prairie dogs, ground squirrels, rabbits & pocket gophers exist. High sensitivity to human disturbance around nests.	-No nesting known in the project- -The project area is primarily above 7000 ft -There are no prairie dog towns in the project area.	No Effect	-There is a small amount of grassland habitat that will be treated. -The creation of opening throughout the project area will improve prey availability for ferruginous hawks

Priority Species	Vegetation Composition Structure	Abiotic/Landscape Factors	Special Factors	Status in the Project Area	No Action	Proposed Action
Swainson's Hawk	-Grassland -More grass and less woody shrubs than Ferruginous hawk habitat -Sparse shrublands, small, open woodlands Nest trees include: cottonwood, catclaw, acacia, tall cholla, juniper -Nests in small trees in smaller clumps, wind breaks, woody washes esp. when adjacent to red-tailed hawks	-Elevation 4,900 to 7,000 ft, locally to 9,500 ft. in the White Mountains -Prefer large expanses of grasslands with interspersed trees or large shrubs -Primarily a tree nester, but also nest on utility poles, windmills	-Eat grasshoppers during migration & on wintering grounds. Foods: lizards, snakes, birds, ground squirrels, voles, pocket gophers. Non-breeders hunt communally & eat primarily insects. Not as sensitive to human disturbance as Ferruginous hawks.	No nesting known in the project area. Due to the amount of potential openings within the project (224 acres), there is potential prey availability for Swainson's hawks.	No Effect	-There are 27 acres of grassland habitat that will be improved. -The creation of openings throughout the project area will improve prey availability for Swainson's hawks
Burrowing owl	-Grassland -Grasses and plant communities in early successional stage -Rock outcrops that attract burrowing mammals to provide burrows	Elevation 650-6,140 ft -Little to no slope -Dry, open, short grass, treeless plains, often associated with burrowing mammals -Need perches: fencepost, mounds, power lines, etc.	-Limited to areas with active small and/or burrowing mammals -Food: insects (grasshoppers, crickets, beetles) and small mammals, herps, birds	-The project area is primarily above 7000 ft -Habitat is limited as there are no known prairie dog colonies in the project.	No Effect	-There is a small amount of grassland habitat that will be treated. -The creation of opening throughout the project area will improve prey availability for burrowing owls

Priority Species	Vegetation Composition Structure	Abiotic/Landscape Factors	Special Factors	Status in the Project Area	No Action	Proposed Action
Grasshopper sparrow	-Grassland -plains lovegrass, sacaton sp., black grama, vine mesquite, little blue stem, agave, taller 30-50cm mixed tall bunchgrass and turf grass or sodgrass	-Elevation 3,800-5,300 ft - Moderately open grassland with patchy bare ground, flat to rolling hills. Some shrubs. Need low perches and tall grass during breeding.	-Feed on grasshoppers and other insects during breeding season -feed on grass seed in winter	-This species only occurs as an accidental species on the Coconino. -The project area is primarily above 7000 ft	No Effect	-There are 27 acres of grassland habitat that will be improved. -The creation of openings throughout the project area will improve prey availability for grasshopper sparrow

Habitat Types

Pine and Pine-Gambel Oak
Ponderosa pine habitat type occurs throughout the project area. Gambel oak is most prevalent in the southern portion of the project area. Four species have been identified as species of concern in pine-pine/oak habitats. They are northern goshawks, olive-sided flycatchers, Cordilleran flycatchers, and purple martins.

Aspen
Aspen habitat is limited with few acres occurring in scattered patches. The red-naped sapsucker has been listed as a species of concern in aspen habitat.

High Elevation Grassland
High elevation grassland habitat types include the mountain meadows and savannah grassland areas. Four species have been identified as species of concern in high elevation grasslands. They are ferruginous hawk, Swainson's hawk, grasshopper sparrow and burrowing owl.

Pinyon-Juniper
Transition, grassland and sparse pinyon-juniper are found north of 89 Mesa. Pinyon jay, gray vireo, black-throated gray warbler and juniper titmouse are species of concern in this habitat type. No treatments are proposed for the pinyon juniper.

Mixed Conifer
Mixed conifer habitat occurs along the west slopes of the project area. The Mexican spotted owl, northern goshawk and olive-sided flycatcher have been identified as species of concern in mixed conifer habitat.

Species

Olive-sided Flycatcher
Olive sided flycatchers prefer forest edges and natural or human-made openings in spruce-fir, mixed conifer, and ponderosa pine forest types. They nest high in coniferous trees and forage primarily on flying insects. Management recommendations include maintenance of creation of opening, management for uneven-aged forest structure, and retention of tall snags or dead-topped trees during salvage operations (Latta 1999).

