CHAPTER 3: AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This section summarizes the physical, biological, social and economic environments of the affected project area and the potential changes to those environments due to implementation of the alternatives. It also presents the scientific and analytical basis for the comparison of alternatives presented in Chapter 2.

The information pertaining to the affected environment and effects of the alternatives are summarized from other documents, including specialist reports. Specialist reports that have been incorporated by reference in this chapter are listed at the beginning of each resource section heading. The planning record includes all project-specific information including specialist reports, ecosystem analyses, and other results of project-related investigations. The record also contains information resulting from public involvement efforts. The planning record is located at the Mogollon Rim Ranger District at the Blue Ridge Ranger Station in Happy Jack, Arizona and is available for review during regular business hours.

Effects of the alternatives are discussed in this section for the following resource areas:

- Vegetation
- Fire and Fuels
- Soil and Water Resources
- Wildlife
- Fisheries
- Sensitive Plants
- Noxious or Invasive Plant Species
- Other Environmental Components
    - Recreation, Lands and Special Uses, Recreation Visual Quality, Opportunity Spectrum and Wilderness
    - Rangeland
    - Heritage
    - Air Quality
    - Economics
    - Environmental Justice

Also, acres used in the effects analysis may differ from one resource to another and may not always agree down to the exact acre. This may be due to the type of database that is being queried to generate acres or rounding parameters used. The acre differences will not affect conclusions made by the resource specialist.

Past, Ongoing and Reasonably Foreseeable Future Actions

Cumulative impacts can result from individually minor, but collectively significant actions taking place over a period of time. Past, ongoing and reasonably foreseeable future actions are described in Tables 11 and 12 below. The projects listed are on the Coconino National Forest except where otherwise noted.

Each resource area discloses actions considered in the cumulative effects analysis. In most cases, past and ongoing activities are incorporated into each resource's existing conditions because they help explain the current condition of the resource. That is, past and ongoing activities are described in the context of how these actions affect present conditions. Similarly, foreseeable future actions (such as the Travel Management Rule and the Managing Motorized Travel EIS that have proposed action) are evaluated as to how they would increase, reduce or not change conditions for the resource.

Projects that are listed in Tables 11 and 12 include those that were evaluated by various resource specialists within their scope of analysis. Past actions are those that have been implemented. For most resources, the time frame evaluated for effects of past actions ranged from 10 to 20 years. Ongoing actions are those that have Decisions made and are ready to implement or are being implemented. Reasonably foreseeable future actions are those projects that are in the planning stages and have developed a proposed action or alternatives, but a Decision has not been made. The time frame evaluated for future and foreseeable actions is 20 years. However, there will need to be a Chapter 18 Review approximately every 5 years to update future and foreseeable projects and ensure that the cumulative effects are still valid.

Many activities and projects occur in the project area such as recreation, hunting, livestock grazing, road maintenance, manual treatment of noxious weeds, roadside hazard tree removal, recreational use, hunting, etc. Of these activities recreation and hunting activities have the most qualitatively measurable impact. There are two developed recreation sites within the area – the Stoneman Lake Day Use Area and the Stoneman Lake Road/FH3 Toilet and Interpretive Site. The Arizona Trail runs through the northeast corner of the analysis area, by Allen Lake. There are no other formally designated trails that run through the analysis area.

Recreational activities include: hiking, viewing wildlife, hunting, dispersed car-camping, backpack camping, orienteering, horseback riding, caving, rock climbing, photography, picnicking, taking scenic drives, ORV/ATV use, bicycling, shooting, and gathering in family or social groups. The area is part of the Arizona Game and Fish Department's hunt "Unit 6A", and is popular for turkey, elk and deer hunting in the fall. Snowmobile use and cross-country skiing are increasing as popular uses in the area. During normal winters, snowmobiles are the only vehicles that access the area.

Other uses within the project area include: firewood cutting, post and pole cutting, collecting boughs and cones, collecting and transplanting wildlings, gathering antlers, collecting food and medicinal resources such as berries, nuts, mushrooms, and bracken fern, and collecting biological specimens for research.

Table 11. Past Actions Considered for the Upper Beaver Creek Watershed Fuel ReductionProject

Project, Completion Date	Description	Acres
Lake Timber Sale, 1993	Timber harvest, >9" DBH partial overstory removals	2,500
Back Timber Sale, 1992	Timber harvest, >9" DBH partial overstory removals	1,860
Blind Lake Timber Sale, 1986	Timber harvest, >12" DBH partial overstory removals	10,400
Banfield Timber Sale, 1987	Timber harvest, >12" DBH partial overstory removals	14,135
Mayes Prescribed Burn, 2001	Broadcast burn of forest fuels	4,770
Stoneman/Apache Maid Prescribed Burn 2004 and 2008	Broadcast burn of forest fuels	3,900
Happy Jack Urban Interface Project 2003	Thinning under 9" DBH and broadcast burn of forest fuels	250
Pile burning on timber sales 1995	Burning of machine piles Lake and Back Timber Sales	500

Table 12. Ongoing and Reasonably Foreseeable Actions Considered for the Upper Beaver Creek Watershed Fuel ReductionProject

Ongoing Actions	
Project & Implementation Year	**Description**
Apache Maid, Beaver Creek, and Walker Basin Range Allotments	Cattle grazing
Hunting/Fishing	Under permits issued by Arizona Game and Fish
Developed Recreation	Developed boat ramp at Stoneman Lake.
Annual Road Maintenance	Road grading and maintenance on FR 213, 230, 305, and 229 roads, and other level 2 roads.
Buck Butte Pit Rock Expansion and Development, 2005 to the present	Cinder rock excavation and screening for road maintenance.
Leafy spurge weed control, 2008	Herbicide spraying of leafy spurge
Montezuma Land Exchange, 2008	Exchange of portions of Double Cabin Park to FS
APS Powerline maintenance	Maintenance of Flagstaff to Happy Jack power line
Discovery Channel Telescope, Lowell Observatory	Construction of the observatory and associated facilities.
Beaver Creek Experimental Watershed Study, Rocky	Installed new stream gage weirs,

Ongoing Actions	
Project & Implementation Year	**Description**
Mountain Research Station	2006. Ongoing research on water yield and peak flows.
T-Bar Tank No.2 Leopard Frog Habitat Protection 2007; implementation 2008	Installation of a sucker road pipe and rail wedge fence around the tank and wet meadow
Reasonably Foreseeable Future Actions	
Project & Projected Implementation	**Description**
Managing Motorized Travel – Implementing the Travel Management Plan NEPA, Proposed Action Scoping 2007; implementation in 2009	Designate open road system, create travel atlas and motorized vehicle use maps, restrict off-road travel, close roads.
Hunting/Fishing	Under permits issued by Arizona Game and Fish Department
Annual Road Maintenance	Road grading and maintenance on FR 213,230, 305, and 229 road and other Level 2 roads.
Walker Basin Allotment Division Fence and Cattle guard	Five miles of electric fence to divide two pastures and installation of one cattle guard

Several projects are in the initial planning stages in the project area but have not yet developed a proposed action. These include the Walker Basin Range Allotment Environmental Assessment, and the Butch Tank Leopard Frog Protection Project. In addition, the Arizona Game and Fish Department and Northern Arizona University Ecological Research Institute have developed a research proposal that could be carried out in the project area should funding arise. The research consists of utilizing an experimental, wildlife-based fuels reduction prescription on selected stands in the project area designed around the tassel-eared squirrel, but also expected to benefit songbirds and other wildlife.

Vegetation

The following section pertaining to the vegetation resource, affected environment and effects of the alternatives is summarized from the Vegetation Specialist Report, by D. Fleishman, 2007 (PR #146).

Vegetation Affected Environment

The resource areas to be affected by the proposals within this analysis are both overstory and understory vegetation.

Overstory and Understory Vegetation by Biophysical Type

There are four distinct biophysical settings that occur within the analysis area (Table 13) Biophysical settings are land delineations based on the geographic area, physical setting, and vegetation community that can occupy the setting.

Table 13: Biophysical Settings within the Upper Beaver Creek Watershed Fuels Reduction Project.

Biophysical Setting	Acres
Colorado Plateau Ponderosa Pine (PPIN5)	34,458[1]
Southwestern Ponderosa Pine (PPIN7)	9,628
Juniper-Pinyon (Frequent Fire) (JUPI1)	729
Mountain Grassland (MGRA2)	3,257

The Colorado Plateau Ponderosa Pine biophysical setting is dominated by ponderosa pine and gambel oak overstory vegetation. Seral stage derived from **INFORMS** modeling (INtegrated FOrest Resource Management System) displays that a majority of the project area is in a closed canopy late seral condition (78%). Early seral stages are poorly represented. Young growth gambel oak is also a dominant feature in the understory, with some sites containing up to 600 stems per acre of young growth gambel oak. Additional understory species include, but are not limited to, Arizona fescue, screwleaf muhly, mountain muhly, deergrass, blue grama, pussy toes, and Fendler's ceanothus.

The Southwestern Ponderosa Pine biophysical setting contains a mix of ponderosa pine, gambel oak, and alligator juniper in the overstory. Seral stage derived from INFORMS displays that a majority of the project area is in a closed canopy late seral condition (78%). Early seral stages are poorly represented. This biophysical setting is a transition zone between the Colorado Plateau Ponderosa Pine and Juniper-Pinyon biophysical settings. The total trees per acre in ponderosa pine are greater in this zone than the Colorado Plateau Ponderosa Pine zone, primarily because this zone contains generally poor growing sites and has had minimal past treatments. This biophysical zone is very diverse, with multiple browse species present, including Fendler's ceanothus, mountain mahogany and cliffrose. Additional understory species include, but are not limited to, Arizona fescues, blue grama, sideoats grama, and pussy toes.

The Juniper-Pinyon (frequent fire) biophysical zone is composed primarily of young to mid-aged, relatively open juniper trees, with sparse pinyon-pine. Understory vegetation is composed of primarily cliffrose, mountain mahogany, blue and sideoats grama, as well as other species.

The Mountain Grassland biophysical zone is composed primarily of grasslands dominated by Kentucky bluegrass, but also containing western wheatgrass, deergrass, blue grama, and Arizona fescue. A scattering of ponderosa pine is found along the edges of the mountain grasslands, with younger ponderosa pine trees (less than 50 years old) beginning to occupy some meadows.

[1] Total acres in the table are 48,072 acres. An additional 107 acres exist in Stoneman Lake for a total project acres of 48,179.

Analysis Methods

Data used in the analysis has come from stand exam data and the Most Similar Neighbor **(MSN)** Analysis computer program within the **INFORMS** model. The INFORMS model is a software system designed to facilitate project-level and landscape level project planning. The MSN program was used to impute vegetative stand attributes measured in one stand to another stand without vegetative data. MSN analysis uses satellite imagery, spatial relationships, and topographic information to match a target site (a stand without data) to the nearest reference site (a stand with data) with the greatest similarity in vegetative characteristics. Tree data from the reference site is then assigned to the target site. Because some of the stand data is 15 years old or older, all of the collected data was first run through a tree growth model, the **Forest Vegetation Simulator (FVS)**, to equalize all stand data to the year 2006. Approximately 30 percent of stands had stand data and the MSN analysis was used to provide data for the rest of the analysis area. The r squared for the data is 0.76.

Average basal areas for the analysis area calculated from **FSVeG** (Field Sampled Vegetation, a national database) and using the MSN data indicate that the average basal area for forested acres is 118 square feet of basal area, with approximately 65% of the area having a basal area greater than 100 square feet. Calculated FVS canopy cover for ponderosa pine in the southwest is low within the model. Canopy cover data was calculated using a locally derived algorithm from the Ft Valley Experimental Forest on the Coconino National Forest (Sheppard, et al. 2002). All modeling was completed in 2006. The two years difference in stand conditions between the modeling and the EA has allowed for two years of additional growth. This additional growth is not significant enough to warrant modeling in 2008 to display the difference.

Overstory Characteristics

Existing old growth was determined by the district wildlife biologist in 2005 on individual stands. Developing old growth was calculated at the stand level using stand data and model data was run through FVS for 50 years to determine which stands would meet VSS5 and VSS6 structural stages quickest. This stand data was aggregated up to the ecosystem management area 10K and project area to ensure compliance with the 20% standard (PR #146).

Existing ponderosa pine old-growth occurs on about 1,671 acres and developing old growth occurs on about 8,602 acres of the 43,844 acres of ponderosa pine vegetative type, or about 23% of the ponderosa pine type. The lack of large trees and snags are the primary limiting factors that keeps habitat from being classified as existing Old Growth.

For each 10K, all four 10K's currently exceed the 20% old growth standard in ponderosa pine (PR #146). The project meets the Forest Plan's Old Growth Guideline that requires at least 20% of naturally forested areas within each forest type is designated as Old Growth for both Ponderosa pine type and the pinyon-juniper type.

There are also approximately 34 acres of existing pinyon-juniper old growth and approximately 383 acres of pinyon-juniper in late successional stage designated as developing old growth. This accounts for roughly 57% of pinyon-juniper woodland within the 729 acres of this habitat type (PR #146). The pinyon-juniper only occurs in three of the four 10K's and exceeds the old growth standard of 20% in two of the three 10K's. The one 10K that is not meeting the 20% old growth standard is the Jack's 10K where there is one pinyon-juniper stand totaling 36 acres.

Existing canopy cover and average quadratic mean diameter vary by biophysical setting vary. Table 14 displays a summary of these values.

Table 14: Average Trees per Acre, Canopy Cover and Quadratic Mean Diameter (QMD) within the Upper Beaver Creek Watershed Fuel Reduction Project, Current Condition (2008).

	average trees per acre	average canopy cover	average QMD
PPIN5	20 to 1,560; average of 255 trees/acre (TPA)	57%	15.0"
PPIN7	60 to 1,230; average of 350 trees/acre (TPA)	62%	9.6"
JUPI1	0 to 810; averaging 20 trees/acre (TPA)	16%	8.3"

Dwarf mistletoes are the most prevalent disease-causing agents in the Southwestern forests. Growth reduction is their most important effect, although severe infection greatly increases mortality (USDA Forest Service 2002). Surveys from some of the proposed treatment stands indicate dwarf mistletoe infection ranges from low to high. The two most common bark beetles affecting ponderosa pine along the Mogollon Rim in Arizona are the pine engraver beetles, *Ips* species, and the Western pine beetle, *Dendroctonus brevicomis*. In general, for both insects, stand densities greater 120 Basal Area are thought to be most susceptible.

Understory Characteristics

Stands with high basal areas (greater than 100 ft^2/acre) have very few canopy openings and generally continuous canopy cover. The continuous canopy cover, as well as the corresponding abundance of needlecast under these thick canopies, precludes the existence of many understory species. Fire dependent buckbrush is noteably absent from a majority of the analysis area. Where stands are in an open condition, understory vegetation is quite diverse, with the main species include screwleaf muhly, mountain muhly, Arizona fescue, and a variety of forbs. Some buckbrush occurs within the analysis area, but does not occur under stands with basal areas in excess of 100 sqaure feet per acre. A lack of fire within the analysis area also has decreased buckbrush. Noxious weeds also occur within the analysis area on areas that have been previously disturbed.

Vegetation Environmental Consequences

No Action Alternative

Direct and Indirect Effects

The units of measure used in this analysis are stand density, average tree diameter and canopy closure. Effects of the No Action Alternative are summarized in Table 15 below.

Under this Alternative, there will be little change to the number of trees per acre that exist on site for the next 20 years, with the only loss of trees occurring through mortality.

Canopy cover does increase over the current condition in all biophysical types, increasing on average 8-10% over 2008 canopy cover values in PPIN5, 1-3% in PPIN7 and over 20% in JUPI1. The result of increasing canopy covers is increased levels of stress on all trees, increased density induced mortality, and increased crown fire hazard (Brown and Smith 2000). Water and nutrient stress decreases the ability of trees to survive drought, bark beetles, and other pathogens. Dwarf mistletoe will continue to spread and intensify, affecting growth and longevity of ponderosa pine. The average rate of spread is approximately 1 foot per year.

Susceptibility to western pine beetle would slowly increase over time. Areas with the greatest likelihood of infestation are those stands with densities greater than 120 BA and average stand diameters greater than 12" DBH. Susceptibility to *Ips* would continue to increase with activity most likely occurring in response to a drought or a snow or ice event that creates fresh pine debris. The end result would be an overall decline in forest health and vigor and an increase risk for high intensity fire (Covington et al. 1994).

Quadratic mean diameter of ponderosa pine within all stands increases with 10 years of growth on average around 1 inch for all biophysical settings (Table 15). Ponderosa pine on average on average sites should grow on about 2" in diameter growth per decade (Schubert, 1974).

Cumulative Effects

Activities considered in the cumulative effects analysis include timber sales, thinning, prescribed burning and riparian improvement projects. The geographic setting for the cumulative effects analysis is the project analysis area. The timeframe for past actions is 10 years. The timeframe for future and foreseeable action is 20 years.

Table 15: Summary of Vegetation Effects by Biophysical Type for the No Action Alternative within the Upper Beaver Creek Watershed Fuels Reduction Project in 2018.

Unit of Measure	Effects under the No Action Alternative, Year 2018		
	Project-wide	WUI	Non-WUI
Colorado Plateau and Southwestern Ponderosa Pine (PPIN5 and PPIN7)			
Trees per acre (TPA)	only reduced through mortality. Does not move towards desired condition.	only reduced through mortality. Does not move towards desired condition.	only reduced through mortality. Does not move towards desired condition.
Average Tree Diameter at Breast Height	QMD increases from 13.9 inches in 2008 to 15.0 inches in 2018.	QMD increases from 15.1 in 2008 inches to 16.0 inches in 2018.	QMD increases from 13.1 inches in 2008 to 14.1 inches in 2018.
Canopy Closure (%)	Canopy closure average increases up to 66% from 58% in 2008. Overall, does not meet the desired condition average of 40% outside of PAC's and PFAs. Average exceeds 40% within PFAs and PACs in VSS 4, 5, 6 (DBH ≥ 12") ; canopy closure would average greater than 50% and meets Forest Plan desired conditions in PAC's and PFAs.	Canopy closure average increases up to 64% from 56% in 2008. Overall, Does not meet the desired condition average of 40% outside of PAC's and PFAs. Average exceeds 40%. Within PFAs and PACs in VSS 4, 5, 6 (DBH ≥ 12"); canopy closure would average greater than 50% and meets Forest Plan desired conditions in PAC's and PFAs.	Canopy closure average increase up to 66% from 59% in 2008. Overall, Does not meet the desired condition average of 40% outside of PAC's and PFAs. Average exceeds 40%. Within PFAs and PACs in VSS 4, 5, 6 (DBH ≥ 12"DBH); canopy closure would average greater than 50% and meets Forest Plan desired conditions in PAC's and PFAs.
Juniper-Pinyon (JUPI1)			
Stand Density (trees per acre)	TPA only reduced through mortality. Does not move towards desired condition.	TPA only reduced through mortality. Does not move towards desired condition	TPA only reduced through mortality. Does not move towards desired condition
Average Tree Diameter at Breast Height	QMD increases from 8.3 inches in 2008 to 9.4 inches in 2018.	QMD increases from 7.8 inches in 2008 to 9.0 inches in 2018.	QMD increases from 8.7inches in 2008 to 9.9 inches in 2018
Canopy Closure (%)	Canopy closure increases to 37% from 16% in 2008.	Canopy closure increases to 35% from 6% in 2008	Canopy closure increases to 39% from 25% in 2008.
Mountain Grassland			
Trees per acre	only reduced through mortality. Does not move towards desired condition.	only reduced through mortality. Does not move towards desired condition	only reduced through mortality. Does not move towards desired condition
Average Tree Diameter at Breast Height	Is non-applicable		
Canopy Closure (%)	Canopy closure increases through deferral, no movement towards desired condition		

The No Action Alternative does not propose any treatments within the cumulative effects boundary; therefore, there will be no cumulative effect from this alternative to vegetation. Over time, the trees will continue to grow. Increased canopy cover will increase the potential for competition-related stress to the overstory component and consequently there will be a continued loss of understory biodiversity, as well as an increasing potential for stand-replacing wildfire.

Proposed Action Alternative

Direct and Indirect Effects

A variety of thinning treatments are prescribed to meet the objectives are summarized in Chapter 2, Tables 5 and 6 and the Treatment Descriptions section of that chapter. The stands would have grass under-story between groups of trees, where sites allow. Fuel conditions would lead to low-intensity ground fires. Regeneration is expected to occur within both treated and untreated stands; however, treated stands will provide a better opportunity for ponderosa pine regeneration, especially in uneven-aged and uneven-aged goshawk stands.

Overall treatment effects of thinning combined with burning for all prescriptions are to decrease the threat of stand replacing wildfire through decreased fire behavior (Fulé et al, 2001) and to decrease insect and disease threats through reduction in basal areas (Kolb et al, 1998). Understory vegetation is also expected to increase after treatments (Moore, et al, 2006). Cool season species are expected to have the largest response to opening of canopies (Moore and Deiter, 1992).

Indirect effects of all thinning silvicultural treatments include three negative effects. First, created slash can actually increase fire intensity through the increase of ground fuels. To minimize this potential effect, all harvest treatment has a piling or lopping of slash requirement. The primary means of slash disposal will be rough piling and lopping slash. This activity fuels treatment would occur at all sites that are traditionally logged (trees are felled by hand and limbed in the woods, then skidded to a landing for removal). If the area is thinned by mechanized harvesting equipment, whole trees would be skidded to the landing for delimbing, and the slash will be piled on the landing. With the majority of the slash piled at landings, then increased fire intensity from burning activity fuels is not an impact.

The second negative effect is that downed slash can create increased breeding sites for *ips* beetles. This negative effect is mitigated through the design feature that limits green slash creation to July to December (Chapter 2, Thinning and Timber Harvest Design Features).

The third negative effect is that mechanized logging equipment can decrease on-site productivity through soil compaction (Garland, 1997; Jurgensen et al in Ercelawn, 1999). Goodwin (2005) noted that compaction is having an effect on ponderosa pine regeneration and growth throughout the Coconino National Forest. Design features of controlling skid trail location and felling to the lead will minimize this effect (Chapter 2, Soil and Watershed Protection Design Features).

Effects Summarized by Treatment Type

Indicators used to evaluate the effects of the Proposed Action Alternative include Stand Density Index, (SDI), quadratic mean diameter (QMD), canopy cover %, and trees per acre (TPA). Tables 16- 21 show the differences in these indicators for the current condition in 2008, the No Action Alternative in 2018, and the Proposed Action in 2018.

Meadow Maintenance

Approximately 80%-90% of the meadow acres in the project area are meadows without existing trees. Only about 90-180 acres of meadows will be thinned under this prescription which removes trees less than 9 inches that have encroached into the meadows. There will be a reduction in the number of trees per acre due to the thinning on these sites. This will improve the available soil moisture for the remaining trees and improve the growth rates on the remaining trees. The lopped and scattered slash will create microclimates for grass/forb regeneration and we can expect to see increased grass/forb components on-site. The burning of the slash will cause a temporary short-term reduction of the grass/forb component.

PAC 9" Minus

The rate at which the stands develop and the types of trees that develop is dependent upon the current and future stand density. If the stands develop under dense, overstocked conditions they will lose the lower part of their canopy, the limbs will be short and small in diameter, the needle retention will be shorter (the tree will drop the foliage sooner due to competition for light and moisture), the tree's natural defense mechanisms to protect against insect attack will be compromised, and growth will be slow. Trees that develop under more open conditions will develop faster, have larger limbs, more dense crowns, have better functioning defense mechanisms, and retain their needles longer.

The stands were modeled from data collected in 1986, 1987, and 2004 and all were grown to the year 2006 and run through the FVS which projects tree growth over time from models validated by stand data collected within these same stand types and ecological areas. FVS uses the **Stand Density Index (SDI)** as a measure of inter tree competition, which will be reflected in individual tree growth and form. Different tree species will be able to prosper and grow at different stand densities. Maximum SDI for ponderosa pine in Northern Arizona is 450-600 (Skov et al, 2004). Ponderosa pine begin to be stressed when SDI reach 35-40% of maximum SDI and the stand becomes susceptible to insect and disease outbreak (Table 16).

The thinning and burning proposed in the understory will not improve tree growth and health greatly in location/site 5560004 because much of the stand density is not removed with the proposed thinning. The other three stands will have some slight improvement in growth and reduced stress with lowered SDI's. SDI's when treated are 40-60% of maximum SDI. If the stands are not thinned, the SDI's increase to 50-85% of the maximum SDI. Canopy covers still will remain high and understory vegetation will not improve greatly.

Table 16: Stand Attributes for the PAC 9" minus treatment by location/site for current year, 2008, 2018 No Action, and 2018 Proposed Action.

			2008	CURRENT	
location/site	**Rx**	**SDI[2]**	**QMD**	**canopy cover**	**acres**
5330003	N/A	347	3.9	67	43
5330017	N/A	200	4.1	53	21
5500010	N/A	290	4.5	64	25
5650004	N/A	810	4.2	89	96
			2018	**No Action**	
location/site	**Rx**	**SDI**	**QMD**	**canopy cover**	**acres**
5330003	N/A	372	4.2	69	43
5330017	N/A	224	4.4	57	21
5500010	N/A	328	5.1	68	25
5650004	N/A	818	4.4	90	96
			2018	**Proposed Action**	
location/site	**Rx**	**SDI**	**QMD**	**canopy cover**	**acres**
5330003	pac 9" minus	270	4.2	61	43
5330017	pac 9" minus	179	4.3	51	21
5500010	pac 9" minus	274	5.2	64	25
5650004	pac 9" minus	729	4.3	87	96
Grand Total					159

Effects Common to all Harvest Activities where trees over 9" DBH will be removed

All stands harvested will utilize the Schubert (1974) stand age class 1 and 2 marking guideline so that no yellow pines will be removed. This may retain higher target basal areas so that stand growth may not be what was modeled. In addition, all harvest prescriptions will retain groups and clumps and will create openings of ¼ to 4 acres in size. These openings are expected to produce some amount ponderosa pine regeneration that will aid in promoting a more diverse age-class structure. Where proposed, the removal of trees up to 18" dbh will aid in reaching the stand objective stated above through a reduction in growing stock and removal of dwarf mistletoe infested trees.