Cordilleran Flycatcher
Cordilleran flycatchers breed predominately in pine, but also spruce, fir and aspen forests. They prefer mist and shaded forest. This species is a facultative secondary cavity-nester that also uses rock crevices, tree roots, and forks in small branches. Numbers of birds have been found to be positively correlated with canopy cover, within stand variability of tree sizes (most abundant in stands with five to twenty percent of pine basal area comprised of one to five inch dbh stems), and snag density. Cordilleran flycatchers need snags and downed logs for nesting. This species is a rare cowbird host. Management recommendations include management for greater than or equal to 2 snags

per acre, manage for greater than 383 ponderosa pine/acre with high variability in size classes, and avoid mechanical thinning of canopy and snags (Latta 1999).

Purple Martin

In Arizona pine forests, purple martins prefer areas with high snag density adjacent to or in open areas. They are secondary cavity-nesters and forage primarily on flying insects.

Management recommendations include creation and retention of large snags (Latta 1999).

Red-naped Sapsucker

The red-naped sapsucker is considered a "double keystone" species for its role in excavating cavities and drilling sap wells, which are both used by a variety of other species for nesting and feeding (Natureserve 2007). The red-naped sapsucker is found foraging in coniferous forests that include aspen and other hardwoods, as well as riparian areas. The sapsucker generally nests in aspen trees or snags. This highly migratory species, travels to neotropical areas and also descends to lower elevations in winter.

Ferruginous Hawk

Ferruginous hawks historically nest in open shrublands, woodlands, and grasslands in southeastern and northern Arizona. The current distribution of breeding birds is restricted to Plains and Great Plains Basin grasslands in northern and northeastern Arizona. Ferruginous hawks range more widely in winter and are found throughout the state, often in agricultural areas and other open habitats (Latta 1999). Ferruginous hawks forage in montane grasslands in the Flagstaff vicinity. Management recommendations include the reduction of chemical control of prairie dogs, particularly in suitable nesting habitat and treatment to control exotic species encroachment of grasslands. Elevation range for this hawk is 3,550- 6,000 feet which is lower in elevation than the project.

Swainson's Hawk

The hawks eat grasshoppers during migration and on wintering grounds. They have a wider variety of food sources than ferruginous hawks: e.g. lizards, snakes, birds, ground squirrels, voles, pocket gophers. Non-breeders hunt communally and eat primarily insects. Not as sensitive to human disturbance as ferruginous hawks.

Burrowing Owl

Burrowing owls take over burrows of prairie dogs and ground squirrels, and dens of coyote, fox and badger. They are also known to use artificial burrows. These owls also need perches, such as mounds and fence posts. They primarily eat insects and small mammals, but are known to take other small-sized species. Elevation range for this owl is 650- 6,140 feet which is lower in elevation than the project.

Grasshopper Sparrow

Grasshopper sparrows are known from southeastern Arizona, extreme southwest New Mexico, and adjacent to Sonora, Mexico. They prefer habitat in open grasslands between 3,800 and 5,300 feet. They are not expected to occur within the project area.

Direct and Indirect Effects

No Action
Under this alternative there would be no changes in the project area. Habitat conditions for birds would generally remain the same, notwithstanding natural processes. Alternative 1 would have no 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.

Alternative 1 - Proposed Action and Alternative 2
Northern goshawk and Mexican spotted owl are discussed in previous pages of this report. Proposed activities may affect these species directly through habitat modification, or indirectly through changes in prey populations.

Species richness is associated with pine, pine oak and mixed conifer habitats. Most of the high species rich areas are associated with MSO habitat in the project and treatments are designed to maintain habitat components important for these species as well as forest-dwelling passerine birds.

Olive-sided flycatcher is associated with forest openings and edges with numerous dead trees and live, mature pines. Disturbances to individuals from thinning and burning will be short-term. This species has been linked to burned areas of ponderosa pine (Altman 1997, Blake 1982, Lowe et al. 1978 in Latta et al. 1999), and burning will likely have short-term beneficial effects by increasing insect abundance post burn. Effects from vegetation modification and burning treatments will be beneficial due to the creation of openings and more edge effect, the retention of snags and large trees.

Cordilleran flycatcher is associated with mid- to late-successional stages with dense canopy cover and drainages that create a cool microclimate. Disturbances to individuals from thinning and burning will be short-term. Through vegetation modification this project will create some open habitat and reduce tree densities which favor early successional birds, not mid-to late successional ones like the flycatcher. However, the project area will continue to support mostly mid-successional and late-successional stages and will maintain habitat in canyons and drainages, which favor this species.

Purple martin is associated with open-canopy, open mid-story and open understory cover, and high snag density. A lack of snags likely limits the abundance and distribution of this species in the project area. The more open understory created by thinning and burning activities favors this species, and burning will likely have short-term beneficial effects by temporarily increasing insect abundance. Both action alternatives will provide open canopy habitat within the project.

Red-naped sapsucker nests in snags in mature to old aspen stands. It is worthy to note that 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. Both alternatives will treat 150 acres of aspen within the project area

in an effort to and provide young seedlings an opportunity to develop into mature aspen over time.

Swainson's hawk is uncommon during June, July and during migration. The openings within the project provide prey availability for Swainson's hawks. Due to the creation of openings within the project, there will be a slight increase in prey availability within the project. It is expected there will be no detectable effect to Swainson's hawk.

Ferruginous hawk is a migrant or uncommon during the winter. The project elevation is not within the elevation range for the ferruginous hawk. Due to the limited grasslands and the elevation range in the project there will likely be little benefit from the project for ferruginous hawks. It is expected that there will be no detectable effect to ferruginous hawks.

Burrowing owl nests in burrows in dry, open grasslands. They also inhabit grass, forbs, and open shrub stages of pinyon pine and ponderosa pine habitats. There are no prairie dog colonies that provide potential burrows for nest sites and there are no known populations of burrowing owls within the project. The project elevation is not within the elevation range for the burrowing owl. There will be no detectable effect to burrowing owls.

Grasshopper sparrow
The project elevation is not within the elevation range for this sparrow. There will be no detectable effect to the grasshopper sparrow.

Cumulative Effects
The area of analysis is the project area. Reviews of all projects (past, present and reasonably foreseeable) that have the potential to impact the above migratory birds were analyzed.

Ongoing recreational activities may result in disturbance of migratory birds. Removal of hazard trees for powerlines and highway safety will reduce snags and reduce habitat for snag dependant species. Present and future 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. No significant cumulative effects to migratory birds would occur from implementation of the proposed action when added to past, present and reasonably foreseeable future actions.

LITERATURE CITED/REVIEWED

AGFD. 1995. Coconino National Forest Riparian Amphibians and Reptiles Survey: Locality Information and Survey Results for the 1993 Field Season. Tech. Report 65. 16pp.

AGFD. 1999. Draft conservation assessment and strategy for the bald eagle in Arizona. Nongame and Endangered Wildlife program. September 1999. Arizona Game and Fish Department, Phoenix, Arizona. 67pp.

AGFD. 2001a. Arizona Game and Fish Department Regional Elk Operational Plan. December 3, 2001. 40 pp. www.azgfd.com.

AGFD. 2001b. Arizona Game and Fish Department Wildlife 2006 Strategic Plan. January 22, 2001. 96 pp. www.azgfd.com.

AGFD. 2002. *Eumops perotis californicus*. Unpublished abstracts compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, AZ. http://www.azgfd.gov/w_c/edits/species_concern.shtml

AGFD. 2008. Unpublished abstracts compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, AZ. http://www.azgfd.gov/w_c/edits/species_concern.shtml

Beier, P., E. C. Rogan, M. F. Ingraldi, and S. S. Rosenstock. 2008. Does forest structure affect reproduction of northern goshawks in ponderosa pine forests? Journal of applied ecology, 45 PP342-350.

Block, W.M., Ganey J.L., Scott, P.E., King, R. 2005. Prey ecology of Mexican spotted owl in pine-oak forests of northern Arizona. Journal of Wildlife Management 69:618-629.

Bushman E.S. and G.D. Therres. 1988. Habitat management guidelines for forest interior breeding birds of coastal Maryland. Maryland Dept. Natural Resources, Wildlife Tech. Publ. 88-1. 50pp.

Cockum, E.L. 1960. The recent mammals of Arizona: their taxonomy and distribution. University of Arizona Press, Tucson. 276 pp.

Dargan, C.M. 1991. Roost site characteristics of bald eagles wintering in north-central Arizona. M.S. Thesis, Northern Arizona University, 73pp.

Dodd, N.L., S.S. Rosenstock, C.R. Miller, and R.E. Schweinsburg. 1998. Tassel-eared squirrel population dynamics in Arizona: index techniques and relationships to habitat condition. Arizona Game and Fish Department Technical Report 27, Phoenix, AZ. 49pp.