Savannah Maintenance

Modeling results from FVS display that thinning and burning will greatly reduce ponderosa pine trees per acre, SDI, and canopy cover (Table 17). The quadratic mean diameter at breast height increases greatly under this prescription (nearly 5 inches over no treatment). There is an exhaustive body of research that shows how reducing stand density helps reduce the incidence of pest damage to a stand (Fiddler et al. 1995, Oliver 1995, Sartwell 1971), and this treatment will reduce the incidence of pest damage to ponderosa pine.

Modeling in FVS also displays that approximately 10,600 trees will be removed on about 1,800 acres in the 16-18" DBH diameter class. These estimates are thought to be the maximum number that may be removed, and it is likely that the number removed in these

[2] SDI in all atables refers to the SDI for all species.

size classes will be less than the modeled amount. Please refer to Appendix A, A-2, for a disclosure of data for individual location/sites. Because the soil type on these sites is a Mollisol, it is expected that grass understory will greatly increase under this prescription on these sites.

Table 17: Average stand attributes for the savannah maintenance treatment on 2,294 acres for current year, 2008, 2018 No Action and 2018 Proposed Actionand Prescribed Burned.

2008 Current					
RX	**QMD_PP**	**SDI**	**canopy cover**	**TPA_ALL**	**TPA_PP**
N/A	9.8	248	63	597	235
2018 No Action					
	QMD_PP	**SDI**	**canopy cover**	**TPA_ALL**	**TPA_PP**
N/A	10.5	270	66	576	224
2018 Proposed Action					
	QMD_PP	**SDI**	**canopy cover**	**TPA_ALL**	**TPA_PP**
Savannah maintenance	15.2	118	44	343	33

Thin From Below

Modeling results from FVS display that thinning and burning will reduce ponderosa pine trees per acre, SDI, and canopy cover (Table 18). Quadratic mean diameter at breast height increases over no treatment by about 1.5". Stand density index is approximately 50% of maximum SDI when treated as opposed to a stand density index 85% when the same stands are modeled with no treatment.

Table 18: Average stand attributes for the Thin from Below treatments on 4,900 acres for current year, 2008, and 2018 No Action and 2018 Proposed Action.

2008 Current					
RX	**QMD_PP**	**SDI**	**canopy cover**	**TPA_ALL**	**TPA_PP**
N/A	9.6	343	67	1,453	248
2018 No Action					
	QMD_PP	**SDI**	**canopy cover**	**TPA_ALL**	**TPA_PP**
N/A	10.4	364	70	1,361	230
2018 Proposed Action					
	QMD_PP	**SDI**	**canopy cover**	**TPA_ALL**	**TPA_PP**
thin from below	11.9	206	53	1,090	69

Modeling in FVS also displays that an estimated 7,600 trees will be removed on about 2,000 acres in the 16-18" DBH diameter class. Thinning up to 16" DBH will occur on about 2,900 acres (Appendix A, Table A-2). These estimates are thought to be the maximum number that may be removed, and it is likely that the number removed in these size classes will be less than the modeled amount.

Transition Maintenance

Modeling results from FVS display that thinning and burning will reduce ponderosa pine trees per acre, SDI, and canopy cover (Table 19). Quadratic mean diameter at breast height increases over no treatment on the same stands by about 3.3". Total trees per acre decrease with the removal of ponderosa pine down to an average of about 30 ponderosa pine trees per acre (the remaining trees are primarily alligator juniper and gambel oak). Stand density index is approximately 33% of maximum SDI when treated as opposed to a stand density index 80% when the same stands are modeled with no treatment.

Table 19: Average stand attributes for the Transition Maintenance treatment on 2,680 acres for current year, 2008, 2018 No Action and 2018 Proposed Action.

	2008 Current				
RX	**QMD_PP**	**SDI**	**canopy cover**	**TPA_ALL**	**TPA_PP**
N/A	10.2	315	67	1,116	219
	2018 No Action				
	QMD_PP	**SDI**	**canopy cover**	**TPA_ALL**	**TPA_PP**
N/A	11.0	340	70	1,057	208
	2018 Proposed Action				
	QMD_PP	**SDI**	**canopy cover**	**TPA_ALL**	**TPA_PP**
Transition maintenance	14.3	139	43	801	30

Modeling in FVS also displays that an estimated 11,500 trees will be removed on about 1,900 acres in the 16-18" DBH diameter class and that thinning up to 16" DBH will occur on about 770 acres (Appendix A, Table A-2). These estimates are thought to be the maximum number that may be removed, and it is likely that the number removed in these size classes will be less than the modeled amount.

Uneven-Aged Management

Modeling results from FVS display that thinning and burning will reduce ponderosa pine trees per acre, SDI, and canopy cover (Table 20). Quadratic mean diameter at breast height increases over no treatment on the same stands by about 1.4". Stand density index is approximately 40% of maximum SDI when treated as opposed to a stand density index 65% when the same stands are modeled with no treatment.

Table 20: Average stand attributes for the Uneven-aged Management treatment on 1,215 acres for current year, 2008, 2018 No Action and 2018 Proposed Action.

	2008 Current					
RX	**QMD_PP**	**SDI**	**canopy cover**	**TPA_ALL**	**TPA_PP**	**acres**
N/A	9.8	254	60	995	266	950
	2018 No Action					
	QMD_PP	**SDI**	**canopy cover**	**TPA_ALL**	**TPA_PP**	**acres**
N/A	10.7	280	63	939	245	950
	2018 Proposed Action					

	QMD_PP	SDI	canopy cover	TPA_ALL	TPA_PP	acres
Uneven-aged	12.1	177	51	714	93	950

Modeling in FVS also displays that an estimated about 800 trees will be removed on about 400 acres in the 16-18" DBH diameter class and thinning up to 16" DBH will occur on about 800 acres (Appendix A, Table A-2). These estimates are thought to be the maximum number that may be removed, and it is likely that the number removed in these size classes will be less than the modeled amount.

Uneven-aged Management-Goshawk

This treatment is similar to the Uneven-Aged treatment above except that the stands selected are not presently exhibiting multi-canopied and aged characteristics. The stands selected for treatments are ponderosa pine-oak. Over half the acres proposed for treatment are in the WUI. Creating openings in the stands will provide the opportunity for regeneration to occur and to begin to have a multi-aged stand.

Modeling results from FVS display that thinning and burning will reduce ponderosa pine trees per acre, SDI, and canopy cover (Table 21). Quadratic mean diameter at breast height increases over no treatment on the same stands by about 2.0". Stand density index is approximately 45% of maximum SDI when treated as opposed to a stand density index 80% when the same stands are modeled with no treatment. Average canopy covers are decreased down to 54% versus 70% if the same stands are not harvested. This will increase sunlight to the ground and should improve understory vegetation density. Modeling in FVS displays that an estimated 3,400 trees will be removed in the 16-18" DBH diameter class on about 1,100 acres (Appendix A, Table A-2).

Table 21: Average stand attributes for the Uneven-aged Management Goshawk on 3,609 acres for current year, 2008), 2018 No Action and 2018 Proposed Action.

			2008		
RX	QMD_PP	SDI	canopy cover	TPA_ALL	TPA_PP
uneven-goshawk	10.2	331	68	1,071	240
			2106 No Cut		
	QMD_PP	SDI	canopy cover	TPA_ALL	TPA_PP
uneven-goshawk	10.9	349	70	1,019	226
	QMD_PP	SDI	canopy cover	TPA_ALL	TPA_PP
uneven-goshawk	12.8	199	54	786	70

Fuel Treatments

Proposed fuel treatments include broadcast burning, maintenance burning, and treating activity slash by machine piling, hand piling and broadcast burning. The effects to units of measure for silvicultural treatments (stand density, average tree diameter and canopy closure) are not direct effects, rather they are indirect effects. Burning treatments will improve timber stands ability to resist stand replacing fire through removal of down woody material and raising crown base heights through scorch and will also minimize

occupation of woody vegetation on-site over time. Burning treatments will also stimulate growth of fire-dependant species, such as buckbrush. Burning will also provide site preparation for natural regeneration of ponderosa pine, but may also kill some ponderosa pine regeneration

Piling of slash will disturb more acres of ground and will stimulate gambel oak reproduction. More acres of potential compaction can occur if tracked equipment is run when ground conditions are conducive to compaction. Design features for soil and watershed protection (Chapter 2) are designed to minimize equipment use when ground is conducive to compaction. The use of equipment can also introduce noxious weeds. Design feature for Noxious or Invasive Weeds (Chapter 2) are designed to minimize the spread of noxious weeds by requiring vehicles to be cleaned prior to working on-site.

Proposed Action Alternative Vegetation Effects Summary

Effects of the Proposed Action Alternative are summarized in Table 22 below. Canopy cover decreases over the current condition in all biophysical settings where thinning occurs Colorado Plateau and Southwestern ponderosa pine , decreasing on average 5-6% over 2008 canopy cover values in Southwestern ponderosa pine and 7-14% in Colorado Plateau ponderosa pine Canopy covers in Pinyon-juniper increase with no thinning by 20%. No values for meadows were modeled due to a lack of data, however are expected to decrease with thinning.

Table 22: Summary of Vegetation Effects by Biophysical Type for the Proposed Action Alternative Alternative within the Upper Beaver Creek Watershed Fuels Reduction Project in 2018.

Unit of Measure	Effects under the Proposed Action alternative, Year 2018		
	Project-wide	WUI	Non-WUI
Colorado Plateau and Southwestern ponderosa pine PPIN5 and PPIN7			
Stand Density (trees per acre)	TPA reduced through thinning to average of 154/acre in PIPO and average of 785 trees/ac in all trees (down from average of 240 trees/acre in PIPO and 947 trees per acre for all trees). Does move towards desired condition.	TPA reduced through thinning to average of 124/acre in PIPO and average of 847 trees/ac in all trees (down from average of 205 trees/acre in PIPO and 1,006 trees per acre for all trees). Does move towards desired condition.	TPA reduced through thinning to average of 148/acre in PIPO and average of 698 trees/ac in all trees (down from average of 213 trees/acre in PIPO and 820 trees/acres forall trees). Does move towards desired condition.
Average Tree Diameter at Breast Height	QMD increases from 13.9 inches in 2008 to 16.0 inches in 2018 (an increase of 1.1 inches over no action).	QMD increases from 15.1 in 2008 inches to 17.6 inches in 2018 (an increase of 1.4 inches over no action).	QMD increases from 13.1 inches in 2008 to 14.8 inches in 2018 (an increase of 0.8 inches over no action).
Canopy Closure (%)	Canopy closure average decreases to 51% in 2018 from 58% in 2008. Does not meet desired average of 40% but moves towards desired condition.	Canopy closure average decreases to 49% in 2018 from 56% in 2008. Does not meet desired average of 40% but moves towards desired condition.	Canopy closure average decreases to 54% in 2018 from 59% in 2008. Does not meet desired average of 40% but moves towards desired condition.
Pinyon-Juniper JUPI1			
Stand Density (trees per acre)	TPA reduced through mortality only to average of 8/acre in PIPO and average of 143 trees/ac in all trees (down from average of 9 trees/acre	TPA reduced through mortality only to average of 11/acre in PIPO and average of 138 trees/ac in all trees (down from average of12 trees/acre	TPA reduced through mortality only to average of 6/acre in PIPO and average of 148 trees/ac in all trees (down from average of 6 trees/acre

Unit of Measure	Effects under the Proposed Action alternative, Year 2018		
	Project-wide	**WUI**	**Non-WUI**
	in PIPO and 146 trees per acre for all trees). Are close to desired.	in PIPO and 141 trees per acre for all trees). Are close to desired.	in PIPO and 151 trees per acre for all trees). Are close to desired.
Average Tree Diameter at Breast Height	QMD increases from 8.3 inches in 2008 to 9.4 inches in 2018 (same as no action).	QMD increases from 7.8 inches in 2008 to 9.0 inches in 2018 (same as no action).	QMD increases from 8.7inches in 2008 to 9.9 inches in 2018 (same as no action).
Canopy Closure (%)	Canopy closure increases to 37% from 16% in 2008. Does not meet desired condition.	Canopy closure increases to 35% from 6% in 2008. Does not meet desired condition.	Canopy closure increases to 39% from 25% in 2008. Does not meet desired condition.
Mountain Grassland MGRA1			
Stand Density (trees per acre)	TPA reduced through thinning. Does move towards desired condition.	TPA reduced through thinning. Does move towards desired condition.	TPA reduced through thinning. Does move towards desired condition.
Average Tree Diameter at Breast Height	Not-applicable		
Canopy Closure (%)	Canopy closure decreases through thinning		

As canopy cover decreases, ponderosa pine litter decreases in depth and percent soil cover. Increased sunlight and precipitation reaches the forest floor due to a reduction in canopy interception. Decreased shading of the forest floor and pine litter accumulation increases herbaceous understory growth, presence, and establishment and increases available soil moisture and nutrients to nearly all plants and soil organisms (Brown and Smith 2000, Naumburg et al. 2001). In addition, increased sunlight and decreased litter will allow for some level of ponderosa pine regeneration.

The result of decreasing canopy covers is decreased levels of stress on all trees, decreased density induced mortality, and decreased crown fire hazard (Brown and Smith 2000). Water and nutrient stress decreases the ability of trees to survive drought, bark beetles, and other pathogens, therefore, a decrease in density will improve the ability of trees to survive drought and pathogens. Susceptibility to western pine beetle and other pathogens will decrease initially, but will increase over time if stand conditions are not maintained. Areas with the greatest likelihood of infestation are those stands with densities greater than 120 BA and average stand diameters greater than 12" dbh.

Quadratic mean diameter of ponderosa pine within all stands increases with 10 years of growth on average around 2 inches for all biophysical settings, as opposed to about 1 inch with no action (Table 15). Ponderosa pine on average sites should grow about 2" in diameter per decade (Schubert, 1974).

Cumulative Effects

Activities considered in the cumulative effects analysis include timber sales, thinning, prescribed burning and riparian improvement projects. The geographic setting for the cumulative effects analysis is the project analysis area. The timeframe for past actions is 20 years. This timeframe was chosen because stand conditions and tree growth begins to approximate pre-treatment growth after 20 years.

The total cumulative effects acres for silvicultural treatments will be 15,945 acres from the Upper Beaver Creek Watershed Fuels Reduction Project added to the 4,250 acres from previous treatments for a total of about 20,200 acres of silvicultural treatment acres, or approximately 41% of the entire project area. The cumulative effects of these treatments are improved resistance to disease through stocking control, reduced crown fire potential through removal of ladder fuels and a reduction of interconnected canopies that carry crown fires, and a reduction of canopy cover for improved understory vegetative response. These effects are applicable for about 10 years on the 4,250 acres for previous treatments, and will last approximately 20 years on the treatments proposed under this project until canopies begin to close and competition for moisture increases as stand density increases.

Overall, cumulative effects of thinning treatments will improve stand conditions for individual sites, as well as the entire landscape over the No Action Alternative. Design features are in place to minimize negative effects from slash creation and compaction. Overall, the Proposed Action Alternative will improve stand conditions and the resiliency of the stands within the analysis area to disease and fire.

Fire and Fuels

The following section pertaining to the fuels resource, affected environment and effects of the alternatives is summarized from the *Fire, Fuels and air Quality Specialists Report,* by J. Thumm and D. Fleishman, 2007, (PR# 186).

Fire and Fuels Affected Environment

Dead and Down Fuels

Dead and down fuel loadings (surface fuels) range across the analysis area from a low of 3 tons per acre to a high of 30+ tons per acre. Surface fuels are comprised of slash from past forest management activities (logging, pulping, and pre-commercial thinning), and from normal annual fuel accumulation (tree blow-downs, tree breakage, conifer litter, and herbaceous litter, etc.). Historic fire intervals for the ponderosa pine forests of the southwest range from two to twenty years (Moore, et al, 1999). One research site located at Limestone Flats Experimental Forest on the Mogollon Rim District had a median return interval of every 4 years (Swetnam and Baisan, 1996). Within the analysis area, fire has been excluded for about the past 100 years with the exception of pile burning on timber sales, and the Mayes and Stoneman Lake/Apache Maid and Happy Jack Urban Interface prescribed burns that have burned approximately 9,000 acres within the analysis area since 2001.

Live Fuels

Live fuels are primarily comprised of conifer tree crowns, shrubs and grasses. Historically, most of the analysis area consisted of stands of generally large diameter

ponderosa pine (likely averaging 30-50 ft^2 /acre basal area) with scattered large Gambel oak, and a well-developed herbaceous under story. Today, the over story is dominated by small diameter ponderosa pine stands, ranging from 100-150 ft^2/acre basal area over much of the analysis area, with scattered Gambel oak of all sizes, and an understory consisting more of pine needles and duff and much less grass than historically occurred within the pine type.

Fire Regime Condition Class

Fire Regime Condition Class (FRCC) is a methodology that describes the current state of a landscape in relation to its natural or historic condition, both in terms of vegetative structure and in terms of the landscape fire regime. The FRCC system uses two sets of descriptors that, when combined, can be used to diagnose a condition[3] class of a given landscape. The first set of factors measures vegetation composition and structure changes. The second set measures possible changes in fire frequency and severity. Within the analysis area, there are four identified Biophysical Settings (BpS)

The current Fire Regime Condition Class (FRCC) for the Biophysical Settings within the analysis areas are derived from INFORMS modeling and run through FRCC software (www.frcc.gov) is as follows:

Table 23: Current Fire Condition and Fire Frequency Data (FRCC)

Colorado Plateau Ponderosa Pine - PPIN5	**Computed Value**	**Condition Class**
Vegetation-Fuel Condition class	68	3
Fire Frequency-Severity Condition Class	47	2
Southwestern Ponderosa Pine - PPIN7	**Computed Value**	**Condition Class**
Vegetation-Fuel Condition class	76	3
Fire Frequency-Severity Condition Class	69	3
Mountain Grassland- MGRA2		**Condition Class**
Vegetation-Fuel Condition class	30	1
Fire Frequency-Severity Condition Class	92	3
Pinyon-Juniper - JUPI1	**Computed Value**	**Condition Class**
Vegetation-Fuel Condition class	60	2
Fire Frequency-Severity Condition Class	91	3
Landscape Weighted Average FRCC	**64**	**2**

Fire Regime Condition Class methodology assigns a class rating for each BpS to the highest computed value for the each BpS strata and also assigns a rating for an entire landscape. For example, the Colorado Plateau Ponderosa Pine BpS (PPIN5) has a vegetation-fuel condition class rating of 68 and a fire frequency-severity condition class of 47. Fire Regime Condition Class methodology assigns an overall score of 68 and a FRCC

[3] Three condtion classes are defined: Condition Class 1: within natural or historical range of variability with vegetation fuel class composition and fire frequency severity characteristic of the natural fire regime; Condition Class 2: moderate departure from natural or historical range of variability; and Condition Class 3: large departure from natural or historical range of variability with a large departure from natural fuel class compostion and fire frequency-severity.

rating of 3 for the PPIN5 BpS. Using this methodology, all of the four BpS's have a FRCC score of 3.

Even though all of the individual strata have an FRCC of 3, the weighted average Fire Regime Condition Class for the entire landscape is a 2 (departure score of 64). This is occurring primarily because the current vegetation fuel departure within the Mountain grassland is very low (30) and the current fire frequency severity class for PPIN5 is also relatively low (47) and these data have skewed the average for all strata combined. Calculated FRCC for the current conditions are shown in Table 24 in the discussion of the No Action Alternative.

All data for the FRCC calculations are from the INFORMS data set for the analysis area that includes Most Similar Neighbor analysis to impute data to all stands, Forest Vegetation Simulator data to "grow" all data to 2008, and the Fire Regime Condition Class model within INFORMS. These data were then input into the FRCC software to calculate BpS specific FRCC and a landscape level BpS.

Fire Modeling Methods

The current stand level potential for crown fire was modeled using the **NEXUS** fire model. Fire behavior was modeled with the NEXUS Fire Behavior and Hazard Assessment System (Scott and Reinhardt, 2001). NEXUS integrates models of surface fire behavior (Rothermel 1972) with crown fire transition (Van Wagner 1977) and crown fire spread (Rothermel 1991). NEXUS is similar to the landscape fire behavior modeling program **FARSITE** in that both link the same set of surface and crown fire models. However, NEXUS is better suited for comparing fire hazards under alternative conditions because environmental and fuel factors are kept constant for each simulation, rather than changing continuously with time and location, as in FARSITE (Fulé et al 2001). Two weather scenarios were modeled. The analysis for both the weather and fuel conditions can be found in the Fuels and Fire Specialist Report (PR #186).

Current Fire Type

The fire types are described as follows:

- Surface fire--fire on the ground;
- Passive crown fire--torching of canopies, but not continuous torching throughout the entire stand;
- Active crown fire--entire stand is involved in crown fire;
- Conditional crown fire--canopy bulk density is sufficient enough to carry an active crown fire, but crown base height is too high for the crown fire to initiate within the stand. If an adjacent stand carries a crown fire into the stand, it will be sustained through the stand.

Fire types modeled using NEXUS for the project area in the current condition are shown in Chapter 2, on Map 3.

Fire and Fuels Environmental Consequences

No Action Alternative

Direct and Indirect Effects

The units of measure used in this analysis include Fire Regime Condition Class and Fire Type. The FRCC score for vegetation and fuel looks at live vegetation and compares reference conditions to current conditions. A condition class of 3 displays a large departure from the range of natural variability and the no action alternative moves the ponderosa pine portions of the analysis area farther away from the natural range of variability, as well as the landscape as a whole (Table 24).

No treatments are planned with the No Action Alternative that will modify the existing condition of the fuels. Fuels both live and dead/down, within the analysis area will not be affected. If a wildfire occurs during extreme fuel and weather conditions, the potential exists to eliminate much of the dead/down fuels within the fire's perimeter and to eliminate many of the live fuels through stand replacement crown fire. Areas that do experience crown fire will lose much of their live fuel loading and dead/down surface fuel loading. Fire killed trees will deteriorate due to rotting, eventually falling and becoming dead/down surface fuels.

Table 24: Fire Condition Class and Fire Frequency Class by Biophysical Setting, Current Conditions, 2008 and under the No Action Alternative, 2018

	Current Conditions 2008		No Action Alternative 2018	
Colorado Plateau Ponderosa Pine - PPIN5	**Computed Value**	**Condition Class**	**Computed Value**	**Condition Class**
Vegetation-Fuel Condition class	68	3	88	3
Fire Frequency-Severity Condition Class	47	2	68	3
Southwestern Ponderosa Pine - PPIN7	**Computed Value**	**Condition Class**	**Computed Value**	**Condition Class**
Vegetation-Fuel Condition class	76	3	98	3
Fire Frequency-Severity Condition Class	69	3	80	3
Mountain Grassland-MGRA2	**Computed Value**	**Condition Class**	**Computed Value**	**Condition Class**
Vegetation-Fuel Condition class	30	1	30	1
Fire Frequency-Severity Condition class	92	3	92	3
Pinyon-Juniper - JUPI1	**Computed Value**	**Condition Class**	**Computed Value**	**Condition Class**
Vegetation-Fuel Condition class	60	2	50	2
Fire Frequency-Severity Condition Class	91	3	88	3
	Computed Value	**Condition Class**	**Computed Value**	**Condition Class**
Project Area FRCC	64	2	83	3

Fuel loadings will continue to increase over time because the existing live and dead/down fuels are not treated, increasing the potential surface fire intensity, surface fire severity, and crown fire potential. The number of acres that may be affected by a high intensity, high severity fire (passive and conditional fire types) will also increase due to increasing homogeneity of surface and aerial fuels across the entire project area. NEXUS fire modeling displays increased acreage of crown fire (active and conditional fire types) from 2008 to 2018, as show by comparing Maps 4 and 5 in Chapter 2 of the EA, particularly in the southern half of the analysis area. The percent area of crown fire (active and conditional fire types) increases from 9% to 12% in the first 10 years with the no action alternative, with the largest increase in the conditional fire type. Active crown fire type actually decreases by just less than 300 acres in this time frame due to increases in crown base heights from tree growth.

This is the result of growth of all trees that presently exist within the analysis area and establishment of conifer regeneration. Growth and regeneration will cause an increase in the average amount of woody biomass (limbs, twigs, pine needles, leaves, etc.) produced on every acre, contributing to increased surface fire intensity and severity over time. Growth will also increase average percent canopy closure, increasing the likelihood of a crown fire, once initiated, to advance through the forest canopy continuously. Potential for transition of surface fire to crown fire increases as surface fire intensity increases. Potential for wide spread over story and under story mortality due to root and cambial injury increases as potential fire severity increases. Soil sterilization, soil seed bank destruction, and soil erosion also increase as potential fire severity increases.

Table 25. Summary of Fire Regime Condition Class for the No Action Alternative in 2008 and 2018

FRCC Summary	VEGETATION/FUEL CONDITION CLASS		FIRE FREQUENCY/SEVERITY CLASS	
	2008	2018	2008	2018
Colorado Plateau Ponderosa Pine (PPIN5)	3	3	2	3
Southwestern Ponderosa Pine (PPIN7)	3	3	3	3
Mountain Grassland (MGRA2)	1	1	3	3
Pinyon-Juniper (JUPI1)	2	2	3	3
No Action Landscape FRCC 2008 = 2		No Action Landscape FRCC 2018 = 3		

Table 26. Summary of Acres of Fire Type for No Action 2008 and 2018

FIRE TYPE	2008	% of AREA	2018 NA	% of AREA
Active	2,625	5%	2,346	5%
Conditional	1,807	4%	3,578	7%
Passive	18,458	38%	14,290	29%
Surface	22,196	45%	24,871	51%
Non-Forest	3,099	8%	3,099	8%

Cumulative Effects

The geographic setting for the cumulative effects analysis is the Project Area boundary. There are no cumulative effects because this alternative does have any effect to the current condition.

Proposed Action Alternative

Direct and Indirect Effects

Prescribed fire can effectively alter potential fire behavior by influencing multiple fuel bed characteristics including: reducing loading of fine fuels, duff, large woody fuels, rotten material, shrubs, and other live surface fuels, which together with compactness and continuity change the fuel energy stored on the site and potential spread rate and intensity (Graham, et al, 2004; Agee and Skinner, 2004; Peterson et al, 2005).

Agee and Skinner (2004) note that to create a fire resilient timber stand that three principles need to be applied: 1) reduce surface fuels; 2) reduce ladder fuels; and 3) reduce crown density. Carey and Schumann (2003) note that prescribed burning achieves principle 1 and a portion of principle 2 and principle 3. Principle 2 is achieved through raising crown base heights, and principle 3 can be achieved if small trees are killed through burning.

Approximately 15,000 acres would be burned within the WUI. As suggested by Nowicki (2002), spotting can occur and lift firebrands "miles ahead of the forest fire". The treatments proposed within the WUI will limit the number of firebrands produced by treating fuels to diminish crown fire, the largest producer of long-range spotting. The actions proposed do not treat directly adjacent to houses as Nowicki (2002) suggests, because the Forest Service does not have jurisdiction on private lands. As evidenced by the Mayes Prescribed Burn, the Stoneman Lake/Apache Maid Prescribed Burn, and the Happy Jack Urban Interface Prescribed Burn that have previously occurred within the analysis area boundary, and as the research suggests, prescribed fire has decreased surface fuel loadings, and has raised crown base heights.

Thinning alone can alter fire behavior primarily through a reduction of crown density, but can also increase surface fuel loadings through the placement of slash on the ground (Carey and Schuman 2003). Carey and Schumann (2003) further note that the use of mechanical thinning alone has a varied effect on modifying fire behavior, primarily because of the created slash. All of the thinning treatments proposed within this analysis are paired with prescribed burning; therefore, the effects analysis will examine the combination of thinning and burning. Various authors have noted that the combination of thinning and burning is the most effective way to alter fire behavior (Strom 2005; Graham et al. 2004; Peterson et al. 2005; Cram et al, 2006)

Removal of small diameter trees will decrease trees per acre, decrease basal area and lower FRCC vegetation and fuel scores. Understory thinning eliminates some of the lower portion of the forest canopy increasing the overall crown base height (CBH) of the

remaining forest canopy. Increasing CBH reduces the potential for surface fires to transition into the forest canopy by increasing the distance between surface fires and the aerial fuel layer, thereby increasing the surface fire intensity required to ignite the crowns (Agee and Skinner, 2004; Graham, et al 2004; Peterson et al, 2005; Cram et al, 2006). Decreasing **crown bulk density (CBD)** reduces the ability of fire to spread horizontally through the forest canopy if it does transition from the surface layer into the aerial layer. (Agee and Skinner, 2004; Graham, et al 2004; Peterson et al, 2005)

If thinning material is not removed it rearranges live aerial fuels into dead /down surface fuels resulting in a potentially substantial increase in surface fuel loading, fuel bed depth, and fuel bed continuity (Carey and Schuman, 2003; Graham et al, 2004). Slash fuel beds produce higher fire intensities and longer flame lengths, than the existing pine litter fuel bed under constant atmospheric conditions. Therefore, the increase of CBH gained through thinning may be ineffective in reducing the ability of a surface fire to transition into the crowns until the fine fuels are removed from the aerial portion of the slash layer. The use of whole tree skidding will minimize this potential negative effect.

The FRCC score for vegetation and fuel looks at live vegetation and comparing reference conditions versus current conditions (Hann, et al; 2008). A condition class of 1 is within the natural range of variability and the higher the condition class, the farther the site is from the natural range of variability. The Table below displays that the treatments proposed in the Proposed Action Alternative begin to move the analysis area toward the natural range of variability for the fire/vegetation condition and fire frequency/severity condition. When the vegetative composition is closer to the natural range of variability, natural processes can occur that will maintain the site (Allen et al, 2002; Falk 2006).

The number of acres that may be affected by a high intensity, high severity fire (passive and conditional fire types) will also decrease due thinning and fuels treatments across the entire project area. NEXUS fire modeling displays decreased acreage of crown fire (active and conditional fire types) from 2008 to 2018, as shown by comparing Maps 3 and 5 in Chapter 2 of the EA. The percent area of crown fire (active and conditional fire types) decreases from 9% to 2% in the first 10 years with the proposed action alternative. Surface fire becomes the dominant fire type, occurring on approximately 70% of the project area.

Table 27: Fire Condition Class and Fire Frequency Class, Current condition 2008, and after the Proposed Action is implemented Year 2018

	2008		2018	
Colorado Plateau Ponderosa Pine - PPIN5	**Computed Value**	**Condition Class**	**Computed Value**	**Condition Class**
Vegetation-Fuel Condition class	68	3	31	1
Fire Frequency-Severity Condition class	47	2	60	2
Southwestern Ponderosa Pine - PPIN7	**Computed Value**	**Condition Class**	**Computed Value**	**Condition Class**
Vegetation-Fuel Condition class	76	3	56	2
Fire Frequency-Severity Condition Class	69	3	42	2
Mountain Grassland-MGRA2	**Computed Value**	**Condition Class**	**Computed Value**	**Condition Class**
Vegetation-Fuel Condition class	30	1	30	1
Fire Frequency-Severity Condition Class	92	3	92	3
Pinyon-Juniper- JUPI1	**Computed Value**	**Condition Class**	**Computed Value**	**Condition Class**
Vegetation-Fuel Condition class	60	2	52	2
Fire Frequency-Severity Condition Class	91	3	91	3
	Computed Value	**Condition Class**	**Computed Value**	**Condition Class**
Project Area FRCC	64	2	57	2

Proposed Action Alternative Fire and Fuels Effects Summary

Effects of the Proposed Action Alternative are summarized in Table 28 and 29 below.

Table 28. Summary of Fire Regime Condition Class for the Proposed Action Alternative in 2008 and 2018.

FRCC Summary	VEGETATION/FUEL CONDITION CLASS		FIRE FREQUENCY/SEVERITY CLASS	
	2008	2018	2008	2018
Colorado Plateau Ponderosa Pine PPIN5	3	1	2	2
Southwestern Ponderosa Pine PPIN7	3	2	3	2
Mountain Grassland MGRA2	1	1	3	3
Pinyon-Juniper JUPI1	2	2	3	3

Table 29. Summary of Acres of Fire Type for Proposed Action Action 2008 and 2018

FIRE TYPE	2008	% of AREA	2018 PA	% of AREA
Active	2,625	5%	354	1%
Conditional	1,807	4%	730	1%
Passive	18,458	38%	10,060	20%
Surface	22,196	45%	33,941	69%
Non-Forest	3,099	8%	3,099	8%

Cumulative Effects

The geographic setting and the timeframe for cumulative effects analysis for the Proposed Action Alternative is the same as described for the No Action Alternative. The only projects that occur, or are proposed to occur within the analysis area that affect fuel loading or fuel arrangements are the prescribed burning of about 9,000 acres on the Mayes, Stoneman Lake/Apache Maid, and Happy Jack Urban Interface project. This project will add about 28,000 acres of additional burning and about 16,000 acres of thinning and prescribed burning treatments. The effects of these past projects to the units of measure are similar to those summarized above. Overall, the project will improve fuels conditions and begin to move the analysis area towards a fire adapted ecosystem.

Comparison of Alternatives for Fire and Fuels

Please see Tables 9 and 10 and related discussions in Chapter 2 of the EA.

Soil and Water

The following section pertaining to soils and water resources, affected environment and effects of the alternatives is summarized from the *Soil and Water Specialist's Report*, by D. Fleishman, 2007 (PR #147).

Soil and Water Affected Environment

Soils

Soil existing conditions are taken from the Coconino National Forest Terrestrial Ecosystem Survey (Miller et al, 1995) and field visits. Water quality data is from the Arizona Department of Environmental Quality and riparian conditions are from field visits.

Table 30. Soil Data within the Upper Beaver Creek Watershed Fuels Reduction Project analysis area.

TES Soil Group	Description or Plant Association	Net Acres	Slope	Erosion Hazard	Soil Condition
50	Grassland	105	0-5	Severe	Satisfactory
55	Grassland	1,065	0-5	Slight	Satisfactory
430	Pinyon- Juniper	0	40-120	Moderate	Unsuited
492	Pinyon- Juniper	2,912	0-15	Moderate	Satisfactory
493	Pinyon- Juniper	176	15-40	Moderate	Satisfactory
495	Pinyon- Juniper	304	0-15	Slight	Satisfactory
520	Ponderosa Pine	851	0-15	Slight	Satisfactory
530	Ponderosa Pine	1,357	15-40	Moderate	Satisfactory
565	Ponderosa Pine	2,320	15-40	Severe	Satisfactory
567	Ponderosa Pine	43	0-15	Slight	Satisfactory
575	Ponderosa Pine	572	40-120	Severe	Satisfactory
578	Ponderosa Pine	3,829	0-15	Slight	Satisfactory
579	Ponderosa Pine	5,115	0-15	Slight	Satisfactory

TES Soil Group	Description or Plant Association	Net Acres	Slope	Erosion Hazard	Soil Condition
582	Ponderosa Pine	13,871	0-15	Slight	Satisfactory
584	Ponderosa Pine	4,066	15-40	Severe	Satisfactory
585	Ponderosa Pine	8,641	0-15	Slight	Satisfactory
586	Ponderosa Pine	2,835	0-15	Slight	Satisfactory
Lake	Open Water	118	0-5		

Watersheds

The Upper Beaver Creek Watershed Fuels Reduction Project occurs within portions of three 5th code watersheds. The predominant 5th code watershed within the project area is the Beaver Creek watershed, which comprises approximately 94% of the analysis area.

Table 31. 5th Code watershed acres within the analysis area

5th Code watershed and HUC Number	Acres in project	% of project area	5th code acres	% watershed in project
Beaver Creek 1506020206	46,262	94.2%	277,088	16.7%
West Clear Creek 1506020301	2,698	5.5%	190,774	1.4%
Walnut Creek 150201502	164	0.3%	124,312	0.1%

Water Quality

No perennial streams occur within the analysis area. Because of this, no water quality data exists for the streams within the watershed. Stoneman Lake occurs within the analysis area and has water quality data associated with it. The designated uses for Stoneman Lake include the following: 1) Aquatic and Wildlife; 2) Full Body Contact; 3) Fish Consumption; 4) Agricultural Livestock Watering, and 5) Agricultural Irrigation (ADEQ, 2004). Water quality data downstream are inconclusive due to change in turbidity standards (ADEQ, 2004).

In the 2004 Arizona Department of Environmental Quality water quality assessment (ADEQ, 2004), Stoneman Lake is considered a non-attaining water body, with only the Fish Consumption designated use in attainment of curent water quality standards. As recent as 2000, Stoneman Lake was currently on the State of Arizona's 303(d) list as impaired for dissolved oxygen (D.O.), pH, and the narrative criteria for nutrients. This is due primarily to the abundant growth of submergent aquatic vegetation (**SAV**) during the warm summer months, with a resulting vertical stratification and hypoxia in the lower water column. A **Total Maximum Daily Load (TMDL**) assessment was completed in 2000 and approved by the Environmental Protection Agency resulting in placement from the EPA Impaired 303d list into a non-attaining assessment Category 4a. Impleementation of recommendations listed in the TMDL are expected to improve the lake water quality into attainment status.

Streams

A riparian assessment using the BLM's Proper Functioning Condition (Prichard, 1993) protocol and scoresheet was accomplished in the analysis area in the summer/fall of 1998 and 1999. Of the approximately 165 miles of streamcourses within the analysis area area, roughly 7 miles are riparian. The riparian reaches within the analysis area are not perennial streams. They are streams that contain intermittent pools and do flow primarily during spring runoff.

Table 32. Riparian Condition Reaches in the Upper Beaver Creek Watershed Fuel Reduction Project Analysis Area

Reach name	Reach id	PFC rating	Miles
Brady Canyon	1506020289G001	PFC	0.6
Jacks Canyon	1506020289F001	PFC	1.6
Jacks Canyon	1506020289F002	PFC	4.6
Grand Total			6.8

Wetlands

Stoneman Lake is a semi-permanent wetland that occurs entirely within the boundary of the analysis area and encompasses approximately 208 acres, of which, nearly 118 acres are on lands managed by the Forest Service. Using the BLM's Proper Functioning Condition (Prichard, 1993) rating assessment for lentic riparian areas, Stoneman Lake is classified as PFC.

Springs

Eleven springs occur within the analysis area. All of the springs are currently functional at-risk due to grazing by ungulates. Exceptions to this are the portions of the springs protected by elk-proof exclosures at Bill Dick, Foster, and Jones Springs.

Table 33. Springs within the Analysis Area

Spring name	Acres	Spring name	Acres
Banfield Spring	0.5	Jones Spring	0.5
Bill Back Spring	0.1	No Name Spring	0.1
Bill Dick Spring	0.1	Quiniptewa Springs	0.1
Bottle Spring	0.1	Tenakhonga Springs	0.1
Campbell Spring	0.1	Yellow Jacket Springs	0.1
Foster Spring	0.5		

Water Rights

Nearly 100% of the analysis area occurs within the Verde watershed 4th code watershed. Water rights within this portion of the analysis area are a mixture of stockponds and springs claims to surface water by the Salt River Project, the Forest Service, various landowners, and range permittees.

Beaver Creek Experimental Watershed

The Beaver Creek Experimental Watershed **(BCEW)** was established in 1956 to study the influence of various vegetative manipulations of pinyon-juniper and ponderosa pine on water yield and peak flows and to evaluate changes in livestock forage, timber production, wildlife habitats, recreational values, and soil movement. Within the analysis area, there are approximately 9,400 net acres of the BCEW.

Soil and Water Environmental Consequences

Soils

No Action Alternative

Direct and Indirect Effects to Soils

There will be no direct effects because there will be no thinning or prescribed burning activities and therefore no acres of ground disturbance from mechanized logging or burning.

Indirect effects from the no action alternative will be an increase in coarse woody debris through natural processes to very high tons per acre in both live and dead fuel loads. Coarse woody debris is expected to increase over time as small diameter material begins rotting and falling. The risk of a stand replacing, high intensity fire will increase over time, which would have a negative effect to soils directly after a stand-replacing, high intensity fire because the wildfire can remove protective ground cover, increase soil repellency (hydrophobisity) which would cause accelerated erosion. Since it is impossible to know where a wildfire could occur, it is difficult to quantify the potential effects.

Cumulative Effects to Soils

The types of projects that were analyzed for cumulative effects to soils include timber sales and thinning that can affect the acres of ground disturbance, primarily through fuel treatments, as well as past burning and wildfires. The geographic setting for the cumulative effects analysis will include the Beaver Creek watershed, which is about 277,000 acres. A small portion of the analysis area exists within the West Clear Creek (WCC) 5th code watershed (about 2,600 acres), but it comprises about 1% of the entire WCC watershed and less than 5% of two 6th code watersheds. It was felt that this small portion of the project in the WCC 5th code did not warrant inclusion in the cumulative effects analysis for soils because the effects to the watershed are extremely small. In

addition, approximately 150 acres of the Walnut Creek 5th code watershed falls within the project boundary. This watershed was not included in the cumulative effects analysis for the same reason as the WCC portion. The timeframe for past actions is 10 years, based on vegetative and coarse woody debris recovery of the site. Because no acres are treated in this alternative and the indirect effects cannot be quantified, there are no quantifiable cumulative effects from this Alternative.

Proposed Action Alternative

Direct and Indirect Effects to Soils

Thinning, Logging and Activity Fuels Treatments

The Proposed Action Alternative will provide short-term indirect benefits from thinning on approximately 16,000 acres through a reduction in the potential of stand-replacing fire. The direct benefit will be that slash will be placed on the ground on these acres, providing a microclimate and protecting the soils, as well as providing for more than adequate coarse-woody debris on-site. Approximately 1,200 acres of the proposed treatment acres occur on soils with a severe erosion rating. Best Management Practices to protect the soils resources are incorporated into the project and are designed to minimize impacts of treatments to severe erosion hazard sites (Chapter 2, Proposed Action Alternative Design Features for Soil and Watershed Protection).

Thinning trees as proposed in this project can be done in a variety of ways. First, the thinning can be performed by chainsaw and not by mechanized harvesting equipment. Limited ground disturbance would occur under hand thinning from vehicles driving off road. However, this will be very limited in extent and for the purposes it is estimated that no more than 5 acres of ground will be disturbed in this manner. The ground disturbance would be in the form of compaction, and not disturbance to where mineral soil is exposed.

Second, thinning can be done by hand/or mechanized felling equipment (shear) and then logs would be skidded to landings by mechanized equipment. Best management practice monitoring on the Mogollon Rim Ranger District (Jagow, 1994; Fleishman, 1996 and Fleishman, 2005) has shown that ground disturbance (skidded to mineral soil) and compaction may occur on approximately 10-15% of the thinning area when mechanized skidding and harvesting occur and Best Management Practices are implemented. This includes felling to the lead and designating skid trails. These two practices limit soil disturbance (Froehlich et al, 1981). Therefore, approximately 1,400 to 2,200 acres of ground disturbance and compaction would be expected to occur in the vegetation removal and thinning treatment areas. Additional effects from ground disturbance include exposing soil to accelerated erosion by removal of vegetative ground cover.

Machine piling of created slash from thinning activities disturbs the greatest amount of ground through re-arrangement and exposure of the soil surface. Compaction is limited because of the use of tracked equipment, but can occur with tracked equipment if machine piling is done when soil conditions are wet.

Mechanized cutting and whole tree skidding takes entire trees to the landing, where they are subsequently delimbed at the landing. All local logging contractors now utilize this

method of harvest. Under this scenario, only the landing will need to be machine piled; or approximately 1% of the entire harvested area, or approximately 160 acres of the acres that are currently proposed for some form of machine piling (strict machine piling and rough piling). Therefore, the approximately 14,300 acres of harvest area that would be rough piled will no longer need this treatment because the created slash from harvest will be at the landing; therefore the amount of ground disturbance from slash treatment is greatly reduced. Hand piling and areas proposed for lop and scatter only will occur on about 150 acres and will not have any ground disturbance associated with the activity.

As a general rule of thumb, hand thinning and mechanical skidding will leave the greatest acreage of thinning slash that will need to be machine piled. Under this scenario, there are two means to machine pile (1) strict machine piling of all material which disturbs approximately 50-60% of the harvested area and (2) rough piling, which just piles accumulations of slash and not all of the slash is piled. Rough piling disturbs approximately ½ of the ground as compared to machine piling, or 25-30% of the harvested area. Under the Proposed Action Alternative, there are about 670 acres of machine piling proposed. These acres are all directly adjacent to urban interface structures. Therefore, it is expected that 340 to 400 acres will have ground disturbance if hand felling and mechanical skidding is used as the harvest method. There are approximately 14,300 acres that are proposed for rough piling. Of this, if hand felling and mechanical skidding logging is used, it is expected that approximately 3,575 to 4,300 acres of ground disturbance will occur.

Burning of machine piles negatively affect soil biotic and chemical properties due to intense soil heating (Korb et al, 2004 and Seymour and Tecle, 2004). Seymour and Tecle (2004) did not note physical changes in burning under piles, this they felt was due to the cobbly nature of the soils. Under a mechaized harvest scenaio where piles at landings are burned and a hand felling with rough pile scenario it is estimated that about 160 acres of piles will be burned. The effects at these sites will be change in soil chemical and biotic properties. The site is very similar to the site where Seymour and Tecle (2004) did there research and it is felt that the soils will contain enough cobble to minimize changes in soil physical properties. Many of the burn acres will be the same acres disturbed as the skidding/landing acres.

Prescribed Burning Treatments

Prescribed burning will occur on approximately 44,000 acres under the Proposed Action Alternative. Prescribed burning can affect soil resources through reduction of coarse woody debris, damage to soil physical structure, and damage to soil biological features (Wells, 1979; Graham et al, 1994; Neary et al, 2005), as well as providing positive effects through nutrient flushes from the burn (Covington and Debano, 1990). This increase is short-lived due to rapid biological and chemical immobilization of released nutrients. The effects from fire are directly related to fire intensity, with the general rule of thumb that the greater the burn intensity, the greater the amount of damage to forest soils (Neary et al, 2005; Wells, 1979). This same general relationship will apply on the Upper Beaver Creek Watershed Fuel Reduction project's prescribed burning treatments. The effect will vary by soil and fuel moisture regimes and fuels distribution. However, duff/litter portions of

the prescribed burn will have the least negative effect on soil properties, while allowing for release of nutrients for a one to two year period. Burning of larger material will increase the risk of negative effects to soil properties as the size of material burned increases, which increases fire intensity.

We can expect that a majority of the effects from the first entry of prescribed burning (approximately 31,000 acres) will be in the duff/litter portion, and should actually have a positive affect due to soil nutrient increases. A smaller percentage of the burned area will be in the moderate sized woody material, and will have a negative effect to soil biotic material through higher soil temperatures; however, soil temperatures are not expected to be high enough to do damage to soil physical structure. This should occur on approximately 1-5% of the treated sites (approximately 300 to 1,600 acres). The larger sized material (10"+ size material) will have the greatest affect to soil properties, similar to the pile burning affects. This should occur on approximately 0-1% of the site (approximately 0-300 acres).

There will be a second stage of prescribed burning fuel treatments on acres that have been thinned, as well as maintenance burning on unthinned sites (44,000 acres). With the second prescribed burning treatment, much of the material will be of medium size (3-10" size material). This is expected to produce a varying intensity of burns, with a majority of the burned area having a low to moderate burn intensity. A small percentage of the areas prescribed burned in the second entry are expected to have a high intensity burn due to fuel arrangements after the precommercial thinning (0-1%, or approximately 0-450 acres).

With the implementation of Best Management Practices and Design Features for Soil and Watershed Protection, effects to soil resources from burning will be minimized. Only activity slash will be piled, so the existing coarse woody debris will remain on-site, hence no affect to long-term soil productivity.

Cumulative Effects to Soils

Cumulative Effects analysis parameters of scope, setting and timeframe are the same as for the No Action Alternative. Projects considered in the analysis are listed at the beginning of Chapter 3.

Table 34: Summary of Direct Effects to Soil for the Proposed Action Alternative

MEASURE	ACRES	% OF PROJECT AREA 48,179 acres
Acres of High Intensity Burns	300-1,900 acres	1-4%
Acres of Soil Disturbance—Logging only[4]	1,400-2,200 acres	3-5%
Acres of Disturbance-Machine Piling with Hand Felling and Mechanized skidding Logging[5]	3,975-4,300 acres	8-9%

[4] This includes skidding and landing of logs.
[5] Hand felling limbs trees in the woods. This activity slash will be piled 100% or rough piled. The acres disturbed include the combination of the two piling methods that are prescribed and described in the text above. If the site is not whole tree skidded, these are the maximum acres of ground disturbance for logging and machine piling.

TOTAL GROUND DISTURBANCE---LOGGING AND MACHINE PILING WITH HAND FELLING LOGGING	***5,375-6,500 acres***	***11-13%***
Acres of Soil Disturbance—Logging only	1,400-2,200 acres	3-5%
Acres of Disturbance-Machine piling of whole-tree skidded logging[6]	150 acres	<1%
TOTAL GROUND DISTURBANCE- MECHANIZED LOGGING, MACHINE PILING, AND WHOLE TREE SKIDDING TO LANDINGS	***1,550-2,350 acres***	***3-5%***
TOTAL HIGH INTENSITY BURNS AND GROUND DISTURBANCE- logging and machine piling with traditional logging	***5,675– 8,400 acres***	***12-17%***
TOTAL HIGH INTENSITY BURNS AND GROUND DISTURBANCE- mechanized logging, machine piling and whole tree skidding to landings	***1,850-4,250 acres***	***4-9%***

There are about 500 miles of open road in the project area which equate to about 900 acres of ground disturbance from roads. For this analysis, it is estimated about 1% of the grazing allotments have ground disturbed by cattle within the cumulative effects analysis area; primarily at watering and salting sites, or about 1,500 acres. Grazing (domestic and wild) also removes biomass that can affect soil productivity, but this is difficult to quantify and is not measurable for this analysis. The total amount of ground disturbance before treatments are implemented is about 2,400 acres for this analysis (about 1.6% of the cumulative effects analysis area).

Overall, there have not been any timber sale ground disturbing activities within the past 10 years. The most recent timber sale was the Lake Timber Sale that occurred north of Stoneman Lake Road on approximately 2,500 acres. The ground disturbance from logging has healed from this project and coarse woody debris has begun to re-establish through bug killed trees and normal tree limb breakage. Therefore, the activities proposed for this project will be the only ground disturbing activities that will add to the existing condition of about 2,400 acres of ground disturbance.

Table 35. Summary of Cumulative Soil Effects Considering Ground Disturbance (logging, machine piling and high intensity burn acres) for the Proposed Action Alternative.

MEASURE	ACRES	% OF ANALYSIS AREA 277,0000 acres
Existing High Intensity Burn Acres	100 acres	0%
Acres of High Intensity Burns Proposed Action Alternative	300-1,900 acres	0 – 0.7%
TOTAL HIGH INTENSITY BURNS	*400-2,000 acres*	*0.1 -0.7%*
Existing Ground Disturbed Acres	2,400 acres	0.9%
Total ground disturbance-- -logging and machine piling with traditional logging	3,975-4,300 acres	1-2%
TOTAL GROUND DISTURBANCE- logging and machine piling with hand fellling.	*6,375-6,700 acres*	*2%*

[6] This is for landing piling on whole tree skidded sites. The total acres of ground disturbance for logging and whoile tree skidding machine piling is 160 acres plus the 1,400-2,200 acres of disturbance from logging.