Dodd, N.L., J S. States, and S.S. Rosenstock. 2003a. Tassel-eared squirrel population, habitat condition, and dietary relationships in north-central Arizona. Journal of Wildlife Management 67:622-633.

Dodd, N.L. 2003b. Landscape-scale forest habitat relationships to tassel-eared squirrel population dynamics in north-central Arizona, guidelines for ponderosa pine forest ecosystem management. Arizona Game and Fish Department Technical Guidance Bulletin No. 6 – July 2003. Draft. Phoenix, Arizona.

Dodd, N.L. 2003c. Personal conversation with Norris Dodd, Arizona Game and Fish Department, Pinetop, Arizona, regarding Abert squirrel. July 9, 2003.

Forest Ecosystem Restoration Analysis Project. 2007. ForestERA data layer overview. Northern Arizona University. Available online at http://forestera.nau.edu/data_overview.htm

Ganey, Joseph L.; Vojta, Scott C. 2007. Modeling snag dynamics in northern Arizona mixed-conifer and ponderosa pine forests. Res. Pap. RMRS-RP-66WWW. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 15 p.

Ganey, Joseph L.; Block, William M.; Ackers, Steven H. Structural characteristics of forest stands within home ranges of Mexican spotted owls in Arizona and New Mexico. Western Journal of Applied Forestry. July 2003. Vol. 18, no. 3:pp. 189-198.

Garnett, G.N., R.L. Mathiasen, and C.L. Chambers. 2004. A comparison of wildlife use in broomed and unbroomed ponderosa pine trees in northern Arizona. Western Journal of Applied Forestry 19:42-46.

Grubb, T.G. and C.E. Kennedy. 1983. Bald eagle winter habitat on southwestern national forests. Research Paper RM-237. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO. 13pp.

Hedwall, S.J., C.L. Chambers, S.S. Rosenstock. 2006. Red Squirrel Use of Dwarf Mistletoe-induced Witches Brooms in Douglas-fir. Journal of Wildlife Management. Vol. 70, Issue 4, pp.1142-1147.

Hoffmeister, D. 1986. Mammals of Arizona. The University of Arizona Press. 602 pp.

Jenness, J.S. 2000. The effects of fire on Mexican spotted owls in Arizona and New Mexico. Master of Science Thesis. Northern Arizona University, Flagstaff, Arizona. 131 pp.

Latta, M.J., C.J. Beardmore, and T.E. Corman. 1999. Arizona Partners in Flight Bird Conservation Plan. Technical Report 142. Version 1.0. Nongame and Endangered

Wildlife Program. Arizona Game and Fish Department. 2221 W. Greenway Rd., Phoenix, AZ 85023-4399. 331 pp.

Laudenslayer, W.F., P.J. Shea, B. Valentine, C.P. Weatherspoon and T.E. Lisle (tech cords). Proceedings on the Ecology and Management of Dead Wood in Western Forests. November 2-4, 1999, Reno, NV, USDA Gen. Tech. Rep. PSW-GTR-181.

Luce, R.J. and D. Keinath (2007, October 31). Spotted Bat (*Euderma maculatum*); a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available: http://www.fs.fed.us/r2/projects/sep/assessment/spottedbat.pdf [1/30/2008].

Mikesic, D.G. and J.R. Nysted. 2001. Species account for *Mustela nigripes*. Navajo Heritage Program. Window Rock, Arizona. Revised: 15 Feb 2005.

NatureServe Explorer: An online encyclopedia of life [web application]. 2007. Version 1.6. Arlington Virginia, USA: NatureServe. Last updated June 2007. Available: http://www.natureserve.org/explorer. (Accessed August 13, 2007).

Randall-Parker, T., and R. Miller. 2000. Affects of Prescribed Fire in Ponderosa Pine on Key Wildlife Habitat Components: Preliminary Results and a Method for Monitoring. In Laudenslayer, W.F., P.J. Shea, B. Valentine, C.P. Weatherspoon and T.E. Lisle (tech cords). Proceedings on the Ecology and Management of Dead Wood in Western Forests. November 2-4, 1999, Reno, NV. USDA Gen. Tech. Rep. PSW-GTR-181.

Reynolds, R.T, R.T. Graham, M.H. Reiser, R.L. Bassett, P.L. Kennedy, D.A. Boyce, Jr., G. Goodwin, R. Smith, and E.L. Fisher. 1992. Management recommendations for the northern goshawk in the southwestern United States. Gen. Tech. Rep. RM-217. Ft. Collins, CO. U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 90 p.