MEASURE	ACRES	% OF ANALYSIS AREA 277,0000 acres
Existing Ground Disturbed Acres	2,400 acres	0.9%
Total ground disturbance—mechanized logging, machine piling and whole tree skidding to landings	1,550-2,350 acres	0.6%
TOTAL GROUND DISTURBANCE—mechanized logging, machine piling, and whole tree skidding to landings	*3,950-4,750 acres*	*1-2%*
SUMMARY ACRES OF GROUND DISTURBANCE AND HIGH INTENSITY BURNS		
TOTAL HIGH INTENSITY BURNS AND GROUND DISTURBANCE- logging and machine piling with hand felling logging	***6,775-9,100 acres***	***2-3%***
TOTAL HIGH INTENSITY BURNS AND GROUND DISTURBANCE--mechanized logging, machine piling, and whole tree skidding to landings	***4,350-6,750 acres***	***2%***

For past and present prescribed burns, there have been a total of about 9,400 acres of burning in the analysis area. In a field review of these burns, less than 1% of the area has had high intensity burns, or about 100 acres. The Proposed Action Alternative accumulates an additional 300-1,900 acres of high intensity burns within the cumulative effects watershed boundary, for a total of about 400-2,000 acres of high intensity burn.

In summary, the Proposed Action Alternative disturbs approximately 2-3% of the ground within the cumulative effects boundary area, depending on the method of logging and the corresponding fuel treatment. No threshold for ground disturbance occurs within the Coconino National Forest Plan. However, Forest Service Handbook 2509.18 (USDA Forest Service 1991) recommends a guideline of a 15 percent reduction in inherent soil productivity potential as a basis for setting threshold values for measurable or observable soil properties or conditions. The 15% threshold of ground disturbance where soil productivity crosses a negative threshold has not been exceeded with this project for the cumulative effects boundary and therefore, long-term soil productivity is maintained. However, if the area is hand felled logged, there is a potential for ground disturbance to exceed the 15% within the project area, but not within the cumulative effects boundary. However, all local logging contractors now are completely mechanized, and conventional logging is only a small possibility. Further protection of soil resources is provided by the use of Best Management Practices that minimize the potential for soil disturbance. Because of these facts, the Proposed Action Alternative will not provide a detrimental cumulative effect to soil resources within the Beaver Creek watershed.

Comparison of Alternatives for the Soils Resource

Table 36. Comparison of Alternatives for the Soils Resource

Environmental Indicator or Unit of Measure	No Action Alternative	Proposed Action Alternative
Acres of High Intensity burns	0 acres, however, higher potential of acres of high intensity burns from wildfire event than the PA.	300-1,900 acres. Reduced threat of high intensity burn acres (see fire and fuels fire type above)
Acres of ground disturbance from	0 acres	3,975 – 4,300 acres – hand felling

Environmental Indicator or Unit of Measure	No Action Alternative	Proposed Action Alternative
logging, machine piling, skidding etc.		logging 1,550 – 2,350 acres – mechanized logging
Total acres of effects to soils, summary of high intensity burn acres and ground disturbance from equipment use.	0 acres. Effects of moderate and high intensity wildfire not estimated.	1,850 – 6,200 acres. From 4-13% of the project area would be disturbed depending on logging methods. This level of disturbance is within FSH 2509.18 recommendation of less than 15% site disturbance.
Disturbance to Beaver Creek Watershed	0% increase in disturbance. Effects of moderate and high intensity wildfire not estimated.	From 2-3% of the Beaver Creek Watershed would be disturbed form the project activities of prescribed burning and logging.

Water

No Action Alternative

Direct and Indirect Effects to Water

There are no direct effects to water quality within this alternative. There are potential, unquantifiable indirect effects from not treating ladder fuels that could lead to an increased risk of stand replacing, high intensity wildfires.

Cumulative Effects to Water

Cumulative Effects analysis parameters of scope, setting and timeframe are the same as for the No Action Alternative for Soils. Projects considered in the analysis are listed at the beginning of Chapter 3. The No Action Alternative will not add any additional ground disturbing activities within the Beaver Creek watershed. Because no acres are treated in this alternative and the indirect effects cannot be quantified, there are no quantifiable cumulative effects from this Alternative.

Proposed Action Alternative

Direct and Indirect Effects to Water

Direct effects to water quality are sediments produced through ground disturbance and acres of high intensity burns where sediments may detach. Indirect effects to water quality are hazardous material use and potential human created waste from contractors camping on-site. An additional indirect effect may be the spraying of noxious weeds as a mitigation measure prior to proposed treatments that may affect water quality; however the lack of live water in the analysis area will limit direct effects of spraying. The effects of spraying noxious weeds have been previously analyzed in the Final Environmental Impact Statement (FEIS) for Treatment of noxious or invasive Weeds, Coconino, Kaibab and Prescott National Forests, and Coconino, Mohave and Yavapai Counties, Arizona (USDA Forest Service 2005) amended the Coconino National Forest Plan. Appendix B of this EA includes specific design features, best management practices, required protection measures and mitigation measures to manage noxious or invasive weeds for the Upper Beaver Creek Watershed Fuel Reduction Project.

As stated in the section on soils above, the total acres disturbed from ground disturbance (logging, slash piling, and high intensity burns) in this Alternative would be from a minimum of about 1,850 acres to a maximum of about 6,200 acres. These disturbed sites have potential to detach and transport sediments and moved these sediments off-site and into connected streamcourses and may pose a short-term risk to water quality (suspended sediments) in Beaver Creek but are predicted to be very minor in magnitude due to proposed small treatment acres in the watershed and BMP applications. In addition, the application of Soil and Watershed project design features listed in Chapter 2 of the EA are designed to limit sediment production through designated filter strips and limiting the operation of equipment within filter strips. No activities are planned within the crater of Stoneman Lake; therefore there will be no effect from the project on water quality to the lake. Additional BMPs listed in Chapter 2 are prescribed to minimize sediment production from upland, non-filter strips sites as well by limiting ground disturbance through designation of skid trails, felling to the lead, erosion control methods, road drainage and maintenance, limiting the slopes where mechanized fuel treatments can occur, and by limiting the timing of operations. The potential of large wildfire is decreased through the proposed activities, which decreases the risk of increased sediments from a large wildfire.

An indirect effect of harvest activities is contractors camping on-site and fueling during harvest activities. Poor sanitation practices and hazardous materials spills could also negatively affect water quality. BMPS are prescribed in the Chapter 2 Proposed Action Design Features to protect soils and watershed values.

Cumulative Effects

Cumulative Effects analysis parameters of scope, setting and timeframe are the same as for the Proposed Action Alternative for Soils. The cumulative effects analysis for soil is germane to the water and water quality. The total acres of ground disturbance are less than 2-3% of the entire cumulative effects boundary, and depends on the type of logging whether traditional or mechanized. All of the thinning, timber harvest, prescribed burning and road maintenance practices are designed with sediment reduction BMPs in place, as detailed in Chapter 2 and Appendix B. Therefore, the Upper Beaver Creek Watershed Fuels Reduction Project is not expected to detrimentally affect water quality in the Beaver Creek drainage system.

Comparison of Alternatives for the Water Resource

Table 37. Comparison of Alternatives for the Water Resource

Environmental Indicator or Unit of Measure	No Action Alternative	Proposed Action Alternative
Water Quality of Beaver Creek Watershed	No direct effects. There are potential, unquantifiable indirect effects from not treating ladder fuels that could lead to an increased risk of stand replacing, high intensity wildfires which could negatively affect water quality.	Sedimentation to water courses may have short-term increase from current levels due to ground disturbance. This effect will be moderated to low levels by BMP's for soils and watershed, stream coarse protection buffers, spill prevention BMPs. Beaver Creek water quality would not be detrimentally affected.

Wildlife

The following section describes the affected environment and effects of the alternatives for the terrestrial wildlife resource which includes: habitat components, threatened, and endangered species, Regional Forester's sensitive species, management indicator species, big game and migratory birds. The analysis presented is summarized from the following reports which are incorporated by reference: *Wildlife Specialist's Report, Upper Beaver Creek Watershed Fuel Reduction Project,* by B. Garcia, 2008 (PR #213); *Biological Assessment and Evaluation, Upper Beaver Creek Watershed Fuel Reduction Project,* by B. Garcia, 2008 (PR# 217); and the *Biological Assessment for Federally Threatened and Endangered Species, Upper Beaver Creek Watershed Fuel Reduction Project,* by B. Garcia and D. Renner, 2008, (PR# 216).

Affected Environment for Wildlife

The affected environment analysis used data from a variety of sources including: field data from site visits, GIS analysis, accessing and querying websites and databases, literature searches, project- and species-specific wildlife and wildlife habitat surveys, peer communications, modeling, and professional experience. All species where surveys were conducted followed either USFS Region 3 survey protocols, USFWS protocols and/or AZGFD protocols for the Mexican spotted owl, Chiricahua leopard frog, Bald Eagle, Northern Goshawk, Peregrine Falcon and Northern leopard frog. Further information and detailed descriptions of species occurrence, habitat preferences and habitat conditions, and rationale for including or excluding species from analysis are found in the reports listed above, (PR #213).

Habitat Components

Wildlife habitat components analyzed include snags, logs and down woody debris, wildlife cover, and old growth. Methods of analysis and data from the analysis of the various habitat components are found in PR #213, the Wildlife Specialist Report.

Snags

In ponderosa pine forests, the Forest Plan standards and guidelines are to manage for a minimum of 2 snags per acre greater than 18" dbh across forested land. Snag data for trees in the 18-24" dbh is lacking for the project area. Snags within Mexican spotted owl micro-habitat plots indicate that over 40% of the plots sampled did not have a snag on the plot, and that 22% of the plots only had 1 snag. This information was collected for snags over 12" and not specifically for snags greater than 18". Either way, the fact that over 40% of the micro-habitat plots sampled did not have a single snag on the plot and 22% had only 1 snag indicates that the Forest Plan standard and guideline for snags is not currently being met within the project area where MSO habitat plots were conducted (PR #144), and probably for the entire analysis area.

Snags do appear to be on the increase within the greater project area as a whole, as evidenced by snag data that was modeled in FVS. This information was modeled where snags were broke down in 10-20" size classes and 20" + size classes, and not along the 18" dbh standard as stated in the Forest Plan. Currently, the 20"+ snags were less than the Forest Plan standard and guideline (.2 snags/acre). Modeling shows snags > 20" dbh increasing through 2046, but still not to the standard and guideline. Again, the number of snags 18" and greater is not known, but is expected to increase.

Ganey et al. (2007) agree with this assessment when he looked at snags in relation to Northern goshawk and found that overall, snags appear to be slowly increasing across the Coconino National Forest. Again, the study did not disclose the size diameter classes of the recruitment. Therefore, project design features and/or mitigations will be set in place to emphasize large diameter (>18" dbh) retention and recruitment and no snags are targeted for removal (see project design features "snags" for detailed description of design features).

Logs and Down Woody Debris

The Forest Plan guidance for down logs states there should be 3 or more logs (12" diameter and greater than 8' long) per acre. Cursory data from the Mogollon Rim Ranger District fuels crew indicates that on average there are about 1.6 logs per acre, and logs range from 0- 15.4 per acre (J. Thumm, Fuels Specialist, personal communication 2008). PFAs and PACs have greater amounts of downed logs, but over the project area, logs are lacking.

Cover

Hiding and **thermal cover** are important attributes of the forest for wildlife habitat. Wildlife cover for the project area was determined from stand data including basal area

and tree size class, and field evaluations. The vast majority (89%) of the project area is of one habitat type – ponderosa pine forest. The project area meets Forest Plan recommendations for cover (30% cover in each habitat, with a minimum of 10% hiding and 10% thermal cover). Hiding cover is found on 20% of the project area, is well distributed and contributes to ladder fuels. Thermal cover is scattered across 17% of the area, and also contributes to ladder fuels. Thermal cover and hiding cover combined are found on 37% of the project area, which meets the Forest Plan Guideline of at least 30% in each habitat. Cover attributes of at least 30% are being met in each of the four 10K's that comprise the analysis area (Blind Lake, Buck Mountain, Jacks and Jones Mountain 10K's, respectively). Data on cover attributes analyzed in 10K blocks within the project area are in the project record (PR #213 and #205)

Old Growth

The project meets the Forest Plan's Old Growth Guideline that requires at least 20% of naturally forested areas within each forest type is designated as Old Growth for both Ponderosa pine type and the pinyon-juniper type (see Vegetation section above and PR #146).

Threatened and Endangered Species

Four terrestrial wildlife species listed as threatened or endangered under the Endangered Species Act, are known or have the potential to occur in the project area are listed in Table 38 (PR #216 and #217). Two of the species are known to occur within the Upper Beaver Creek Project boundary: the bald eagle and the Mexican spotted owl. The southwestern willow flycatcher is not known to occur nor does suitable habitat exist within the project Area and will not be analyzed. The Chiricahua leopard frog has not been detected in the project area since the early 1970's but suitable habitat is found in the project area. Additionally, designated critical habitat for the Mexican Spotted Owl exists within the project boundary. The analysis area includes habitat available within the project area, plus 0.5 miles beyond the project area boundary for federally threatened or endangered (T&E) species. Habitat needs and components, survey information, and detailed information on these species are contained in PR #216 and #217.

Table 38. Threatened and Endangered Species considered in this analysis

Species	Scientific Name	Status
Bald eagle	*Haliaeetus leucocephalus*	Federally Threatened-Yavapai County
Chiricahua leopard frog	*Rana chiricahuensis*	Federally Threatened
Mexican spotted owl-Species and Habitat	*Strix occidentalis lucida*	Federally Threatened
Mexican spotted owl-Critical Habitat	*Strix occidentalis lucida*	Federally Threatened

Bald Eagle

Bald eagles are frequently encountered in the project area, mostly during the winter months and during migration. Key habitat components include nighttime roosts used during harsh weather and prey availability. A 1986 – 1994 bald eagle research study on the Coconino National Forest, which included the proposed project area, located overnight use sites ("roosts") using telemetry and ground surveys (Mogollon Rim Ranger District files). The 13 sites (out of 60 total) that were used across multiple years likely represent roost "areas". Based on this information, there are areas where it is likely for bald eagles to roost, however exact specific locations or the exact trees of these roosts have not been formally identified in the project area. There are no nesting eagles known to be in the project area but potential nesting habitat exists. Therefore, for the purposes of this analysis, only effects to wintering and summer foraging bald eagles are addressed.

Chiricahua leopard frog

The Chiricahua leopard frog historically occupied habitats in the southern end of the project area with the nearest historic population last being recorded in 1972 at two tanks, Bar D Tank and Buck Mountain Tank (Table 39). Statewide surveys indicate a severe decline in this species (Sredl et al. 1997). Potential habitat for the species may exist in the project area, especially in the southern portion, and would likely be associated with stock tanks. In 2005, 27 earthen stock tanks in the analysis area were surveyed for Chiricahua leopard frogs. Of the tanks surveyed, 17 were considered to contain potential habitat for the species and were subsequently resurveyed in 2006 and 2007. The surveys from 2005 to 2007 did not find any evidence of Chiricahua leopard frogs. Surveys are ongoing in 2008.

Table 39: Tanks that have been historically occupied by Chiricahua leopard frogs.

Tank Name	Historically Occupied	Recently Occupied		Suitable Unoccupied (year surveyed)
		Years with Negative Survey	Years with Positive Survey	
Bar D Tank	X	2006-2007	1972	2006-2007
Buck Mountain	X	2006-2007	1972	2006-2007

Mexican spotted owl

Nine MSO PACs are designated wholly (4) or partially (5) within the Upper Beaver Creek Project analysis area (Table 40), totaling approximately 6,028 acres (~12% of the analysis area). Approximately 3,369 acres of PAC habitat are within the UBC Project area (includes portions of four PACs along the north boundary of the project area), with approximately 2,659 acres of PAC habitat found within the 0.5 mile buffer around the project boundary.

Table 40: MSO PACs in the Upper Beaver Creek Project area

PAC Name	PAC #	Year of first monitoring	Last Detection	PAC in Project Area
Fain Mountain	040410	1989	2001	Partial
Gash Mountain	040521	1989	2006	No*
Jacks Canyon	040402	1988	2006	Whole
Jones Mountain	040429	1991	1996	Whole
Lake Mountain	040411	1989	2006	Whole
Rattlesnake	040102	1990	2006	Partial
Rocky Gulch	040433	1992	1993	Whole
Roundup	040545	1997	1998	Partial
Weir	040104	1995	1998	Partial

* The Gash Mountain PAC is outside the project boundary, but within the 0.5 mile buffer.

The entire analysis area has been surveyed for Mexican spotted owls in 2006-2007 and is currently being surveyed in 2008 following Region 3 protocols with additional measures adopted from U.S. Fish and Wildlife Service protocols (USDI Fish and Wildlife Service 2003).

Mexican spotted owls inhabit the steep canyon slopes of the analysis area. The majority of the project area consists of the pine-oak forest type (about 45,200 acres) on flat or gently sloped terrain. Restricted habitat within pine oak forest type is defined as having at least 10% of the site basal area consisting of oak greater than 5"drc. Approximately 31,077 acres of the analysis area is classified as restricted habitat.

The Recovery Plan for Mexican spotted owls quantifies existing and potential nesting and roosting habitat in Table III.B.1 of the Recovery Plan and calls it **Target/threshold Habitat** (USDI Fish and Wildlife Service, 1995). Within the project area a minimum of 10% restricted habitat must be identified as target/threshold habitat to help ensure that nesting and roosting habitat is maintained/developed within identified Mexican spotted owl habitat. Approximately, 3,966 acres have been identified as target/threshold habitat for MSO. This equates to 13% of identified restricted habitat. This exceeds the 10% level as required by the Coconino Forest Plan and the MSO recovery plan (Table 41). Currently only two stands meet all of the requirements of a threshold stand (5390004 and 5790009). Stand 5390004 is scheduled for treatment with an uneven goshawk treatment and has a modeled post stand condition of 170 BA, 20 trees/acre greater than 18' dbh and an oak basal area of 79---all attributes that retain the stand as a threshold stand. Stand 5790009 is not scheduled for treatment.

Table 41: MSO Habitat within the Project Area

Mexican Spotted Owl Habitat	Acres
Other Forest and Woodland Types[7]	13,191
Protected Habitat: PAC designation = 3,394 acres (includes portions of 4 PACs) Steep Slopes = 351 acres	3,745
Restricted Habitat: Pine-Oak = 31,243 acres; includes 3,966 acres of Target Threshold Mixed Conifer[1] = 0 acres	31,243
Grand Total	48,179

[1] The mixed conifer habitat type is present as small inclusions within some canyon-associated stands, but is not considered large enough (i.e. sufficient acres) to warrant their own stand designations.

Mexican Spotted Owl Critical Habitat

This project is partially within the Critical Habitat Unit called the Upper Gila Management Unit 11 (UGM-11). Not all areas within the mapped critical habitat unit boundaries contain habitat elements important to the owl. Not the entire MSO habitat in the project area is classified as Critical Habitat. There are 20,594 acres of designated MSO Critical Habitat within the project area.

Regional Forester's Sensitive Species

Regional Forester Sensitive Species (RFSS) 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)). Of the 30 terrestrial wildlife species on the MRRD's list of Regional Forester's Sensitive Species (RFSS), 20 are present and/or have potential habitat within the analysis area (Table 42) (PR #216 and #217). The remaining species were excluded from this analysis due to the lack of potential or suitable habitat or the species' presence within the analysis area. The rationale for excluding species from analysis is provided in the project record (PR #216 and #217).

Table 42. Regional Forester's R3 Sensitive Species Analyzed and Habitats in the Project Area

Common Name Scientific Name	Listing Status	Presence and General Habitat	Habitat in Project Area
Birds (6)			
Northern goshawk	SEN, MIS	Y	Three known PFAs, totaling 1,934 acres.

[7] Includes ponderosa pine that is not restricted habitat and juniper woodlands (9,273 acres) and grasslands. Grasslands do have some trees so are included here.

Common Name Scientific Name	Listing Status	Presence and General Habitat	Habitat in Project Area
Accipiter gentilis			Latest survey year, 2007. • Brady Canyon PFA (040403, 656 acres) • Bottle Butte PFA (#040404, 693 acres) • Lake PFA (#040402, 585 acres) No birds were detected in the 2007 surveys. There are 9,273 acres of "other forest and woodland" habitat types in the project area where FP S & G's will apply.
American peregrine falcon *Falco pereginis anatum*	SEN	Y-foraging	There is one known eyrie at Stoneman Lake. A single peregrine falcon was documented there in April 2008; a nest was not detected but suspected by the whitewash and behavior of the bird (B. Garcia personal observation 2008). The closest known eyrie other than Stoneman lake is in the Bear Canyon area of West Clear Creek, approximately four miles south of the project's southern boundary (MRRD files). Suitable nesting habitat occurs in the project area where cliff faces greater than 200 feet in elevation occur in Jack's Canyon and Brady Canyon.
Bald Eagle *Haliaeutus leucocephalus*	SEN, Threatened	Y-wintering and summer foraging	Frequently encountered in the project area, mostly during the winter months and during migration. They use clumps of large trees and snags on canyon slopes for roosts, and congregate around bodies of water. Bald eagles are seen frequently along Forest Highway 3 during the winter months and near Stoneman Lake. Past surveys have noted roost sites and areas that have used by bald eagles but there are no known established roost sites.
Common Black-hawk *Buteogallus anthracinus*	SEN	Y-foraging	The common black-hawk has been observed along Beaver Creek outside of the project area. There have been no observations of black-hawks in the project area, or along any of the perennial springs. Suitable nesting habitat in the project area is not available. Common black hawks have been observed foraging at earthen livestock tanks and meadows in other areas of the species range so it is possible that black-hawks could use the project area for foraging.
Ferruginous hawk *Buteo regalis*	SEN	Y-foraging	The ferruginous hawk has not been observed in the project area. Suitable nesting habitat in the project area is not available. There is suitable foraging habitat within the project area which is why the

Common Name Scientific Name	Listing Status	Presence and General Habitat	Habitat in Project Area
			species was analyzed further.
Western Burrowing Owl *Coccyzus americanus occidentalis*	SEN,	Possibly	Habitat includes high elevation grasslands. They prefer to nest in burrows in the ground, often in old burrows of other animals. No surveys have been conducted and there are no known observations of this species in the project area.
Mammals (10)			
Mogollon Vole (formerly Navajo Mountain Mexican vole) *Microtus mexicanus navaho*	SEN	Y-habitat	Habitats in Northern Arizona include grassy meadows in ponderosa pine, and it also be found in more mesic habitat including montane riparian areas and marshes. No surveys have been conducted and there are no known observations of this species in the project area. There is suitable habitat within the project area which is why the species was analyzed further.
Long-tailed vole *Microtus longicaudus*	SEN	Y-habitat	It resides in a wide variety of habitat types, with many different dominant plant species: dry, grassy areas far from water, mountain slopes, and alder and willow-sedge areas. Range includes northeast Arizona. No surveys have been conducted and there are no known observations of this species in the project area. There is suitable habitat within the project area which is why the species was analyzed further.
Merriams Shrew *Sorex merriami leucogenys*	SEN	Y-habitat	Habitats include various grasslands, including grasses in sagebrush scrub and pinyon-juniper woodland, as well as mountain mahogany shrublands and mixed woodlands. No surveys have been conducted and there are no known observations of this species in the project area. There is suitable habitat within the project area which is why the species was analyzed further.
Dwarf Shrew *Sorex nanus*	SEN	Y-habitat	It inhabits various habitats including rocky areas in alpine tundra and partly into subalpine coniferous forest, other types of rocky slopes (e.g., with ponderosa pine) , sedge marsh, subalpine meadow, dry brushy slopes, arid shortgrass prairie, dry stubble fields, and pinyon-juniper woodland. Range includes the San Francisco Peaks, White Mountains and Kaibab Plateau of Arizona. No surveys have been conducted and there are no known observations of this species in the project area. There is suitable habitat within the project area which is why the species was analyzed further.

Common Name Scientific Name	Listing Status	Presence and General Habitat	Habitat in Project Area
Plains harvest mouse *Reithrodontomys montanus*	SEN,	Y-habitat	Possible habitat in the project area includes ponderosa pine forest, pinyon-juniper, juniper woodland, grassland and open-water/riparian habitats. There are no documented populations or sightings of voles, shrews or mice in the project area directly; however, suitable habitat exists within the project area and some of the species above have been trapped in other areas adjacent to the project area. No surveys have been conducted in the project area. There is suitable habitat within the project area which is why the species was analyzed further.
Allen's lappet browed bat *Idionyctris phyllotis*	SEN	Y	In Arizona, this species is found most often in lower-elevation ponderosa pine forests, and pinyon-juniper woodlands. This species forms day roosts in rock crevices, caves, and mines and therefore typically prefers areas associated with cliffs, outcrops, boulder piles, or lava flows. The Allen's lappet-browed bat is the only bat documented and confirmed near the project area. Allen's lappet-browed bat are known to roost in large Ponderosa Pine snags (>24") with sloughing bark. To date 6 ephemeral roosts have been documented; none of these are within the project boundary itself but within a .5 mile of the project boundary.
Spotted bat *Euderma maculatum*	SEN	Possibly-foraging and day roosting	Spotted bats are in general a desert specialist most often occupying rough, rocky, semi-arid terrain. It is often captured in open ponderosa pine woodlands. It roosts by day in rock crevices located on high cliffs. This bat has been documented using various riparian habitats including mesquite, rabbit brush, sagebrush, creosote bush, snakeweed, yucca and pinyon-juniper.
Pale Townsend's Big eared bat *Corynorhinus townsendii pallescens*	SEN	Possibly-foraging and day roosting	In Arizona this species is found in desert scrub, pinon-juniper woodlands, oak woodlands, and coniferous forests. It can also be found in pine habitats. Females form maternity colonies in caves, mines, and buildings whereas males are typically solitary.
Greater Mastiff Bat *Eumops perotis californicus*	SEN	Possibly-foraging and day roosting	Occurs in western US to Mexico; this species is known to occur in lower elevations in Arizona. Roosts in cliffside caves and canyons.
Four bat species listed above			No surveys have been conducted and there

Common Name Scientific Name	Listing Status	Presence and General Habitat	Habitat in Project Area
			are no known observations of three of the four species in the project area. Some of the bat species listed above have been trapped in other areas adjacent to the project area (C. Chambers, personal communication 2008). Suitable cliff habitat and rim rock occurs throughout the project area in Jacks Canyon, Brady Canyon, Wet Beaver Creek, and Stoneman Lake.
Amphibians (1)			
Northern leopard frog *Rana pipiens*	SEN	Y	There are no perennial streams within the Upper Beaver Creek Project area. However, during the spring runoff, temporary pools could provide habitat for Northern leopard frogs. The majority of potential and suitable habitat in the project area is associated with springs and stock tanks. 51 of the 118 tanks have documented records of Northern leopard frogs, as well as several springs and intermittent drainages with seeps or long-lasting pools. The species is found in Stoneman Lake, the only large body of water within the area. Survey efforts from 2006-current are in the project record.
Invertebrates (3)			
Four spotted skipperling *Piruna polingii*	SEN	Y-habitat	Range includes Arizona, New Mexico and Mexico. Habitat includes Moist woodlands, grassy meadows and riparian habitat. Adults feed on the nectar of various flowers including yellow composites. They are also found in moist grassy riparian situations. Potential suitable habitat includes soils hosting *Viola* and thistle plants. Population status is unknown. No surveys have been conducted. Suitable habitat occurs.
Blue-black silverspot *Speyeria Nokomis Nokomis*	SEN,	Y-habitat	Range includes Arizona and New Mexico. The caterpillar host plant is *Viola nephropphylla*. The adults feed on flower nectar including that from thistles. It is found in streamside meadows and open seepage areas with an abundance of violets in generally desert landscapes. Population status is unknown. No surveys have been conducted. Suitable habitat occurs.
Mountain silverspot *Speryeria Nokomis nitocris*	SEN,	Y-habitat	

Status Codes:
Threatened: Federally listed species,
SEN =On Regional Forester's Sensitive Species List (7/21/99; updated 9/4/2007)
MIS = Coconino Management Indicator Species from the Forest Plan

Management Indicator Species

Management Indicator Species (MIS) have been identified and described in the Coconino National Forest's *Land and Resources Management Plan* (USDA Forest Service 1987, as amended). Forest wide trends of all MIS have been assessed and are reported in Management Indicator Species Status Report for the Coconino National Forest, (USDA Forest Service 2002b). The MIS analyzed for this project are listed in Table 43 below (PR #213). Eleven (11) MIS occur or have potential habitat in the project area. There are several species of MIS that are also categorized as Threatened and Endangered Species, Regional Forester's Sensitive Species (RFSS), Big Game Species and/or Migratory Birds. Effects to these species are covered in their respective section. These species include: Mexican spotted owl, Northern goshawk, elk, mule deer, wild turkey, and juniper titmouse. Rationale for why certain MIS species were eliminated from detailed analysis is contained in the project record (PR #213).

Table 43. Management Indicator Species Analyzed, Habitats and their Forest-wide Habitat and Population Trends

Species	Management Area in Project Area	Habitat Indicator	Forest-wide Habitat Trend	Forest-wide Population Trend	Evaluation for Analysis/Affected Environment
Abert's Squirrel	3, 4, 6	Early seral ponderosa pine	Stable	Inconclusive	Occurs within analysis area. Habitat is widely scattered across the project's landscape. Early seral pine habitat is limited to ~ 450 acres. Stands of dense, intermediate-aged ponderosa pine with scattered large, mature yellow pines suitable for Abert's squirrels are common.
American Pronghorn	9, 10	Early and late seral grasslands	Stable-to-declining	Declining	Occurs within analysis area, suitable grassland and meadow habitat available.
Cinnamon Teal	12	Wetlands/aquatic	Semi permanent -- increasing; Seasonal – stable but below potential; Open water – stable.	Inconclusive	Stoneman Lake, during wet years. No treatments proposed in the crater.
Elk	3, 4, 6, 7, 9	Early seral pinyon-juniper, ponderosa pine, mixed conifer, and spruce-fir	Increasing	Declining	Occurs within analysis area, suitable habitat available within ponderosa pine habitat. Big Game species.
Hairy Woodpecker	3, 4, 6	Snag component in ponderosa pine, mixed conifer and spruce-fir	Increasing	Stable to Increasing	Occurs within analysis area, suitable habitat available within ponderosa pine habitat – snag component. Also utilizes aspen snags.
Juniper (Plain) Titmouse	7	Later seral and snag component of pinyon-juniper	Stable	Stable-to-declining	Occurs within analysis area, suitable habitat available. Migratory Bird species.
Mexican Spotted Owl	3, 4	Later seral mixed conifer and spruce-	Declining	Inconclusive	Occurs within analysis area, suitable habitat available. Cavity nester. TE

Species	Management Area in Project Area	Habitat Indicator	Forest-wide Habitat Trend	Forest-wide Population Trend	Evaluation for Analysis/Affected Environment
		fir			species.
Mule Deer	6, 7	Early seral aspen and pinyon-juniper	Aspen – declining; pinyon-juniper – stable.	Declining	Occurs within analysis area, suitable habitat available. Big Game species.
Northern Goshawk	3, 4	Late seral ponderosa pine	Declining	Inconclusive	Occurs within analysis area, suitable habitat available. RFSS species.
Pygmy Nuthatch	3, 4	Late seral ponderosa pine, snags	Declining	Stable	Occurs within analysis area, suitable habitat available. Habitat includes open park like stands of yellow pines and dense pine forest with large trees and snags.
Wild Turkey	3, 4	Late seral ponderosa pine	Declining	Stable	Occurs within analysis area, suitable habitat available. Big Game species.

Big Game Species

Big game species analyzed include elk, mule deer, wild turkey and black bear (PR #213). The project area is within Game Management Units (GMUs) 6A and 5B-S for big game.

Elk

The project area is part of a major elk herd encompassing **Game Management Units (GMUs)** 5A, 5B, and 6A. Population trends for the combined GMUs are identical to Forest-wide trends (declining), with estimates ranging from about 11,000 in 1986 to a high of about 20,000 in 1994 to about 11,500 in 2001. Based on population data, the AZGFD has succeeded in reducing the elk population, and the current plans are to stabilize the elk population through hunting (Dan Caputo, AZGFD, pers. comm. 2007; Garrett Fabian, AZFD, pers. comm. 2008).). Declines since 2001 have continued at a very slow rate Forest-wide. Care must be taken in interpreting estimates, but the trends are reliable.

Elk use grasslands and early-seral stage woodlands, as well as mid- and late-seral stages of conifer and woodland habitats. These habitats comprise roughly 80% of the project area (most of this in the mid- seral stage). Early seral ponderosa pine habitat has not increased within the project area to a measurable degree over the past 20 years, and what increases there have been were due to wildfires. The Forest-wide habitat trend for early seral ponderosa pine, mixed conifer and spruce-fir is increasing (USDA Forest Service 2002b).

Mule Deer

Arizona Game and Fish Department survey data shows that mule deer were decreasing on the Forest (USDA Forest Service 2002b), but since 2002 the species' population has stabilized to slightly increasing mule deer population across the Forest (Garrett Fabian, AZGFD, pers. comm. 2008; Dan Caputo, AZGFD pers. comm. 2007). Early-seral stages

of ponderosa pine, early-seral stages of aspen, mixed-conifer, pinyon-juniper woodlands, and chaparral habitats are important for this species. These habitats comprise less than 10% of the project area.

Wild Turkey

The wild turkey is an indicator of late seral stage ponderosa pine forests, based on roost habitat requirements. Ponderosa pine vegetation comprise more than 89% of the project area, but a minor amount of it is currently late seral stage (~12%). Roosts are generally clumps of large ponderosa pine located in pine stands. Key habitat attributes include mast from ponderosa pine, pinyon pine, juniper, and oak; riparian areas around springs and seeps, and small openings for invertebrate and seed production. Turkey roosts and nesting habitat occur in steep drainages.

The project area does provide summer breeding habitat, but it is more important as a wild turkey wintering area, primarily due to high mast production (Dan Caputo, AZGFD, pers. comm. 2007; Garrett Fabian, AZFD, pers. comm., 2008). The species' winter range is in pine/woodland transition areas in the southern portion of the project area where turkeys feed on seed heads and mast. The Arizona Game and Fish Department began using a new turkey population index, which showed an increasing population trend between 1997 and 2001 that has stabilized in the past few years (USDA Forest Service 2002b).

Black Bear

The black bear is not a management indicator species, but is a species of public concern as well as a big game species. The project area's resident bear population is small due to poor habitat quality and limited food availability; however, during high mast years, the local population may increase temporarily (Dan Caputo, AZGFD, pers. comm. 2007). Drainages, such as Jack's Canyon, shelter sows with cubs during the spring and summer, and provide some foraging habitat. The project area is primarily used by transient bears which move along corridors, e.g. drainages, to access better quality habitat elsewhere on the District (ibid). According to the Arizona Game and Fish Department, the population on the Mogollon Rim Ranger District appears to be stable at the present time.

Migratory Birds

The project area provides habitat for many bird species, including migrants, year-round residents, and species that are present only during the summer breeding or winter seasons. Federal agencies are directed to promote the conservation of migratory birds by evaluating and identifying potential effects of actions on migratory birds and their habitats, avoiding or minimizing any adverse effects, and restoring and/or enhancing habitats. Data from the Arizona Partners in Flight Bird Conservation Plan (BCP: web site - *http://www.partnersinflight.org/bcps/plan/pl_az_10.pdf*) along with available District data was used to identify potential priority species present in the project area by habitat type (PR #213). Thirteen (13) "partners in Flight" species have habitat and/or are known to occur in the project area. Of these, five(5) have already been analyzed since they are either threatened or endangered species, Regional forester's sensitive specie or MIS and

will not be analyzed here and include: Mexican spotted owl (Pine and Oak); Northern goshawk, (Pine and Oak); Ferruginous hawk (high elevation grassland); Burrowing owl (high elevation grassland); and Juniper (Plain) titmouse (pinyon-juniper). Habitats and priority species present within the project area are listed in Table 44 below.

Table 44. Arizona Partners In Flight Designated Priority Species by Habitat in the Project Area.

Generalized Habitat	Priority Species	Habitat and Presence
Pine and Pine Oak	Cordilleran flycatcher	Breeding habitat includes pine and aspen forests, preferably in moist and shaded forests. It also inhabits hollows, canyon bottoms, and riparian woodlands. Natural nest sites include rock crevices, niches, tree roots and cavities. No surveys have been conducted. Flycatchers have been observed at the Happy Jack Ranger Station and three baby birds were found in 2008. Suitable habitat is present within the project area.
	Olive-sided flycatcher	Associated with ponderosa pine forests and montane riparian wetlands with aspen, Douglas fir, white fir and ponderosa pine. Prefer forest edges and openings and burned areas in forests. No surveys have been conducted and there are no known observations of this species in the project area. Suitable habitat is present within the project area.
	Purple martin	Generally inhabit open and cut over woodlands, open grassy river valleys, meadows around pools, shores of lakes, marsh edges; prefer habitats near open water. In Arizona pine forests, martins prefer areas with a high snag density, adjacent to or in open areas. No surveys have been conducted and there are no known observations of this species in the project area. Suitable habitat is present within the project area.
Mountain grassland	Swainson's Hawk	Prefers open grassland or open agricultural fields which have a scattering of taller trees or trees along a riparian corridor for roosting, nesting, and perching. No surveys have been conducted and there are no known observations of this species in the project area. Suitable habitat is present within the project area.
Pinyon-juniper	Black-throated gray warbler	Primarily associated with pinyon pine and juniper woodlands (occasionally with scattered ponderosa pine) and mixed oak-pine woodlands. No surveys have been conducted and there are no known observations of this species in the project area. Suitable habitat is present within the project area.
	Gray flycatcher	Most common in larger and taller stands of pinyon pine and/or juniper with open understory sometimes interspersed with sagebrush, cliffrose, and barberry. No surveys have been conducted and there are no known observations of this species in the project area. Suitable habitat is present within the project area.
	Gray vireo	Prefer open mature pinyon-juniper woodlands on canyon and mesa slopes. No surveys have been conducted and there are no known observations of this species in the

Generalized Habitat	Priority Species	Habitat and Presence
		project area. Suitable habitat is present within the project area.
	Pinyon jay	Ponderosa pine forest, pine-oak forest, and pinyon and juniper forest. No surveys have been conducted and there are no known observations of this species in the project area. Suitable habitat is present within the project area.

Environmental Consequences for Wildlife

The primary environmental consequence to wildlife habitat and associated species from vegetation treatments and prescribed burning is from changes to habitat components critical for the species, changes to the food chain abundance (prey), and disturbances to wildlife from project activities. The units of measure that were used in determining effects include the following:

- Changes to habitat components such as vegetation, snags, logs and woody debris, cover, old growth etc.
- Effects to species such as disturbance e.g. noise, smoke etc.
- Changes to food sources or prey abundance
- Compliance with Forest Plan Standards and Guidelines for wildlife

Habitat Components

Snags

No Action Alternative

Direct and Indirect Effects for Snags

The No Action alternative would have no direct effects on snags. The number of snags per acre would remain close to the current number in the analysis area. Snags would decay and fall and would be created through natural means. In the event of a large crown-wildfire, widespread loss of existing snags would occur. High tree densities in ponderosa pine would continue to limit the growth of large diameter trees thereby limiting the replacement of large diameter snags.. The project area would continue to succeed but without the natural effect of fire it would therefore lack components outside the historical range of variation for the area. .

Cumulative Effects for Snags

The cumulative effects boundary is the Upper Beaver Creek Project area (including the 0.5 mile project buffer); the time frame for the analysis is twenty years. Since there will be no direct or indirect effects, there will be no cumulative effects for the No Action alternative.

Proposed Action Alternative

Direct and Indirect Effects for Snags

Some snag loss would occur on the approximately 44,000 acres proposed to be treated with prescribed fire under this alternative. Many of the large snags in critical wildlife areas (e.g. MSO PACs, goshawk nest stands, and old-growth) would be protected from fire by lining to the extent possible; the extensiveness of the treatments limits the amount of lining that would occur. Snags of any size class would not be cut during the proposed thinning treatments, unless they are a hazard to thinning and/or prescribed burning crews.

A combination of treatments for converting live trees to snags and felling of trees either after burning, before, or both will aid to replace snags and logs consumed by prescribed burning and thus provide additional habitat. Areas have been identified in PACs, PFAs, portions of restricted habitat where snag densities from microhabitat data are less then desired, and important waters (including some tanks and ephemeral streams).

Although fire can have a detrimental effect on existing snags, it can also cause live trees to die and become snags after fire, although it is difficult to discuss the magnitude and distribution of these newly created snags. With the retention of yellow pine trees and old growth recruitment site management, some trees would in time naturally convert to snags. This natural conversion of snags to logs would contribute to additional numbers of snags and logs on the ground. Recognizing that all snags are not created equal, the aforementioned measure to create additional logs and snags will aid the potential loss of naturally occurring logs and snags over the project area. Additionally, less competition between trees for moisture, nutrients, and sunlight will promote the growth of large trees that can eventually become snags. Larger diameter snags (>18" dbh) will be emphasized for retention along stringers, dependable water sources, and the pinyon-juniper woodland interface. Variable upper diameter limits and a tree classification marking guide that leaves yellow pines for thinning are proposed and would retain all old and large trees providing a greater number of trees that could convert to snags and logs. Also, tree marking guidelines will be used to retain green trees that have a high likelihood of becoming future snags. Snags would also not be directly ignited during prescribed burning. Design features for bats, MSO and northern goshawk will also maintain the snag component. Ponderosa pine trees will begin to turn "yellow" at approximately 100-150 years of age. Higher densities in several stands results in, "yellow" pines with smaller diameters than we normally associate with old trees due to decreased growth rates. This alternative will provide long-term maintenance of large trees and will assure a renewable source of future large snags and downed logs.

Cumulative Effects for Snags

The cumulative effects boundary is the Upper Beaver Creek Project area (including the 0.5 mile project buffer); the time frame for the analysis is twenty years. When considered with past, present and reasonably foreseeable future fuel reduction projects, the Proposed Action would have a minor adverse cumulative effect on large trees within the ponderosa forest type (due to the loss of snags) in the short term. Snag retention and recruitment project design features are proposed for the project to reduce impacts from prescribed

burning. Past prescribed burns and wildfires have promoted the development of snags. The Proposed Action would increase the amount of large diameter trees and snags across the entire analysis area over time. Additionally, by following mitigations and project design features for this project, the loss of snags can be drastically decreased.

Logs and Woody Debris

No Action Alternative

Direct and Indirect Effects to Logs and Woody Debris

There would be no direct effects to the log habitat component from this alternative. The number of logs per acre would remain at their current level on the analysis area, and would likely continue to fulfill the needs for wildlife at the existing level. Logs would decay and be provided through natural means. The high fuel loading throughout the analysis area would remain, however, increasing the risk of high-intensity wildfires, which could result in heavy decreases in the number of logs, an adverse indirect effect, but is not quantifiable. The project area would continue to succeed naturally but without the natural effect of fire and could therefore lack components outside the areas' historical range of variation.

Cumulative Effects to Logs and Woody Debris

The cumulative effects boundary is the Upper Beaver Creek Project area (including the 0.5 mile project buffer); the time frame for the analysis is twenty years. Since there will be no direct or quantifiable indirect effects, there will be no cumulative effects for the No Action alternative.

Proposed Action Alternative

Direct and Indirect Effects to Logs and Woody Debris

Short-term losses of logs and down woody debris would occur under this alternative through the prescribed burning treatments. This would result in a reduction of hiding and nesting cover for small mammals, as well as other organisms that contribute to ecosystem health. Mitigation measures (such as lining logs, and avoidance of direct ignition) would be employed to protect large logs from being burned in important wildlife areas such as PACs, PFAs, portions of restricted habitat where snag densities from microhabitat data are less then desired and at important waters (including some tanks and ephemeral streams). Even with mitigation measures implemented, the loss of logs would be unavoidable. According to the literature, losses of about 30 - 50% of the existing logs could be expected in burned areas (Randall-Parker and Miller 2000). However, new logs would be created following the prescribed burns as burned trees fell and burn-stressed trees died and fell over time. Maintenance burning would maintain lower fuel loadings, and fewer logs. A combination of girdling and felling of large trees between 12 and 18" inches either before or after burning (or both) will aid to replace snags and logs consumed by prescribed burning and thus provide additional habitat.

Cumulative Effects to Logs and Woody Debris

The cumulative effects boundary is the Upper Beaver Creek Project area (including the 0.5 mile project buffer); the time frame for the analysis is twenty years. When considered with past, present and reasonably foreseeable future fuel reduction projects, the Proposed Action would have a minor adverse cumulative effect on logs within the ponderosa forest type in the short term. Log retention and recruitment project design features are proposed to reduce impacts from prescribed burning. The Proposed Action would contribute to large tree development in the previously treated dense stands, and start the process towards old-growth conditions in the remaining dense stands within the analysis area. The Proposed Action would increase the amount of large diameter trees and snags across the entire analysis area over time. Additionally, by following mitigations and project design features for this project, the loss of logs and down wood can be drastically decreased.

Old Growth

No Action Alternative

Direct and Indirect Effects to Old Growth

There would be no direct effects to Old Growth under the No Action Alternative. The No Action alternative could have an adverse indirect effect on Old Growth as the threat of stand replacing wildfires would remain high, which would reduce the amount of Old Growth within the analysis area. The project area would continue to succeed but without the natural effect of fire and could therefore lack components outside the areas historical range of variation.

Cumulative Effects to Old Growth

The cumulative effects boundary is the Upper Beaver Creek Project area (including the 0.5 mile project buffer); the time frame for the analysis is twenty years. The amount of existing and developing Old Growth within the analysis area's ponderosa pine forest type is slightly above the Forest Plan Guideline (22%). While there is very little existing Old Growth pinyon-juniper, about 57% of that vegetation type is developing Old Growth which meets Forest Plan standards. When considered with past, present and reasonably foreseeable future fuel reduction projects, the No Action would have a minor adverse cumulative effect on Old Growth within the ponderosa forest type (due to high stocking densities and poor nutrient flow to allow for larger and older trees). The No Action would not contribute to Old Growth development in the previously-treated dense stands, and would not start the process towards old-growth conditions in the remaining dense stands within the analysis area. This would be even more evident in the Pinyon-Juniper areas.

Proposed Action Alternative

Direct and Indirect Effects to Old Growth

Of the approximately 10,273 acres of existing and developing Old Growth ponderosa pine vegetation types within the proposed project area, approximately 3,500 acres of Old Growth would be thinned and burned (approximately 500 acres of existing and 2,900

acres of developing old growth, respectively); approximately 8,500 acres (approximately 1,500 acres of existing and 7,000 acres of developing old growth, respectively); would be prescribed burned (includes both broadcast and maintenance burning); with the remaining acres of Old Growth not being treated. The tables below disclose the acres of proposed harvest and burn treatment by 10K by type of old growth.

10K	Old Growth Type	Rx	Acres
Blind Lake	existing	pac 9" minus	25
		thin from below	36
		uneven	89
		uneven-goshawk	209
Blind Lake Total			359
Buck Mountain	existing	thin from below	34
Buck Mountain Total			34
Jacks	existing	thin from below	36
		uneven-goshawk	80
Jacks Total			116
Jones Mountain	existing	thin from below	5
		uneven	8
		uneven-goshawk	15
Jones Mountain Total			28
Grand Total			537

These treatments are designed to protect the existing Old Growth from catastrophic fires, as well as protecting existing old growth structure and promote regeneration to create old uneven-aged structure. Thinning will not target large diameter trees but rather free nutrients being used by smaller trees to aid in larger tree growth and vigor. The design feature for existing old growth stands will maintain basal areas and trees greater than 18" that meet the Forest Plan old growth standard and guideline (Coconino National Forest Plan – Amendment No. 11 – 6/96 New Page 70-2).

10K	Old Growth Type	Rx	Acres
Blind Lake	developing	savannah maintenance	354
		thin from below	227
		tsi	13
		uneven	136
		uneven-goshawk	384
Blind Lake Total			1,114
Buck Mountain	developing	savannah maintenance	97
		thin from below	63
		uneven	141
		uneven-goshawk	84
Buck Mountain Total			385
Jacks	developing	savannah maintenance	101
		thin from below	312
		uneven-goshawk	336
Jacks Total			749

10K	Old Growth Type	Rx	Acres
Jones Mountain	developing	savannah maintenance	177
		thin from below	232
		uneven	107
		uneven-goshawk	155
Jones Mountain Total			671
Grand Total			2,919

In existing and developing Old Growth areas that are proposed to be prescribed burned, some large trees vulnerable to fire may be damaged during the burns. However, efforts would be made to limit the amount of mortality on these trees (see Design Features for snags and logs and old growth). The prescribed burns would also result in various degrees of mortality of younger and smaller diameter trees, which should stimulate tree growth within dense stands that have stagnated or have drastically reduced tree growth. While some snags and logs would be lost during the proposed burns, larger snags would be created over time, through increased tree growth, and senescence. These snags would eventually replace logs lost during burning. Furthermore, old trees within existing and developing old growth are being protected through all silvicultural prescriptions by the use of tree classification from Schubert (1973). Additionally, the proposed thinning and prescribed burning treatments in existing or developing Old Growth would not eliminate old-growth characteristics in these stands, and would promote a faster conversion of developing Old Growth to established Old Growth.

In the pinyon-juniper type, no old growth is scheduled to be harvested, therefore there will be no affect to pinyon-juniper old growth from harvest activities. All 417 acres of existing and developing old growth are proposed for prescribed burning and the effects to logs will be similar on these sites as the ponderosa pine sites.

Cumulative Effects to Old Growth

The cumulative effects boundary is the Upper Beaver Creek Project area (including the 0.5 mile project buffer); the time frame for the analysis is twenty years. When considered with past, present and reasonably foreseeable future fuel reduction projects, the Proposed Action would have a minor adverse cumulative effect on Old Growth within the ponderosa forest type (due to the loss of snags and logs), but a minor beneficial cumulative effect in the pinyon-juniper type. Prescribed burning in pinyon-juniper stands would improve the health of developing old growth pinyon–juniper by killing young ponderosa pine trees that have encroached into the stands. However, mitigation and project design features will aid in snag and log retention and recruitment. Past prescribed burns and wildfires have promoted the development of old-growth characteristics by reducing tree density and stimulating tree growth within the stands that were treated. The Proposed Action would contribute to Old Growth development in the previously-treated dense stands, and start the process towards old-growth conditions in the remaining dense stands within the analysis area. The treatments would prove more beneficial within the pinyon-juniper, since the amount of existing Old Growth within this forest type is very low. The Proposed Action would increase the amount of Old Growth across the entire analysis area over time.

Cover

No Action Alternative

Direct and Indirect Effects to Cover

There would be no direct effects to cover under the No Action Alternative as the actions would be deferred. The No Action alternative could have an adverse indirect effect on cover as the threat of stand replacing wildfires would remain high, which would threaten and could reduce the amount of cover within the analysis area. On the other hand, some of the project area will continue to keep the small diameter stands that provide cover and would therefore be beneficial to some degree. Overall, there would be no measurable effects and the project area would continue to succeed naturally but without the natural effect of fire and could therefore lack components outside the areas historical range of variation.

Cumulative Effects to Cover

The cumulative effects boundary is the Upper Beaver Creek Project area (including the 0.5 mile project buffer); the time frame for the analysis is twenty years. Since there will be no direct or indirect effects, there will be no cumulative effects for the No Action alternative.

Proposed Action Alternative

Direct and Indirect Effects to Cover

Even with treatments, cover continues to increase over the current condition, primarily through stand growth and deferrals, but not as great as the No Action Alternative. In this analysis, cover is displayed on a project-wide, as well as a 10K basis. The acres of cover for the project area are disclosed below.

Table 45. Cover by type for current conditions (2008), 2018 PA (Proposed Action) and 2018 NA (No Action) for the project area

Year	Cover Type (Acres)		Total Cover Acres	% of Project Area
	Thermal	Hiding		
2008	8,308	9,697	18,005	37%
2018 PA	5,734	17,501	22,875	47%
2018 NA	11,746	20,360	32,106	65%

Total cover within the four 10K blocks are displayed below. All 10Ks meet the Forest Plan guideline of managing for 30% cover within each respective 10K block.