Reynolds, R.T. Literature Review. 2004. Is the Northern Goshawk an old Growth Forest Specialist or a Habitat Generalist? U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 34 p.

Seamens, M.E., R.J. Gutierrez, and C.A. May 2002. Mexican spotted owl (*Strix occidentalis*) population dynamic: influence of climatic variation on survival and reproduction. The Auk 119(2):321-334.

Sousa, P.J. 1987. Habitat suitability index models: hairy woodpecker. U.S. Fish Wildl. Service Biol. Rep.82(10.146). 19pp.

States, J.S. and W.S. Gaud. 1977. Ecology of hypogenous fungi associated with ponderosa pine. [Patterns of distribution and scorocarp production in some Arizona forests. Mycologia 89:712-721.

Stalmaster, M.V. 1998. Effects of recreation activity on wintering bald eagles. Wildlife monograph. 137: 1-46.

USDA Forest Service. 1982. Analysis of the Management Situation, Coconino National Forest. Southwestern Region.

USDA Forest Service. 1987a. Coconino National Forest Service Land and Resource Management Plan, as amended. Flagstaff, Arizona.

USDA Forest Service. 1987b. Environmental Impact Statement for the Coconino National Forest Plan. Southwestern Region. 438 p.

USDA Forest Service. 2002. Management indicator species status report for the Coconino National Forest. Working draft July 1, 2002. Coconino National Forest, Flagstaff, Arizona. 94 pp.

USDA Forest Service and Arizona Game and Fish Department. 1981. Arizona Wildlife and Fisheries Comprehensive Plan. Forest Service, Region 3.

USDA Forest Service and Arizona Game and Fish Department. 1990. Arizona Wildlife and Fisheries Comprehensive Plan: Coconino National Forest. Forest Service, Region 3. 24 pp.

USDI Fish and Wildlife Service. 1973. Threatened wildlife of the United States. U.S. Department of the Interior. 289 pp.

USDI Fish and Wildlife Service. 1978. Determination of Certain Bald Eagle Populations as Endangered or Threatened, Final Special Rule, 17.41(a). Federal Register 43:6230-6233.

USDI Fish and Wildlife Service. 1982. Bald eagle recovery plan (southwestern population). US Fish and Wildlife Service, Albuquerque, NM. 74 pp.

USDI Fish and Wildlife Service. 1988. Black-footed ferret recovery plan. U.S Fish and Wildlife Service, Denver, Colo. 154 pp.

USDI Fish and Wildlife Service. 1993. Endangered and threatened wildlife and plants; final rule to list the Mexican spotted owl as a threatened species. Federal Register 58(49): 14248-14271.

USDI Fish and Wildlife Service. 1995a. Endangered and threatened wildlife and plants; final rule to reclassify the bald eagle from endangered to threatened in all of the lower 48 states. Federal Register 60:35999-36010.

USDI Fish and Wildlife Service. 1995b. Recovery plan for the Mexican spotted owl: Vol I. Albuquerque, New Mexico. 172 pp.

USDI Fish and Wildlife Service. 1996. Endangered and threatened wildlife and plants: establishment of a nonessential experimental population of Black-footed Ferrets in Aubrey Valley, Arizona; final rule. Federal Register 61(55):11320-11336.

USDI Fish and Wildlife Service. 1998. Endangered and Sensitive Species of Arizona. Phoenix, Arizona. 123 pp.

USDI Fish and Wildlife Service. 1999. Final rule to remove the American Peregrine Falcon from the Federal List of Endangered and Threatened Wildlife, and to remove the similarity of appearance provision for free-flying peregrines in the conterminous United States. August 25, 1999. Federal Register 64 (164): 46542- 440875.

USDI Fish and Wildlife Service. 2004. Endangered and threatened wildlife and plants; final designation of critical habitat for the Mexican spotted owl. August 31, 2004. Federal Register 69(164): 53182-53230.

USDI Fish and Wildlife Service. 2007. Final rule to remove the Bald Eagle in the lower 48 states from the list of Endangered and Threatened Wildlife. July 9, 2007. Federal Register 72(130): 37346 – 37372.

USDI Fish and Wildlife Service. 2007. National Bald Eagle Management Guidelines.

Vahle, R.J. and D.R. Patton. 1983. Red squirrel cover requirements in Arizona mixed conifer forests. Journal of Forestry Vol. 81(1): 14-15, 22.

Ward, J.P., Jr. 2001. Ecological responses by Mexican spotted owls to environmental variation in the Sacramento Mountains, New Mexico. Ph.D. Dissertation. Colorado State University, Fort Collins, Colorado.