Table 46. Total cover % by 10K for current condition (2008), 2018 PA (Proposed Action) and 2018 NA (No Action)

10K name	2008	2018 PA	2018 NA
Blind Lake	40%	37%	65%
Buck Mountain	35%	46%	57%
Jacks	41%	63%	76%
Jones Mountain	31%	43%	64%

Cumulative Effects to Cover

The cumulative effects boundary is the Upper Beaver Creek Project area (including the 0.5 mile project buffer); the time frame for the analysis is twenty years. When considered with past, present and reasonably foreseeable future fuel reduction projects, the Proposed Action would have a minor adverse cumulative effect on cover within the ponderosa forest type at individual sites in the short term, but overall, there will not be a loss below Forest Plan guidance (this also only occurs in one 10K block). The Proposed Action maintains and increases cover development within the analysis area over the long term (>10 years).

Threatened and Endangered Species

Complete discussions on the analyses used to reach the determination of effects for the bald eagle, Chiricahua leopard frog , Mexican spotted owl, and southwestern flycatcher are found in the *Biological Assessment and Evaluation, Upper Beaver Creek Watershed Fuel Reduction Project,* by B. Garcia and D. Renner, 2008 (PR# 217) and the *Biological Assessment for Federally Threatened and Endangered Species, Upper Beaver Creek Watershed Fuel Reduction Project,* by B. Garcia and D. Renner, 2008, (PR# 216). Direct, indirect and cumulative effects are summarized here.

Bald Eagle

No Action Alternative

Direct and Indirect Effects

The No Action alternative would have no direct effects on the bald eagle within the portion of it range where it is federally listed as threatened (600 acres within the analysis area). Since the actions would be deferred, the current availability of potential perch and roost trees would be maintained over the short term. Snags would be lost and created through natural processes, including wildfires that would provide a continuous supply of potential perches over the long term. The No Action alternative would not affect bald eagle foraging habitat, and therefore would have no effects on the species' foraging opportunities. Roosting and foraging habitat would remain close to current in the analysis area. Habitat would be created through natural means. In the event of a large crown-wildfire, widespread loss of habitat would occur. High tree densities would continue to limit the growth of large diameter trees thereby limiting the replacement of large diameter snags. This effect would be indirect but generally undesirable in nature. The project area

would continue to succeed but without the natural effect of fire it could therefore lack components outside the areas historical range of variation.

Cumulative Effects

The cumulative effects boundary is the Upper Beaver Creek Project area (including the 0.5 mile project buffer); the time frame for the analysis is twenty years. Since there will be no direct or indirect effects, there will be no cumulative effects for the No Action alternative.

Proposed Action Alternative

Direct and Indirect Effects

Foraging Areas and Historic Roosts:

The Proposed Action Alternative would have no direct effects on the bald eagle or its viability since the species is not known to nest within the Upper Beaver Creek Project boundary. The proposed project activities would not affect foraging opportunities for bald eagles. Stoneman Lake could provide bald eagles with potential prey items in the fall and late winter/early spring. There are no treatments proposed within the lake or within the crater area. Additionally, the proposed action will not inhibit hunting or big game carrion that eagles could feed on.

There are no known bald eagle roost sites in the analysis area, though potential sites are located on canyon slopes and possibly along ridges throughout the project area. Additionally, more recent work (last 20 years) has illustrated that although individual roosts may not be known, roost areas and communal foraging areas are known. These "potential" or "suitable" areas are based on work by C. Dargin (1991) and also a 1986-1994 research study. These areas have been mapped. Activities in these areas will follow recommendations by the Bald Eagle Assessment and Strategy, Bald Eagle National Guidelines and the Coconino Forest Plan. Should a communal foraging area or roost become identified at any time, Forest Plan guidance and the Bald and Golden Eagle act guidelines will apply, and mitigation measures and or no treatment would be implemented.

Potential Roost Habitat - Old Growth:

Please refer to the old growth discussion in the Habitat Components section.

Potential Roost Habitat -Snags

Please refer to the snag discussion in the Habitat Components section.

Cumulative Effects

The cumulative effects area and timeframe for the analysis is the same as for the No Action Alternative. When considered with past, present and reasonably foreseeable future fuel reduction projects, the Proposed Action would have a minor adverse cumulative effect on large trees within the ponderosa forest type (due to the loss of snags and logs) in the short term. Snag and log retention and recruitment project design features are proposed for the project to reduce impacts from prescribed burning. Past prescribed burns

and wildfires have promoted the development of old-growth characteristics by reducing tree density and stimulating tree growth within the stands that were treated. The Proposed Action would contribute to large tree development in the previously treated dense stands, and start the process towards old-growth conditions in the remaining dense stands within the analysis area. The Proposed Action would increase the amount of large diameter trees and snags across the entire analysis area over time. Treatments along foraging areas adjacent to ridgelines, tanks and other migration areas will be designed to maintain wildlife objectives. Additionally, by following project design features, forest plan standards and guidelines, recovery plans and/or peer reviewed papers, negative effects have been minimized.

Chiricahua Leopard Frog

No Action Alternative

Direct and Indirect Effects

The No Action Alternative will have no direct effects on the Chiricahua leopard frog since the actions would be deferred and the species is not currently known to occur within the Upper Beaver Creek Project boundary. Habitat would be created and lost through natural processes. In the event of a large crown-wildfire, loss of habitat could occur (which is unquantifiable), overland flow would increase with potential high sediment loads and water quality would be adversely affected on a wide scale. At present, project area would continue to succeed naturally but without the natural effect of fire to reduce fuel accumulations, it could therefore lack components outside the areas' historical range of variation.

Cumulative Effects

The cumulative effects boundary is the Upper Beaver Creek Project area (including the 0.5 mile project buffer); the time frame for the analysis is twenty years. Since there will be no direct or quantifiable indirect effects, there will be no cumulative effects for the No Action alternative.

Proposed Action Alternative

Direct and Indirect Effects

The Upper Beaver Creek Project area contains intermittent streams and springs that may provide potential habitat for the Chiricahua leopard frog. No Chiricahua leopard frogs have been documented in the project area from 2005-2007 surveys although the southern end of the project area has two historic sites located at earthen tanks and suitable habitat elsewhere does exist. However, the species is not currently known to occupy these areas. Stock tanks are considered to be marginal habitat but the best habitat these animals have at the current time. The proposed action would have little direct effects to the species in stream and spring habitats. In order to protect and maintain the integrity of these aquatic habitats, Best Management Practices and other mitigations (no action buffers and seasonal buffers) would be implemented to limit the input of ash and sediment into creeks from the

proposed prescribed burns. While slight amounts of ash and sediments may enter the creeks, this would have negligible impacts on potential habitat for the species. Burning could have both negative effects through direct fire effects (Vogl, 1973, Friend 1993, Russell et al. 1999b, Papp and Papp 2000) and through indirect effects to habitat from decreased soil moisture in openings (Groves et al. 1996, McGraw 1997, Murphy et al. 1981, Bury and Corn 1988) and possible positive effects from fire (Russell et al. 1999b, de Mayandier and Hunter 1999) through improved habitat for basking. To minimize possible negative effects, this project will implement: Best Management Practices to protect soil and water resources; seasonal buffers around identified potential breeding sites (AZGFD information in coordination with USFS); buffers around logical and potential dispersing corridors and no action buffers around known historically occupied sites and critical breeding sites for another species, the northern leopard frog. Should a new breeding site be detected at anytime during the implementation of this project, buffers and/or seasonal restrictions would be applied. See the design features for a full list of measures to minimize impacts to the Chiricahua leopard frog. Due to these design features, it is reasonable that the treatments would be negligible to frogs.

Cumulative Effects

The cumulative effects boundary is the Upper Beaver Creek Project area (including the 0.5 mile project buffer); the time frame for the analysis is twenty years. The cumulative effects area and timeframe for the analysis is the same as for the No Action alternative.

Benefits to the species would be primarily associated with intermittent streams and springs where potential habitat could develop. When combined with past prescribed burns, the Proposed Action would contribute to and continue watershed improvement efforts over the short and long term. Tank use by livestock and wildlife would continue to contribute to increased sedimentation into the tanks. Implementation of the design features for this project would produce negligible effects to frogs and their habitat. When considered with past, present and reasonably foreseeable projects or activities, the Upper Beaver Creek Project's proposed treatments would have minor cumulative effects on the Chiricahua leopard frog within the analysis area.

Mexican spotted owl

No Action Alternative

Direct and Indirect Effects

The No Action Alternative would have no direct or indirect effects to the habitat or critical habitat for the Mexican spotted owl since the proposed treatments would not occur. Under this alternative, the current conditions of MSO PAC, protected, restricted, target/threshold and critical habitats would continue in their current states with any major changes to primary MSO and its prey habitat components occurring in the absence of large-scale disturbances, such as wildfires.

However, this alternative would maintain the current risk of stand replacing wildfires within the project area, including MSO habitat. While the risk is not uniform across the

project area, including within MSO habitat, large areas of forested habitat would be affected if a large wildfire were to occur. This could include habitat within the project area's MSO PACs. In turn, this could affect the suitability of current nesting and foraging MSO habitat and the availability of MSO replacement nesting and foraging habitat and MSO prey availability within the project area. The project area would continue to succeed naturally but without the natural effect of fire and could therefore lack components outside the areas' historical range of variation.

Cumulative Effects

The cumulative effects boundary is the Upper Beaver Creek Project area (including the 0.5 mile project buffer); the time frame for the analysis is twenty years. Since there will be no direct or indirect effects, there will be no cumulative effects for the No Action alternative.

Proposed Action Alternative

Direct and Indirect Effects

The Proposed Action Alternative would reduce the risk of high-intensity, stand replacing wildfire within MSO habitat by reducing fuels, through thinning or prescribed burning, within the project area. Table 47 outlines treatment types (acres) proposed within MSO habitat.

Table 47: Mexican spotted owl habitat within the project area by treatment type

MSO Habitat In Treatment Areas	A Broadcast + Maintenance Burns	B Thinning + Burning	C Total MSO Acres Treated (A+B)	D No Treatment	 Total Acres (C+D)
Other Forest and Woodland Types	8,627	4,205	12,832	359	13,191
Protected: PAC/steep slopes	525	159	684	3,061	3,745
Restricted: Pine-Oak	14,710	11,428	26,138	1,139	27,277
Target/Threshold	3,717	153	3,870	96	3,966
Total Acres	***27,579***	***15,945***	***43,524***	***4,655***	***48,179***

There are nine PACs totally or partially within the analysis area. All of the PACs are within ½ mile of a proposed treatment area, with activities proposed within three PACs (Table 48). No treatments are proposed within designated MSO core nest buffers.

Table 48: MSO PACs, Treatments and Timing of Teatments within and adjacent to PACs.

PAC Name, #	Treatments and Timing of Treatments within and adjacent to PACs.
Fain Mountain 040410	Treatments within 0.5 miles of the PAC Broadcast/maintenance burning could occur during the breeding season 0.5 mile from PAC boundary.
Gash Mountain 040521	Treatments directly adjacent to the PAC Broadcast/maintenance burning could occur during the breeding season 0.5 mile from PAC boundary.
Jacks Canyon 040402	411 acres of prescribed burning in the PAC Broadcast/maintenance burning could occur adjacent to PAC during the breeding season.
Jones Mountain 040429	96 acres of thinning and pile burning in the PAC, outside of the breeding season. Broadcast/maintenance burning could occur adjacent to PAC during the breeding season.
Lake Mountain 040411	63 acres of thinning and pile burning in the PAC, outside of the breeding season and 114 acres of prescribed burning in the PAC outside of the breeding season on the south side of FR 213 (in section 10). Broadcast/maintenance burning could occur within and adjacent to PAC during the breeding season.
Rattlesnake 040102	Treatments directly adjacent to the PAC. Broadcast/maintenance burning could occur during the breeding season 0.5 mile from PAC boundary.
Rocky Gulch 040433	Treatments directly adjacent to the PAC. Broadcast/maintenance burning could occur adjacent to PAC during the breeding season.
Roundup 040545	Treatments within 0.5 miles of the PAC. Broadcast/maintenance burning could occur during the breeding season 0.5 mile from PAC boundary.
Weir 040104	Treatments directly adjacent to the PAC. Broadcast/maintenance burning could occur during the breeding season 0.5 mile from PAC boundary.

The PACs have been analyzed individually for effects of the Proposed Action and are summarized in Table 49 in the next section.

General Effects to MSO Common to All PACs

The end result of the Proposed Action Alternative is to create a more open stand, with trees arranged in groups, or patches of uneven-aged clumps separated by open interspaces that more closely resemble a forest structure that existed prior to the interruption of the natural fire regime, approximately 100-150 years ago. Only ponderosa pine is targeted for thinning and removal. Modeling estimates that over 90% of trees targeted for removal will be 0-16" dbh and trees greater than 18" dbh will not be removed.

The effects of prescribed fire include both negative and beneficial effects on spotted owl habitat. Beneficial aspects would include increased response of herbaceous vegetation after a fire. Negative effects would include the potential loss of spotted owl prey habitat components such as herbaceous cover, down logs and snags. The effects of fire on the prey base of the spotted owl are complex and are dependent on the variations in fire characteristics and in prey habitat. Fire intensity, size, and behavior are influenced by numerous factors such as vegetation type, moisture, fuel loads, weather, season, and topography. Fire can effectively alter vegetation structure and composition thereby affecting small mammal habitat. Prescribed fire is likely to have initial short term negative effects on some rodent populations, but as cover and plant forage species recover, rodent

populations, particularly *Peromyscus sp*, are likely to reach and exceed pre-treatment population numbers.

Population responses by small mammals to fire-induced changes in their habitat vary (Ward and Block 1995; Campbell et al.1977; Wright and Bailey 1982). Biswell et al. (1973) suggested that rodent populations would be less affected during fall fires, because at that time of year rodents have accumulated seed caches that will mitigate loss of food sources. Although most of the prescribed burning will occur in the fall, areas that are proposed for spring burning that will directly impact breeding MSO include the following PACS: Lake Mountain, Jacks Canyon, Jones Mountain and Rocky Gulch. Impacts would be related to smoke moving in a northeasterly direction as well as changes to habitat elements adjacent to all four of these PACS and also within the Jacks Canyon PAC.

Additionally, the following PACs will be impacted by smoke moving in the northeasterly direction during spring burning within a 0.5 mile of the PAC boundary: Fain, Gash, Weir, Roundup. The smoke disturbance can create displacement and even nest abandonment.

Predation by MSO on of surviving rodents that are part of the diet of the spotted owl may increase immediately after prescribed fire. In one study in northern California, radio-collared northern spotted owls spent considerable time in burned-over areas. This activity was assumed to be due to easy capture of prey (Patton and Gordon 1995).

The activities proposed are expected to improve the long term habitat of MSO for the project area by increasing the forest's ability to withstand and mitigate the effects of a catastrophic/severe wildfire and by short term increases in rodent populations benefiting MSO foraging habitat. Effects of fire on small mammals under present environmental conditions are unclear (Ward and Block 1995).

Seven of the nine PACs (all but Fain Mountain and Roundup) have treatments proposed directly adjacent to the PAC. Three of the PACs have treatments proposed within the PAC. Treatments include both thinning, pile burning and prescribed burning.

There is a potential for prescribed burning treatment to affect MSO protected habitat. Measures have been identified to protect habitat within PACs such as lining snags, and felling of trees post burning for down woody debris. There would be a loss of ground vegetation, e.g. grasses, forbs and smaller diameter woody vegetation, and potentially logs, snags and woody debris. Impacts to MSO habitat would likely be minimal since the ground vegetation would re-establish quickly after treatment (during the spring growing season) while woody debris and other components would be replaced over time naturally or through project design features. Additionally no more than 200 acres in a PAC per year can be conducted to minimize cumulative impacts over the greater landscape. There could be a temporary decrease in prey availability within the PAC burned area depending on the size of the area burned; however, the impacts would be localized and would not affect the PAC's overall habitat suitability or its ability to support MSO. Over the long term however, treating the area will aid in lower wildfire risk and total loss of the PAC.

The potential for spring burning adjacent to PACs has been analyzed. Spring burning will occur 0.5 miles from the PAC boundary for five of the nine PACs. Spring burning can occur adjacent to a four of the PAC's. For all PACs spring burning adjacent to a PAC would have fewer losses or effects on downed wood, logs and other woody debris component than fall burning due to higher fuel moistures. The ability to burn during spring would be determined by the district wildlife biologist and owl monitoring data. A determination would be made every year a spring burn was proposed. Stringent measures will be taken to line and maintain as much restricted habitat as possible. The wildlife biologist will coordinate with fuels crews to plan and prepare for implementation and may be on site during ignition of burning. Adverse effects to nesting birds is likely and at least in the short term, adverse effects to habitat and/or prey species will be evident. Since prevailing winds in the spring come from the southwest, it is expected that smoke will move in a northeasterly direction. Topography and wind may aid with smoke dispersal but especially in canyons and overnight, smoke could be heavy near or within PACs during the breeding season. Over the long-term however, the reduction in heavy fuel loads while retaining MSO habitat to the extent possible, will ensure long-term habitat for MSO breeding in all PACs.

Direct and Indirect Effects to PACs

Table 49 summarizes the potential effects to the nine PACs in the analysis area from implementation of the Proposed Action. All mitigations and design features for Mexican spotted owl will be implemented and the potential effects are based on these mitigations and design features. A complete discussion of the effects to

Table 49. Summary Potential Effects to Breeding MSO or Protected MSO Habitat within PACs for the Project analysis Area

PAC Name	Location	100 acre nest buffer designated?	Treatments proposed in PAC?	Adjacent treatments proposed?	Potential for affecting breeding MSO or protected habitat within the PAC?
Fain Mountain (40410)	This PAC is located along the northern boundary of the analysis area, with approximately half of the PAC within the project boundary and half in the 0.5 mile project buffer.	YES	NO	"Meadow maintenance", "uneven-goshawk", "savannah maintenance", "broadcast burn" and "thin from below" treatments are proposed about 0.25 miles from the PAC boundary, but are about 0.75 miles from the nest protection area boundary.	Burning will be done in the spring but will be done ½ mile from the PAC boundary. Minimal potential due to location of treatments and topographical barriers. Smoke impacts are likely to occur but should be dispersed over the ½ mile buffer.
Gash Mountain (40521)	This PAC is located along the northern boundary of the analysis area, with the entire PAC located outside the project boundary, but within the 0.5 mile buffer.	NO	NO	"Meadow maintenance", "savannah maintenance", "uneven-goshawk", "broadcast burn" and "maintenance burns", treatments are proposed directly adjacent to the PAC's southern boundary.	Minimal since there are no proposed treatments within the PAC and those adjacent to the PAC would not be implemented within ½ mile of the PAC boundary during the MSO breeding season (March 1- August 31).
Jack's Canyon (40402)	This PAC is located in the east-central portion of the analysis area, with the entire PAC located within the project boundary.	YES	YES, 411 acres of prescribed burning	"Broadcast burn", "maintenance burn", "savannah maintenance", "thin from below", and "uneven-goshawk treatments are proposed directly adjacent to the PAC's boundary. Broadcast burning and maintenance directly within the PAC.	Adverse effects to nesting birds are likely and at least in the short term, adverse effects to habitat and/or prey species will be evident. Over the long-term however, the reduction in heavy fuel loads while retaining MSO habitat to the extent possible, will ensure long-term habitat for MSO breeding in Jack's Canyon. All MSO mitigation measures would apply. Prescribed burning within and adjacent to the PAC could occur during the breeding season. Burning within and adjacent to this PAC would adversely impact owls from smoke – – see General Effects to MSO and Effects of Adjacency Common to All PACs discussion.

PAC Name	Location	100 acre nest buffer designated?	Treatments proposed in PAC?	Adjacent treatments proposed?	Potential for affecting breeding MSO or protected habitat within the PAC?
Jones Mountain (040429)	This PAC is located in the north-central portion of the analysis area, with the entire PAC located within the project boundary.	YES	YES, 96 acres of thinning and pile burning	"PAC 9 inch minus", "broadcast burning", "savannah maintenance", "thin from below", "transition maintenance", "timber stand improvement", "uneven" and "uneven-goshawk" treatments are proposed directly adjacent to the PAC's boundary.	Moderate potential for adversely affecting breeding MSO or the PAC's protected habitat Thinning and pile burning within the PAC would occur outside the breeding season; prescribed burning adjacent to the PAC is proposed during the breeding season. Burning adjacent to this PAC would adversely impact owls from smoke. See General Effects to MSO and Effects of Adjacency Common to All PACs discussion; spring burning adjacent to this PAC would adversely impact owls from smoke.
Lake Mountain (040411)	This PAC is located in the north-central portion of the analysis area, with the entire PAC located within the project boundary.	YES	YES, 63 acres of thinning and pile burning and 114 acres of prescribed burning	"Broadcast burn", "thin from below" and "uneven-goshawk" treatments are proposed directly adjacent to the PAC boundary.	Moderate potential for adversely affecting breeding MSO or the PAC's protected habitat Thinning and pile burning within the PAC would occur outside the breeding season; prescribed burning adjacent to the PAC is proposed during the breeding season. Burning adjacent to this PAC would adversely impact owls from smoke. See General Effects to MSO and Effects of Adjacency Common to All PACs discussion; spring burning adjacent to this PAC would adversely impact owls from smoke.
Rattlesnake (040425)	This PAC is located along the northern boundary of the analysis area, with approximately 141 acres of the PAC within the project boundary, and the remaining acres within the 0.5 mile buffer.	NO	NO	"Transition maintenance" and "uneven-goshawk" treatments are proposed directly adjacent to the PAC's southern boundary.	Minimal since there are no proposed treatments within the PAC and those adjacent to the PAC would not be implemented within ½ mile of the PAC boundary during the MSO breeding season (March 1- August 31).

PAC Name	Location	100 acre nest buffer designated?	Treatments proposed in PAC?	Adjacent treatments proposed?	Potential for affecting breeding MSO or protected habitat within the PAC?
Rocky Gulch (040425)	This PAC is located in the west-central portion of the analysis area, with the entire PAC located within the project boundary.	YES	NO	"Savannah maintenance" and "uneven-goshawk" treatments are proposed directly adjacent to the PAC. Broadcast and maintenance burning directly adjacent to PAC.	Broadcast and maintenance burning directly adjacent to PAC in the breeding season would adversely impact owls from smoke.
Roundup (040545)	This PAC is located along the northern boundary of the analysis area, with approximately 58 acres of the PAC located within the project boundary, and the remaining acres occurring within the 0.5 mile buffer.	NO	NO	No treatments proposed directly adjacent to the PAC. "Meadow maintenance" and "savannah maintenance" treatments are proposed within 0.5 miles of the PAC's south-eastern boundary.	Minimal since there are no proposed treatments within the PAC and any proposed treatments adjacent to the PAC would not be implemented within ½ mile of the PAC boundary during the breeding season (March 1- August 31).
Weir (040104)	This PAC is located along the northern boundary of the analysis area, with approximately 209 acres of the PAC located within the project boundary, and the remaining acres occurring within the 0.5 mile buffer.	NO	NO	"Uneven-goshawk" and "thin from below" treatments are proposed directly adjacent to the PAC's boundary.	The potential of adversely affecting breeding MSO is minimal since there are no proposed treatments within the PAC and any proposed treatments adjacent to the PAC would not be implemented within ½ mile of the PAC boundary during the breeding season (March 1- August 31).

specific PACs are included in the project's Biological Assessment and Biological Assessment and Evaluation (PR #216 and #217).

Direct and Indirect Effects to Protected, Restricted and Target/Threshold Habitat

Treatments proposed in Protected, Restricted and Target/Threshold habitat are summarized in Table 50 below.

Table 50. Treatments in Protected, Restricted and Target/Threshold Habitat

Habitat and Total Acres	Treatments Proposed	Acres	% of Habitat Treated
Protected, 3,745 acres	Thinning and Prescribed Burning	159	4%
	Broadcast/Maintenance Burning	525	14%
Restricted, 27,277 acres	Broadcast/Maintenance Burning	14,170	52%
	Thinning and Prescribed Burning	11,428	42%
Target/Threshold 3,966	Broadcast/Maintenance Burning	3,717	94%
	Thinning and Prescribed Burning	153	4%

Protected Habitat

There are 159 acres of vegetation management treatments (thinning) proposed within MSO protected habitat and 525 acres of protected habitat are proposed to be broadcast burned, with approximately 35 of these acres occurring within MSO designated critical habitat. Mitigation measures for prescribed burning within MSO habitat are detailed in Project Design Features. Short term impacts to protected habitat would be adverse in nature although the 525 acres burning within protected habitat would be lined and protected according to MSO recovery guidelines. Creeping fire would minimize the loss of logs, snags and large trees, but some logs and snags are likely to be lost to the burn. The burn areas would still retain some downed woody material however even after a fall burn, as treatments would produce a patchwork of burned and unburned areas. In addition, snags and logs lost to the burn would be replaced, over time, through recruitment and senescence. Overall, the reduction in fire risk and stimulation of ground vegetation due to the removal of needle cast and a suffusion of soil nutrients would improve habitat for MSO and their prey species over the long term.

Restricted Habitat

All proposed burning within restricted habitat would follow a modified prescription with mitigation measures designed to limit effects to important characteristics of MSO habitat (see Design Features for MSO). While efforts would be made to avoid the loss of large snags and logs during the burns, some snags and logs are likely to burn. Spring burns would reduce the amount of loss due to higher fuel moistures. The reduction in snags and logs could result in a temporary decrease in small mammal populations within the treated areas. As the snag and log components were replaced through recruitment, small mammal populations would recover over time. Maintenance burning could further reduce or maintain lower than desired log and snag densities within the proposed treatment areas, especially where a more frequent burn interval is followed. Overall, the burns would create a mosaic of burned and unburned areas, thin out small diameter understory trees,

create small openings (approximately 0.25 acre), but would not change the overall structure of the stand.

The proposed burns, whether conducted in the spring or fall, would remove or drastically reduce hazardous fuel loadings (up to 30 tons per acre) that put spotted owl habitat (and firefighters and private property) at a high risk of wildfires. While the proposed burns would have an adverse effect on restricted habitat over the short term, the lowered risk of high intensity, stand replacing wildfires would have an overall beneficial effect on MSO and MSO habitat over the long term.

The majority of trees to be thinned within restricted habitat would be in the 5 inch - 12 inch dbh range, with the upper dbh limit for many stands being 18 inches. In all restricted habitat, yellow pines and trees > 18 inches dbh would be retained. Thinning the dense stands would reduce fuel loading, break-up canopy connectivity, remove ladder fuels and increase crown-to-base height over the short-term, thereby reducing the potential for stand replacing wildfires. Thinning would also increase ground and understory vegetation health and vigor, and promote establishment and expansion into previously bare areas. The increase in ground cover would improve MSO prey species foraging habitat as well. Over time, the release of the remaining trees would increase tree growth and canopy closure within the treated stands. Short term impacts to prey species would be adverse in nature.

In the short term, the Proposed Action would decrease the availability of snags, logs and coarse woody debris in restricted habitat, with less of a decrease from spring burns. The reduction would affect habitat for small mammals, which MSO prey upon. Treated areas would still retain some downed woody material however, even after fall burns, as the treatments would produce a patchwork of burned and unburned areas. The increased growth-rates on larger trees would improve habitat over time. Finally, reducing the risk of high intensity wildfire in restricted habitat would benefit MSO and restricted habitat for the long term. Effects from the Proposed Action may minimally change productivity or population trends for MSO in the short term at the local project scale, but these changes, in the long term would be immeasurable forest-wide. Forest population trends, therefore should not be affected.

Target/Threshold Habitat

Effects to target/threshold habitat from the proposed prescribed burning would be similar to those described for restricted habitat. Effects to habitat have been minimized by project design standards for MSO. There would a loss of snag and log availability, and a potential reduction in MSO prey species populations. The project design features for MSO relating to prescribed burning would reduce the number of snags and logs lost. And also like restricted habitat, snags and logs would, over time, be replaced through recruitment and senescence. The reduction in fuel loading within the target/threshold habitat would decrease the potential for high-intensity wildfires as well.

Four target threshold stands are proposed to receive vegetation treatments (i.e. thinning and burning). Another 19 stands are proposed to be broadcast and maintenance burned to

reduce needle cast and fine fuels and to reintroduce fire into the ecosystem. According to the MSO Recovery Plan "management priority should be placed on reducing identified risks to spotted owl habitat. The primary existing threat is catastrophic wildfire (USDI Fish and Wildlife Service 1995: p. 94, # 6)". In addition, the Coconino Forest Plan states that in restricted habitat "encourage [the use of] prescribed and prescribed natural fire to reduce hazardous fuel accumulation….[and] to reduce ladder fuels and the risk of crown fire (Amendment 11, page 65-4)". While the thinning treatments in both stands would reduce their basal areas below their current basal area, the treatments would greatly reduce the potential for the complete loss of the habitat due to a stand replacing wildfire. The four stands would remain as designated target/threshold habitat. There would be no impacts from implementing the proposed thinning treatments to the two stands' threshold habitat basal area suitability or their "large trees over 18" dbh "suitability. The NEXUS fire model currently places two of the stands at a high risk for a stand replacing, "active" wildfire due to high canopy connectivity and low crown-to-base height levels within the stands. Implementing the proposed action would reduce canopy connectivity and raise their CBH such that would be lowered to "passive crown" fire behavior or to a surface fire type. On two other stands, thinning and prescribed burning would maintain the stand at a surface fire type. These stands are on poor sites, rocky mineral soils, with a high density of 14"-16" dbh trees competing for limited resources. While the thinning treatments in both stands would reduce the stand's basal areas, the treatments need to be done in order to meet threshold condition for the large tree element in the future. More importantly, the treatments would greatly reduce the potential for the complete loss of the habitat due to a stand replacing wildfire. The two stands are therefore designated as target stands and not threshold since they currently meet the basal area but not the large tree parameters. The goal of the thinning treatment is to move the stands towards "threshold". The proposed thinning treatment would not change the stands' overall character, but would decrease tree density and therefore reduce competition for resources, resulting in increased growth rates on the remaining trees. This would allow them to reach a larger size sooner than no treatment. Over time, the stands' basal area would increase, which along with the increased large tree component and reduction in stand replacing wild fire, would improve the suitability and sustainability of each stands' threshold habitat compared to the No Action alternative.

Direct and Indirect Effects to Critical Habitat and Primary Constituent Elements

Critical Habitat

In general, the proposed treatments would improve critical habitat for the MSO over the long term. Thinning approximately 8,598 acres of critical habitat (42% of the project area's critical habitat) would increase tree growth due to decreased competition for sunlight, nutrients and water, resulting in increased basal area of large diameter trees in the treated areas. Understory plant growth and establishment would be promoted as well, with the increase in ground cover providing an increase in food supplies for MSO prey species. While thinning would reduce canopy closures and basal areas within the treated stands over the short term, treatment prescriptions would maintain a wide range of tree sizes, multi-layered canopies, and plant species richness in those acres. Broadcast or maintenance prescribed burning of treated stands (about 8,774 acres or 43% of the project area's critical habitat) would reduce the availability of snags, logs, fallen trees and other

woody debris within critical habitat over the short term. Spring burning would reduce the loss due to higher fuel moistures present in spring than in fall. The increased tree growth due to thinning would provide larger recruitment snags and logs over the long term. In addition, the ash would provide additional soil nutrients for plant growth.

Primary Constituent Elements:

A. Forest Structure:

(1) The range of tree species would not be affected. No treatments are proposed in mixed-conifer habitat. Pine-oak habitat would be thinned and prescribed burned, but this would not affect the range of these species.
(2) There would be some short-term changes to shade canopy due to thinning treatments, primarily in restricted habitat. Canopy cover will not fall below 40%.
(3) The availability of large snags would likely be reduced by the proposed burning treatments. However, based on 2006 surveys, there is an average of approximately seven (6.8) snags per acre (12 inches + dbh) on approximately 22,000 acres (50%) of the forested acres within the analysis area. Over the entire project area, the average is approximately four (3.9) snags per acre 12" dbh and larger). Mitigation measures would be implemented to minimize the loss of large snags (see Design Features for snags and logs in Chapter 2). The retention goal for snags in Protected and Restricted Habitat is 70%. Some snag loss would be evident however in the short term.

B. Prey Species:

(1) Fallen trees and woody debris would likely be reduced by the proposed burning treatments.
(2) Retention goals for oaks in Protected and Restricted Habitat are 95% for large oaks, and 70-75% for small oak trees.
(3) Residual plant cover would be reduced in the short term due to burning treatments. This effect should be reversed quickly, as grasses and annuals respond well to burning. There should be a long-term increase in plant cover in the treatment areas.
(4) Project design features to minimize effects to logs, woody debris, hardwood components would be implemented. Short term loss of logs, woody debris and hardwood components would be evident.

C. Canyon Habitat:

(1) The presence of water would not be affected because treatments are generally over ½ mile from canyon streams. In addition, the majority of the streams are intermittent.
(2) Clumps and stringers of trees in canyons would not be treated. Canyon walls would also not be affected, as they would not be treated.
(3) Ground litter and woody debris in canyons would not be affected, because no treatments are proposed in canyons.

Cumulative Effects to PACs, Protected, Restricted, and Target/Threshold Habitat, Critical Habitat and Primary Constituent Elements

The cumulative effects boundary is the Upper Beaver Creek Project area (including the 0.5 mile project buffer); the time frame for the analysis is twenty years. No additional state or private activities are proposed in the project area. There are parcels of private property within the project area; however, no known activities are occurring or planned at this time.

When considered with past, present and reasonably foreseeable future vegetation management actions, the proposed action would have an overall adverse cumulative effect on the Mexican spotted owl and MSO Protected and Restricted habitat in the short term. In the long term when combined with past, present and reasonably foreseeable future vegetation management actions, the Proposed Action would contribute to the reduction in the risk of high intensity stand replacing wildfires in PACs and restricted habitat by reducing the availability of hazardous fuels, ladder fuels, and canopy connectivity, while increasing crown-to-base height. The Proposed Action would also contribute to the development and health of the project area's understory and ground vegetation, improving foraging habitat for MSO prey species. This would be a neutral to beneficial effect overall to foraging habitat.

On the other hand, prescribed burning, both spring (although less) and fall burns, would contribute to and/or maintain a lower concentration of snags, logs and woody material in the treated areas than desired. A high concentration of snags and logs is an important constituent element of critical habitat, and MSO habitats. This reduction would have an adverse cumulative impact to MSO prey species, and therefore to spotted owls. However, since the availability of snags and logs and woody material would increase over time, the benefits of reducing the threat of stand replacing wildfires to Protected and Restricted and Critical MSO habitat would outweigh negative effects of prescribed burning.

As the overall forest structure would not change there would be no cumulative effects from thinning and prescribed burning. There would be minor reductions in shade canopy from thinning, but this would be a short term negative cumulative effect. Snags and down woody debris would be reduced initially by prescribed burning, .Down wood is anticipated to be reduced over the short and long term; implementation of Project Design features to maintain an adequate log component would be implemented to keep cumulative effects to a low level. Effects to prey species would have a short term negative cumulative effect but over the longer term components important for prey species such as logs, down wood, hardwoods and plant cover would be maintained or increased resulting a neutral or beneficial cumulative effect for prey species. Canyon habitat would not be affected therefore there should be no cumulative effect.

Regional Forester's Sensitive Species

Complete discussions on the analyses used to reach the determination of effects for the 19 species that are present and/or have potential habitat within the analysis area, are found in the *Biological Assessment and Evaluation, Upper Beaver Creek Watershed Fuel Reduction Project,* by B. Garcia and D. Renner, 2007, (PR #216). Direct, indirect and

cumulative effects are summarized here. The Proposed Action Alternative meets all Forest Plan Standards and Guidelines for Regional Forester's Sensitive Species (RFSS).

Northern Goshawk

There are three known goshawk post-fledging areas (PFAs) within the project area:

1. The 656-acre Brady Canyon PFA (#040403) was delineated in 1991, and fledged two young in 1991, 1992 and 1993. The following year the nest was abandoned. Informal monitoring of the PFA found no birds from 1995 – 2001. A single bird of unknown sex was present in the PFA in 2002. In 2003, a pair fledged two young, while in 2004 the site was occupied but there was no evidence of nesting. In 2005, the PFA was unoccupied. There is no information on the PFA for 2006. No birds were detected in 2007.
2. The 693-acre Bottle Butte PFA (#040404) was delineated in 1992, and fledged two young in 1992 and 1993. Informal monitoring of the PFA found no birds from 1994 – 2001, and in 2005. There is no information on the PFA from 2002 – 2004, and for 2006. No birds were detected in 2007.
3. The 585-acre Lake PFA (#040402) was delineated in 1992; there have been no nests or young reported from this PFA. There is no information on this PFA since the original delineation in 1992. The Lake PFA, except for an approximately 36-acre stand in the NE corner of the PFA, is completely within the Lake Mountain MSO PAC (#040411). No birds were detected in 2007.

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 (Tables 51 and 52). VSS distribution of sites within the PFAs still lacks optimal nesting stands. Optimal nest stands for northern goshawk have a vegetative structural stage classification of VSS 5B through VSS 6 (Reynolds et al. 1992). Currently there is a lack of optimal nest sites across the project area.

Table 51: Existing and Desired VSS Distribution for Other Forest and Woodland types within the Upper Beaver Creek Project Area

VSS	1	2	3	4	5	6
Desired %	10%	10%	20%	20%	20%	20%
Existing %	1%	2%	24%	46%	20%	7%

Table 52: Existing and Desired VSS Distribution within three Post Fledging Areas combined

VSS	1	2	3	4	5	6
Desired %	10%	10%	20%	20%	20%	20%
Existing %	4%	0%	33%	60%	3%	0%

No Action Alternative

Direct and Indirect Effects to Northern Goshawk

There would be no direct effects to northern goshawks since the actions would not occur. This alternative would have a minor adverse long-term indirect effect by keeping even-aged stands succeeding at their current state, thus never allowing the recommended VSS distribution to come to fruition as quickly. Under this alternative, the current conditions of goshawk habitat would continue in its current state with any major changes to primary goshawk and its prey habitat occurring from large-scale disturbances, such as wildfires. While the risk is not uniform across the project area, including within goshawk habitat, large areas of forested habitat would be affected if a large wildfire were to occur. This could include habitat within the project area's goshawk PFAs. In turn, this could affect the suitability of current nesting and foraging goshawk habitat and the availability of goshawk replacement nesting and foraging habitat within the project area.

The current VSS distribution within the Project area and within the PFAs would continue to be skewed toward the mid-aged size classes (VSS 3 and VSS 4). These stages tend to be dense due to the high number of small, immature trees, with few if any openings within the forest. These stages typically do not provide potential nesting habitat (i.e. mature to over-mature trees) or foraging habitat (e.g. small to medium-sized openings within the forest and/or mature forest with a relatively open understory). The current status of VSS 5 and VSS 6 within the project area, including the PFAs, would not be altered except through succession and/or natural disturbance, e.g. wildfire. The project area would continue to succeed naturally but without the natural effect of fire and could therefore lack components outside the areas' historical range of variation.

Cumulative Effects to Northern Goshawk

The cumulative effects boundary is the Upper Beaver Creek Project area (including the 0.5 mile project buffer); the time frame for the analysis is twenty years. Based on the discussion previously for the No Action alternative, it is likely that there would be a small negative cumulative effect on northern goshawk from the even-aged, uneven and unbalanced VSS distribution outside the recommended goshawk habitat parameters, however, this project will not add any acres of treatment to the cumulative effects boundary area.

Proposed Action Alternative

Direct and Indirect Effects to Northern Goshawk

Since goshawks are sensitive to disturbance at their nest site, proposed project activities, i.e. thinning or burning, would not be allowed within 180 acres of a nest stand (nest buffer area Coconino NF 1986) during the species' breeding season (March 1 to September 30).

Conducting prescribed burns and vegetation management activities could affect goshawk foraging behavior.

Broadcast burning would result in the loss of some snags and logs, and may kill a few (up to 10%) of the large trees in the overstory. While measures would be taken to preserve large trees, snags and logs, up to 20% of snags and 50% of logs may be lost (Randall-Parker and Miller 2000). See the snag and log effects section previously for a more detailed discussion.

Changes to the habitat could result in short-term decreases in populations of ground dwelling or ground foraging prey species such as squirrels and cottontails. These species may be temporarily affected by a loss of cover or foraging habitat. However, the regeneration of lost ground vegetation that typically occurs after controlled burning would promote the recovery of microhabitat conditions for these species. Prey species such as mourning doves prefer less ground cover for foraging (Mirarchi and Baskett 1994), and these populations may show temporary increases when ground cover is reduced.

There is a potential for a treatment to affect the northern goshawk. Although, measures have been identified to protect habitat within PFAs (such as lining, felling of trees post burn for down woody and snag retention), There would be a loss of ground vegetation, e.g. grasses, forbs and smaller diameter woody vegetation, and potentially logs, snags and woody debris. Impacts to goshawk habitat however would likely be minimal since the ground vegetation would re-establish quickly after treatment (spring growth), while woody debris and other components would be replaced over time or post burn by dropping trees identified to be thinned anyway. Additionally no more than 200 acres of treatment in a PFA per year can be conducted to minimize cumulative impacts over the greater landscape. There could be a temporary decrease in prey availability within the PFA burned area depending on the size of the area burned; however, the impacts would be localized and would not affect the PFA's overall habitat suitability or its ability to support goshawk. Over the long term however, treating the area will aid in lower wildfire risk and total loss of the PFA.

The potential for spring burning within and adjacent to PFAs has been analyzed. Spring burning adjacent to all three PFAs will occur and spring burning within two of the PFAs is proposed. Measures will be taken to ensure the least amount of smoke into all the PFAs by burning on days where there is good ventilation. No burning will be done in the spring in the nest buffer area. For all PFAs, spring burning within and adjacent to a PFA would have fewer losses or effects on downed wood, logs and other woody debris component than fall burning due to higher fuel moistures. The ability to burn during spring would be determined by the district wildlife biologist and goshawk monitoring data. A determination would be made every year a spring burn was proposed. Stringent measures will be taken to line and maintain as much habitat as possible. The wildlife biologist will coordinate with fuels crews to plan and prepare for implementation and may be on site during ignition of burning. Impacts to nesting birds from smoke are likely for short periods of time. Since prevailing winds in the spring come from the southwest, it is expected that smoke will move in a northeasterly direction. Though active nests would be

buffered from prescribed burning, there still could be smoke impacts. Topography and wind may aid with smoke dispersal but, smoke could be heavy near or within PFAs during the breeding season. Over the long-term however, the reduction in heavy fuel loads while retaining goshawk habitat to the extent possible, will ensure long-term habitat for goshawk breeding. Anytime a new nest is found, a nest no action buffer would be put in place for the duration of the proposed treatments in that area.

A noise study on goshawks conducted by Grubb et al. (1998) found that logging trucks did not elicit a discernible response when they passed within 500 meters (1,642 ft) of active nests. Noise from mechanical treatments may impact foraging goshawks Disturbances associated with the Proposed Action to foraging goshawks would be unlikely to affect the overall distribution of the species in the project area. Noise from mechanical treatments may impact foraging goshawks. Disturbances associated with the Proposed Action to foraging goshawks would be unlikely to affect the overall distribution of the species in the project area.

About 3,700 acres of "uneven aged goshawk" treatments are proposed throughout the project area. Of these treatments, approximately 790 acres are proposed for treatments in northern goshawk habitat (other forest and woodland habitat not in restricted or protected MSO habitat). These treatments would create openings in the stands of ¼ to 4 acres in size which would allow regeneration of the stand to occur and would also provide increased foraging opportunities for the goshawk. These treatments are supported by local USFWS biologists and also biologists with the AZGFD.

Thinning the Brady Canyon and Lake PFAs would open up the dense understory, providing a more open foraging habitat condition (although would be less in the Lake PFA to maintain habitat goals for MSO). Thinning would also help promote the development of ground vegetation through reduced shading effects and by creating small openings in the canopy.

Effects on Individual PFAs.

Treatments in the three PFAs are tabulated below.

Table 53: Northern Goshawk PFAs and Treatment Acres, Proposed Action Alternative

PFA	Treatment	Acres Treated	PFA Acres
Brady Canyon - #040403	Broadcast/Maintenance Burn	*573*	*656*
	Thin and burn	*83*	
	Total acres treated	*656*	
Bottle Butte - #040404	Maintenance burn	*696*	*696*
	Total acres treated	*696*	
Lake - #040402	Broadcast/Maintenance Burn	*50*	*585*
	Thin and burn	*98*	
	Total acres treated	*148*	
All		**1,500**	**1,937**

1. Brady Canyon PFA (# 040403): The entire PFA is proposed to be treated either through broadcast burning or thinning and burning. The stand proposed to be thinned and burned (83 acres) with the "uneven-goshawk" treatment is currently classified as single-storied VSS 3. This is not the nest stand. The treatment would create new or expand existing openings and initiate the development of a multi-storied canopy through thinning the dense pine stand. While the thinning treatment would not change its VSS status, the openings created or expanded in the stand would increase habitat diversity within the PFA, as well as increase regeneration. The proposed broadcast burning would likely result in mortality of trees of VSS 4 and below (largely VSS 1 and 2), but would cause little to no mortality of trees in the VSS 5 and 6 classes. Maintenance burning within the PFA would occur on a 3 -15 year schedule, depending on fuel load build-up. Mitigation measures would protect nesting goshawks and goshawk habitat components, i.e. large trees, logs and snags would be protected, where and when possible. VSS distribution and average canopy cover after treatment (year 2018) within the PFA are as follows:

VSS	acres	Average canopy cover
1	78	13
3	81	56
4	494	60

VSS for the PFA is currently lacking VSS 5 and 6 stands; however there are VSS 5 and 6 sized class trees within stands in the PFA. Canopy cover meets the Forest Plan guidance for Ponderosa Pine of canopy cover for mid-aged forest (VSS 4) should average 1/3 60+% and 2/3 50+%. After treatment 44% of the VSS 4 in the PFA exceeds 60% canopy cover and 76% exceed 50% canopy cover. In 2028, 52% of the VSS 4 in the PFA exceeds 60% canopy cover and 76% exceeds 50% canopy cover.

2. Bottle Butte PFA (# 040404): All 696 acres of this PFA are proposed to be maintenance burned; there are no vegetation treatments proposed within the PFA. Effects to goshawks and habitat would be similar to those for the Brady PFA broadcast burns. As with the Brady PFA, mitigation measures would protect nesting goshawks and goshawk habitat components, i.e. large trees, logs and snags would be protected, where and when possible. The actions would reduce the risk of high intensity fire, while retaining large dead and down material important to goshawk prey species. VSS distribution and average canopy cover after treatment (year 2018) within the PFA are as follows:

VSS	acres	Average canopy cover
3	15	69
4	676	66

VSS for the PFA is currently lacking VSS 5 and 6 stands; however there is VSS 5 and 6 sized class trees within stands in the PFA. Canopy cover meets the Forest Plan guidance for Ponderosa Pine of canopy cover for mid-aged forest (VSS 4)

should average 1/3 60+% and 2/3 50+%. After burning treatments 100% of the VSS 4 in the PFA exceeds 60% canopy cover and 100% exceed 50% canopy cover. In 2028, 100% of the VSS 4 in the PFA exceeds 60% canopy cover and 100% exceeds 50% canopy cover.

3. Lake PFA (# 040402): Approximately 25% (148 acres) of the Lake PFA is proposed to be either broadcast burned or thinned and burned. However, since the Lake Mountain MSO PAC (# 040411) and Lake PFA overlap spatially, except for approximately 36 acres, management for MSO and MSO habitat characteristics within the Lake Mountain PAC would take precedence over those for northern goshawk and the Lake PFA. Management for MSO that would occur within the PFA includes 62 acres of thinning and burning via the "PAC 9 inch minus" proposed treatment. This action would be follow more closely recommended habitat guidelines for northern goshawks since only pines 9 inches dbh or smaller would be removed, while larger pines and all oaks would be retained. An additional treatment that would occur within both the PAC and PFA is an approximately 50-acre broadcast burn. Again, this would affect trees in the VSS 4 and below size classes, with little to no tree mortality in the VSS 5 and 6 size classes. Finally, a northern goshawk/PFA-specific treatment includes a 36-acre thin and burn via the "uneven-goshawk" proposed treatment. Effects from this action would be similar to those for the Brady Canyon PFAs thin and burn vegetation treatment. Timing restrictions and mitigation measures for MSO would apply to actions within the PAC, while northern goshawk mitigation measures would apply to the 36-acre thinning and burning. VSS distribution and average canopy cover after treatment (year 2018) within the PFA are as follows:

VSS	acres	Average canopy cover
3	50	76
4	443	69
5	92	60

VSS for the PFA is currently lacking VSS 6 stands; however there is VSS 6 sized class trees within stands in the PFA. Canopy cover meets the Forest Plan guidance for Ponderosa Pine of canopy cover for mid-aged forest (VSS 4) should average 1/3 60+% and 2/3 50+%. After thinning and burning treatments 95% of the VSS 4 in the PFA exceeds 60% canopy cover and 100% exceed 50% canopy cover. In 2028, 100% of the VSS 4 in the PFA exceeds 60% canopy cover and 100% exceeds 50% canopy cover. For the VSS 5 stands, 100% of the stands exceed the 50% canopy cover after-treatment, with an average of 60% canopy cover for the entire PFA.

Effects to VSS Distribution and Canopy Cover

There are approximately 9,700 acres of other Forest and Woodland type within the project area where northern goshawk standards apply. Within these acres, approximately 3,400 acres are proposed for harvest treatment (see tables below).

Proposed Harvest	Acres
savannah maintenance	542
thin from below	961
transition maintenance	829
uneven	284
uneven-goshawk	780
TOTAL ACRES	3,397

10K	Rx	Acres	% of 10K in goshawk habitat
Blind Lake	savannah maintenance	178	5%
	thin from below	227	6%
	transition maintenance	476	13%
	uneven-goshawk	583	16%
Blind Lake Total		1,464	40%
Buck Mountain	savannah maintenance	126	13%
	transition maintenance	144	14%
Buck Mountain Total		271	27%
Jacks	thin from below	454	27%
	transition maintenance	164	10%
	uneven	24	1%
	uneven-goshawk	26	2%
Jacks Total		668	40%
Jones Mountain	savannah maintenance	238	7%
	thin from below	281	8%
	transition maintenance	44	1%
	uneven	260	8%
	uneven-goshawk	171	5%
Jones Mountain Total		994	29%
Grand Total		3,397	35%

The uneven-aged and uneven-aged goshawk treatments have the expressed intent to regenerate stands to create uneven-aged conditions, which is occurring on 11% of the other Forest and Woodland Type. In addition, design features in all treatments to create wholes and clumps/groups are expected to increase the amount of VSS 1 in the first decade. The proposed harvest will improve overall VSS distribution over the no action Alternative.

For canopy cover, a locally derived algorithm was used (Sheppard et al, 2002) and displays a difference for each VSS class and each 10K (see below). Even with the reduction of canopy cover from the treatments, each 10K still meets the Forest Plan guidance to maintain an average canopy cover of at least 40% in the ponderosa pine outside of PFA's.

Table 54: % Vegetative Structural Stages for Northern goshawk habitat within the Upper Beaver Creek Watershed Fuels Reduction Project and by 10K –Proposed Action Alterantive

Proposed Action 2018					
VSS	**All goshawk habitat**	**Blind Lake**	**Jacks**	**Buck Mountain**	**Jones Mountain**
1	9%[8]	8%	8%	15%	11%
2	1%	0%	0%	4%	0%
3	20%	19%	33%	45%	8%
4	37%	41%	21%	31%	44%
5	28%	27%	36%	1%	31%
6	5%	5%	2%	4%	6%
Proposed Action 2028					
VSS	**All goshawk habitat**	**Blind Lake**	**Jacks**	**Buck Mountain**	**Jones Mountain**
1	2%	1%	0%	6%	4%
2	8%	7%	8%	12%	7%
3	15%	17%	4%	44%	8%
4	40%	36%	43%	32%	47%
5	26%	27%	43%	0%	25%
6	9%	12%	2%	6%	9%

Table 55: % Canopy Cover for Northern goshawk habitat within the Upper Beaver Creek Watershed Fuels Reduction Project and by 10K –Proposed Action Alterantive

Proposed Action 2018					
VSS	**All goshawk habitat**	**Blind Lake**	**Jacks**	**Buck Mountain**	**Jones Mountain**
4	56	57	54	50	57
5	52	50	60	46	50
6	48	48	59	53	44
Proposed Action 2028					
VSS	**All goshawk habitat**	**Blind Lake**	**Jacks**	**Buck Mountain**	**Jones Mountain**
4	56	59	57	53	59
5	57	55	65	49	54
6	48	47	61	58	47

In addition to the decrease in canopy cover, the vegetation section displays that the modeling does display an increase in tree diameter growth and decrease in basal areas on a stand basis where harvesting occurred (see vegetation section for summary).

The proposed action alternative is moving towards Forest Plan standards and guidelines for northern goshawk habitat outside of northern goshawk PFA's. However, the amount of acres that are in a regeneration status is not enough to provide for the desired VSS distribution of 10-10-20-20-20-20 in the long-term, so the proposed action is not able to fully move towards the FP standard and guideline. The proposed action is decreasing fire risk both within the PFA's and in northern goshawk habitat outside of PFA's and is also

[8] Modeling cannot assign spatial feature of openings that are in the design feature of all treatments., therefore a % in regeneration status was calculated by taking 10% of harvest treatments stands as openings.

moving the landscape as a whole towards the natural range of variability for fire adapted ecosystems (see fuels section above).

Effects to Other Habitat Components

Existing conditions and effects on habitat components such as snags, logs, cover and old growth have been previously discussed. Goshawk guidelines and the Forest Plan call for a minimum of two (2) snags per acre > than 18" dbh and three (3) logs per acre in the ponderosa pine vegetation type. In summary, the findings for snags are that the project area is not meeting the snag guideline but snags are slowly increasing. For logs, the findings are that the project area lacks the amount of logs to meet the guideline. As previously discussed, prescribed burning would result in the loss of some snags and logs and would also kill some of the large trees in the overstory. These effects could results in short-term decreases in populations of prey species for the goshawk that are ground dwelling or ground foraging. Design features would be implemented to protect and maintain the snag and down wood component within PFAs.

Cumulative Effects to Northern Goshawk

The cumulative effects boundary is the Upper Beaver Creek Project area (including the 0.5 mile project buffer); the time frame for the analysis is twenty years. The proposed action would contribute to the reduction in the risk of high intensity stand replacing wildfires in PFAs (and outside the PFAs) by reducing the availability of hazardous fuels, ladder fuels, and canopy connectivity, while increasing crown-to-base height. The Proposed Action would also contribute to the development and health of the project area's understory and ground vegetation, improving foraging habitat for goshawks and their prey species. For multiple scales of analysis, forest plan guidance and northern goshawk habitat recommendations will be met or be put on a positive trend for VSS classes, canopy cover, and snags.

On the other hand, conducting the proposed prescribed burns in stands previously burned, either through prescribed burning and/or wildfire would contribute to the reduction in the availability of snags, logs and woody material in the treated areas. This reduction would have an indirect negative cumulative impact on goshawk prey species, and therefore to northern goshawks. However, since the availability of snags and logs and woody material would increase over time, the benefits of reducing the threat of stand replacing wildfires to goshawk habitat and throughout the analysis area would outweigh negative effects of prescribed burning. Additionally, pre-identified and mapped areas within PFAs will target snags, logs and woody debris for retention and/or recruitment with project design features listed in Chapter 2. When considered with past, present and reasonably foreseeable future vegetation management actions, the proposed action would have a minimal cumulative effect on the northern goshawk.

Peregrine Falcon

No Action Alternative

Direct and Indirect Effects to Peregrine Falcon

The No Action Alternative would have no direct or indirect effects on Peregrine falcon. No treatments would occur. The No Action alternative would not affect falcon foraging habitat. Cliff nesting habitat would remain the same in availability and surrounding habitat would also stay untouched. Surrounding habitat would be created through natural means for peregrine prey. The project area would continue to succeed naturally but without the natural effect of fire and could therefore lack components outside the areas historical range of variation.

Cumulative Effects to Peregrine Falcon

The cumulative effects boundary is the Upper Beaver Creek Project area (including the 0.5 mile project buffer); the time frame for the analysis is twenty years. Since there are no direct or indirect effects to peregrine falcon there are no cumulative effects.

Proposed Action Alternative

Direct and Indirect Effects to Peregrine Falcon

There would be no direct effects to nesting peregrine falcons since there are no treatments proposed within the Stoneman lake crater itself. This incorporates over 0.6 miles of no treatment area from the known eyrie at Stoneman Lake. Thinning and burning treatments are all outside the nest buffer so there is no seasonal restriction from March 1-August 15. Although no burning is proposed in the 0.6 nest buffer area, there will likely be smoke impacts. Short-term, indirect effects may include temporarily disrupting feeding behavior of foraging peregrines from smoke, fire vehicles and human presence during project activities. Indirect effects would also include a decrease in the number of available snags (plucking perches) within foraging habitat due to snag consumption during proposed prescribed burns (see snag effects analysis in the wildlife section). This loss would not inhibit peregrines from utilizing and nesting in the area in subsequent years. Additionally, pre-identified and mapped areas within PACs, important water areas, and PFAs will target snags, logs and woody debris for retention and/or recruitment following project design features listed in Chapter 2.

Cumulative Effects to Peregrine Falcon

The cumulative effects analysis area includes lands within the Upper Beaver Creek Project boundary and lands within a ten (10) mile buffer around the boundary in order to include potential impacts to nesting peregrine falcons near the project boundary. There are six known peregrine falcon eyries within 10 miles south and west of the proposed project boundary, and one four miles south (MRRD files). The Proposed Action would have no cumulative effect on the peregrine falcon from thinning and prescribed burning due to the long distance to the other eyries outside of the project area, and placement of the no action buffer for the Stoneman Lake eyrie.

Bald Eagle

The bald eagle occurring within the Coconino County parts of the project area is classified as Regional Forester's Sensitive Species. Eagles under the "sensitive" classification will be analyzed under the guidance of The Bald and Golden Eagle Act and technical advice is asked of the USFWS rather than concurrence. All eagles in this project area are known as wintering and foraging eagles. There are no nesting eagles known in the roughly 50,000 acre project area. Therefore, for the purposes of this analysis, effects to wintering and foraging bald eagles are addressed.

No Action and Proposed Action Alternatives

Direct, Indirect and Cumulative Effects to Bald Eagle

The effects are the same as those for the Bald Eagle analyzed in the Threatened and Endangered Species section.

Common Black-hawk and Ferruginous Hawk

No Action Alternative

Direct and Indirect Effects to Common Black-hawk and Ferruginous Hawk

The No Action Alternative would have no direct or indirect effects on foraging black-hawks and ferruginous hawks. No treatments would occur. Foraging habitat would remain the same as far as availability and the surrounding habitat would also stay untreated. The project area would continue to succeed naturally but without the natural effect of fire, and could therefore lack components outside the areas' historical range of variation.

Cumulative Effects to Common Black-hawk and Ferruginous Hawk

The cumulative effects boundary is the Upper Beaver Creek Project area (including the 0.5 mile project buffer); the time frame for the analysis is twenty years. Since there will be no direct or indirect effects, there will be no cumulative effects for the no action alternative.

Proposed Action Alternative

Direct and Indirect Effects to Common Black-hawk and Ferruginous Hawk

There are no known black-hawk or ferruginous hawk nests in the project area but it is possible that both hawk species forage in the project area along stock tanks, meadows and open grasslands. There would be no direct effects on either hawk species. Indirect effects to foraging black-hawks and ferruginous hawk would be in the way of short term loss of habitat in meadows and grasslands. However, the proposed thinning and burning treatments are also intended to increase vigor in the long-term. Studies done by NAU students have shown that post fire and thinning treatments can stimulate small mammal populations increasing them three fold (C. Chambers, personal communication, 2008). Mitigations and project design features for frog tanks, frog migration areas along

intermittent/ephemeral corridors and shrew, vole and mice measures for burning prescriptions will greatly protect foraging areas for black-hawks and ferruginous hawks.

Cumulative Effects to Common Black-hawk and Ferruginous Hawk

The cumulative effects boundary is the Upper Beaver Creek Project area (including the 0.5 mile project buffer); the time frame for the analysis is twenty years. Based on the above discussion, there are no known black-hawk or Ferruginous hawk nests in the project area. The cumulative effects of this project in combination with other past, ongoing or future foreseeable projects would result in short term loss of habitat for foraging birds in grasslands and meadows but project design features for tanks and stream corridors would aid in protecting potential foraging habitat.

Burrowing Owl (western)

No Action Alternative

Direct and Indirect Effects to Burrowing Owl (western)

The No Action alternative would have no direct effects on burrowing owl. This alternative would have an adverse long-term indirect effect by allowing woody vegetation, primarily ponderosa pine, to continue to encroach into the project area's approximately 2,000 acres of grassland habitat (includes meadows). This would reduce the availability and quality of the species' habitat over time. Tree density within existing pinyon-juniper woodlands would also increase, further reducing the availability and quality of habitat. The denser cover would also provide predators with hiding/ambush cover. Finally, encroachment and increasing tree densities would reduce forage availability, i.e. forbs and shrubs, due to competition with pinyon and pine for resources and space, and due to increased shading of the plants. The project area would continue to succeed naturally but without the natural effect of fire, and could therefore lack components outside the areas' historical range of variation.

Cumulative Effects to Burrowing Owl (western)

The cumulative effects boundary is the Upper Beaver Creek Project area (including the 0.5 mile project buffer); the time frame for the analysis is twenty years. Based on the discussion previously for the No Action alternative, it is likely that there would be a small negative cumulative effect on burrowing owls from tree encroachment into their habitat.

Proposed Action Alternative

Direct and Indirect Effects to Burrowing Owl (western)

The Proposed Action would have a minor adverse direct effect on the burrowing owl due to displacement from habitat where the proposed actions were being implemented. However, the effects would be short term and would be scattered temporarily and spatially.

The Proposed Action would have a beneficial indirect effect by increasing the suitability and availability of habitat in areas that currently provide marginal habitat for the species. The proposed "meadow maintenance" treatments would thin and/or remove ponderosa pines within grassland habitat and meadows. Periodic prescribed burns would help maintain these areas in an open land condition over the long term. It is anticipated that forbs and some shrub species would increase in abundance and diversity with the reduction in tree densities and the reintroduction of fire. Other indirect benefits include the reduction in predator hiding cover and improving conditions (e.g. decreasing tree density/canopy cover in meadows and grasslands). Overall, 931 acres of mountain meadow occur in this project; out of 9,049 available across the forest this equates to roughly 10%. Not all of this acreage will be treated. Of the acres that will be treated the intent is to improve meadows by thinning encroaching trees and by creating additional openings that have now become dense tree stands.

Cumulative Effects to Burrowing Owl (western)

The cumulative effects boundary is the Upper Beaver Creek Project area (including the 0.5 mile project buffer); the time frame for the analysis is twenty years. It is likely the proposed action will have little to no impact on the above species and it is possible one would see localized adverse and beneficial habitat trends. However, stochastic events, such as the current drought, ungulate and domestic grazing could delay project-related improvements to burrowing owl habitat, especially the recovery of forage over the short and potentially the long term. There is no more than 10% being proposed for treatment and the area would be characteristically changed but not eliminated. Through project design, the proposed action is geared to improve habitat for the above species. Balancing the local adverse and beneficial effects along with cumulative effects would keep the habitat trends at the current level. When considered with the past prescribed burns, the Proposed Action would contribute to opening the meadows and savannah grasslands that area currently being encroached by competing pine trees. Overall, the Proposed Action would contribute to the reduction in the risk from catastrophic fire thus helping to maintain or create burrowing owl habitat within the analysis area over the long term and would provide important habitat that is currently being lost or converted by trees.

Voles, Shrews and Mice

Since potential impacts would be similar, *Mogollon Vole, Long-tailed Vole, Merriam's shrew, dwarf shrew, Wupatki Arizona pocket mouse and plains harvest mouse* will be analyzed together.

No Action Alternative

Direct and Indirect Effects to Voles, Shrews and Mice

The No Action alternative would have no direct effects on voles, shrews and mice. This alternative would have an adverse long-term indirect effect by allowing woody vegetation; primarily ponderosa pine to continue to encroach into the project area's approximately 2,000 acres of grassland habitat (includes meadows). This would reduce the availability

and quality of the species' habitat over time. Tree density within existing Ponderosa and pinyon-juniper woodlands would also increase, further reducing the availability and quality of habitat. The denser cover would also provide predators with hiding/ambush cover. Finally, encroachment and increasing tree densities would reduce forage availability, i.e. forbs and shrubs, due to competition with pinyon and pine for resources and space, and due to increased shading of the plants. The project area would continue to succeed naturally but without the natural effect of fire, and could therefore lack components outside the areas' historical range of variation.

Cumulative Effects to Voles, Shrews and Mice

The cumulative effects boundary is the Upper Beaver Creek Project area (including the 0.5 mile project buffer); the time frame for the analysis is twenty years. Based on the discussion previously for the No Action alternative, it is likely that there would be a small negative cumulative effect on voles, shrews and mice from tree encroachment into their habitat.

Proposed Action Alternative

Direct and Indirect Effects to Voles, Shrews and Mice

The Proposed Action would have a minor adverse direct effect on the voles, shrews and mice due to displacement from habitat where the proposed actions were being implemented. However, the effects would be short term and would be scattered temporarily and spatially. In the long term the Proposed Action would result in beneficial long-term habitat trends for the species.

The Proposed Action would have a beneficial indirect effect by improving habitat conditions in areas currently used by voles, shrews and mice and by increasing the suitability and availability of habitat in areas that currently provide marginal habitat for the species. The proposed "meadow maintenance" treatments would thin and/or remove ponderosa pines within grassland habitat and meadows. Periodic prescribed burns would help maintain these areas in an open land condition over the long term. It is anticipated that forbs and some shrub species would increase in abundance and diversity with the reduction in tree densities and the reintroduction of fire. Other indirect benefits include the reduction in predator hiding cover and improving conditions (e.g. decreasing tree density/canopy cover, stimulating the growth and promoting the establishment of ground vegetation) along travel corridors for animals moving to and from meadows and grasslands. Additionally, project design features have been incorporated to aid in protection of habitats for these animals (see chapter 2 of this EA). Of the acres that will be treated the intent is to improve meadows by thinning encroaching trees and by creating additional openings that have now become dense tree stands.

Cumulative Effects to Voles, Shrews and Mice

Cumulative effects for shrews, voles and mice are the same as for the borrowing owl because they utilized similar habitats. Please refer to that section above in this EA.

Bats

Since potential impacts would be similar, *Allen's lappet-browed bat, spotted bat, Pale Townsend's big-eared bat and the Greater mastiff bat* will be analyzed together. There are no caves, canyons, mines or historic buildings where possible maternity colonies and large roosting areas would be impacted by either alternative. The effects to ephemeral roosts in the form of snags will be analyzed and described below. This would be the main habitat component utilized by bats that could be affected by the thinning and prescribed burning treatments that are proposed.

No Action Alternative

Direct and Indirect Effects to Bats

There would be no direct effects to the snag habitat component from deferring the proposed project activities. The number of snags per acre would remain close to current number in the analysis area. Snags would decay and fall and would be created through natural means. In the event of a large crown-wildfire, widespread loss of snags would occur. High tree densities would continue to limit the growth of large diameter trees thereby limiting the replacement of large diameter snags. This effect would be indirect but generally undesirable in nature. The project area would continue to succeed naturally but without the natural effect of fire and could therefore lack components outside the areas' historical range of variation.

Cumulative Effects to Bats

The cumulative effects boundary is the Upper Beaver Creek Project area (including the 0.5 mile project buffer); the time frame for the analysis is twenty years. The no action alternative will not have any measurable direct or indirect effects on snag density, quality and location over the greater project area. Since there will be no direct or indirect effects, there will be no cumulative effects for the no action alternative.

Proposed Action Alternative

Direct and Indirect Effects to Bats

The existing conditions and the effects of this alternative on snags have been previously described. Some snag loss would occur on the approximately 44,000 acres proposed to be treated with prescribed fire under this alternative. Many of the large snags in critical wildlife areas (e.g. MSO PACs, goshawk nest stands, and old-growth) would be protected from fire by lining to the extent possible; the extensiveness of the treatments over the project area limits the amount of lining that would occur. Any size class snag would not be cut during the proposed thinning treatments, unless they are a hazard to thinning and/or prescribed burning crews. A combination of girdling and felling of trees either after burning, before, or both will aid to replace snags and logs consumed by prescribed burning and thus provide additional habitat. These areas have been identified as PACs, PFAs, portions of restricted habitat where snag densities from microhabitat data are less then desired and important waters (including some tanks and ephemeral streams).

Although fire can have a detrimental affect on pre-burn snags, it can cause live trees to die and become snags after fire, although it is difficult to discuss the magnitude and distribution of these newly created snags. With the retention of yellow pine trees and old growth recruitment site management, some trees would in time naturally convert to snags. This natural conversion of snags to logs would contribute to additional numbers of snags and logs on the ground. Recognizing that all snags are not created equal, the aforementioned measure to create additional logs and snags will aid the potential loss of naturally occurring logs and snags over the project area. Additionally, less competition between trees for moisture, nutrients, and sunlight will aid with larger growth prior to becoming snags. An 18-inch upper diameter limit for thinning treatments would provide a greater number of trees that could convert to snags and logs. Recent work by C. Chambers et al has concluded that trees greater than 24" dbh are most used by roosting bats, however bats could use snags in the 18" to 24" diameter class as well (C. Chambers pers, comm., 2008). This alternative will provide long-term maintenance of large trees and with the measures outlined above will assure a renewable source of future large snags and downed logs. This alternative will provide long-term maintenance of large trees and with the measures outlined above will assure a renewable source of future large snags and downed logs.

There are no documented bat roosts located within the project area. It is definitive that roosts exist in the project area, however. Should bat roosts become identified during anytime of the implementation of this alternative, the wildlife biologist will be informed and will assess alternatives and or artificial roosts.

Cumulative Effects to Bats

The cumulative effects boundary is the Upper Beaver Creek Project area (including the 0.5 mile project buffer); the time frame for the analysis is twenty years. The proposed action may have some short term adverse direct effects to the snag density, quality and location but these effects will be short lived. It is predicted that there will be an indirect beneficial effect on snag recruitment over the long term. Project mitigation measures and design features will likely decrease any adverse effect and add to any beneficial effect. Cumulatively with other actions across the project area, the proposed action is not likely to shift the forest wide trend from its existing condition.

Northern Leopard Frog

No Action Alternative

Direct and Indirect Effects to Northern Leopard Frog

The No Action Alternative would have no direct effects on the northern leopard frog since the actions would be deferred and there would be no project-related effects to natural tanks, man-made tanks, lakes and intermittent streams and springs that provide habitat for the Northern leopard frog. Habitat would be created and lost through natural means. In the event of a large crown-wildfire, widespread loss of habitat could occur in timbered stands surrounding water features. The project area would continue to succeed naturally

but without the natural effect of fire and could therefore lack components outside the areas' historical range of variation.

Cumulative Effects to Northern Leopard Frog

The cumulative effects boundary is the Upper Beaver Creek Project area (including the 0.5 mile project buffer); the time frame for the analysis is twenty years. Since there will be no direct or indirect effects, there will be no cumulative effects for the no action alternative.

Proposed Action Alternative

Direct and Indirect Effects to Northern Leopard Frog

The Upper Beaver Creek Project area contains natural tanks, man-made tanks, lakes and intermittent streams and springs that provide habitat for the Northern leopard frog. Frogs have been documented in the project area. Additionally, due to the boom or bust population dynamics of frogs and the recent wet year in 2008, it is possible that frogs are in other areas of the project area. There is little information about dispersing frogs but there is some evidence that they can move during the monsoons or spring runoff time when water is more abundant and widespread over the landscape, (J. Agyagos pers. comm.. 2008; B. Garcia pers. observation, 2008).

Frogs evolved with fire but the magnitude, time of year and distribution of fire is different from what was probably seen over the landscape historically. The proposed action would have little direct effects to the species in stream and spring habitats. In order to protect and maintain the integrity of these aquatic habitats, Best Management Practices and other design features would be implemented to limit the input of ash and sediment into creeks from the proposed prescribed burns. While slight amounts of ash and sediments may enter the creeks, this would have negligible direct and indirect impacts on potential habitat for the species. Burning could have both negative effects through direct fire effects (Vogl, 1973, Friend 1993, Russell et al. 1999b, Papp and Papp 2000) and through indirect effects to habitat from decreased soil moisture in openings (Groves et al 1996, McGraw 1997, Murphy et al 1981, Bury and Corn 1988) and possible positive effects from fire (Russell et al 1999b, deMayandier and Hunter 1999) through improved habitat.

To minimize possible negative effects, this project will implement: Best Management Practices to protect soil productivity and water quality; seasonal buffers around identified potential breeding sites (AZGFD information in coordination with USFS); buffers around logical and potential dispersing corridors along streams; and no action buffers around known critical breeding sites. Should a new breeding site be detected at anytime during the implementation of this project, buffers and/or seasonal restrictions would apply. See the design features for Chiricahua leopard frogs in Chapter 2 for the list of measures to minimize impacts to the northern leopard frog. Due to these actions it is reasonable that the treatments would be negligible to frogs.

Cumulative Effects to Northern Leopard Frog

The cumulative effects boundary is the Upper Beaver Creek Project area (including the 0.5 mile project buffer); the time frame for the analysis is twenty years. No additional state or private activities are proposed in the project area. Benefits to the species would be primarily associated with protection of intermittent streams and springs where potential habitat could develop. When combined with past prescribed burns, the Proposed Action would contribute to and continue watershed improvement efforts over the short and long term. In addition, new fencing that excludes livestock from riparian streams, one pipe and sucker rod fence to exclude OHV use, and two wedge fencing/exclosure projects on earthen tanks in the project area would improvement the habitat provided by the tanks. Tank use by livestock and wildlife would continue to contribute to increased sedimentation into the tanks. Implementation of the design features for this project would produce negligible effects to frogs and their habitat. When considered with past, present and reasonably foreseeable projects or activities, the Upper Beaver Creek Project's proposed treatments would have no negative cumulative effects on the Northern leopard frog within the analysis area.

Invertebrates-- Butterflies

Since potential impacts to invertebrates would be similar, *the four spotted skipperling, blue-black silverspot, and mountain silverspot butterflies* will be analyzed together.

No Action Alternative

Direct and Indirect Effects to Invertebrates -- Butterflies

The No Action Alternative would have no direct effects to any of the invertebrate species since the proposed actions would be deferred and the species are not known to occur within the proposed project boundary. This alternative could have an indirect impact on the above species due to encroachment of woody vegetation into potential habitat, i.e. openings and meadows through succession. Left untreated, the openings and meadows would succeed to forested habitat types. The project area would continue to succeed naturally but without the natural effect of fire and could therefore lack components outside the areas' historical range of variation. Over time, this would reduce the availability and suitability of potential habitat for these species.

Cumulative Effects to Invertebrates -- Butterflies

Cumulative effects for butterflies are the same as for the burrowing owl because they utilize similar habitats. Please refer to that section above.

Proposed Action Alternative

Direct and Indirect Effects to Invertebrates -- Butterflies

The Proposed Action could have an adverse direct effect since the prescribed burns could cause a loss of a year's reproduction by destroying eggs, larvae and/or pupae. Because the burns would be staggered temporally and spatially, potential effects would be on local

populations. In addition, since the prescribed burns would create a mosaic of burned and unburned areas, there is the potential for eggs, larvae and/or pupae to survive the proposed initial and maintenance prescribed burning treatments that would allow the local population to recover over time.

The Proposed Action could have an overall short-term adverse effect on potential habitat and the availability of the species' nectaring and host plants, again through the proposed prescribed burns. In general, implementing a burn prior to and/or during a species flight period could result in the loss of the species' nectaring and host plants. However, a spring burn would have minimal to no impacts on nectaring and host plant availability for species with a fall flight period (and visa-versa for fall burns) as the vegetation would quickly recover after the burn. Burning during the spring in potential spotted skipperling habitat would have a beneficial impact on the species in particular, (a fall flier), by invigorating the growth of the grasses. The proposed thinning treatments would help maintain the open land habitats, e.g. meadows and openings, preferred by the above species.

Because the proposed treatments would be staggered temporally and spatially and there would be burned and unburned habitat within the burn areas, the effects on potential habitat and the availability of nectaring and host plants for all of the invertebrate species analyzed would be localized. The impacts would be unlikely to impact the species' project-wide populations and distribution. In addition, reducing the risk of stand replacing wildfires would have an overall beneficial impact on the species over the long term.

The Proposed Action would have a beneficial indirect effect by improving habitat conditions in areas currently used by butterflies by increasing the suitability and availability of habitat in areas that currently provide marginal habitat for the species. The proposed "meadow maintenance" treatments (~900 acres) would thin and/or remove ponderosa pines within grassland habitat and meadows. The intent is to improve meadows by thinning encroaching trees and by creating additional openings that have now become dense tree stands. It is anticipated that forbs and some shrub species would increase in abundance and diversity with the reduction in tree densities and the reintroduction of fire. Overall 48,729 acres of habitat are available for the above species. Not all of this acreage will be treated. In summary, direct and indirect effects would be localized and short term negative effects; overall the habitat would benefit from treatment.

Cumulative Effects to Invertebrates -- Butterflies

The cumulative effects boundary is the Upper Beaver Creek Project area (including the 0.5 mile project buffer); the time frame for the analysis is twenty years. It is likely the proposed action will have little to no impact on the above species and it is possible one would see localized adverse and beneficial habitat trends. No more than 10% of the best available habitat (meadows and grasslands) proposed for treatment and the project area as a whole would be characteristically changed but not eliminated. Through project design, the proposed action is geared to improve habitat for the above species. Balancing the local adverse and beneficial effects along with cumulative effects would keep the habitat trends at the current level. When considered with the past prescribed burns, the Proposed

Action would contribute to opening the meadows and savannah grasslands that are currently being encroached by competing pine trees. However, stochastic events, such as the current drought, ungulate and domestic grazing could delay project-related improvements to habitat, especially the recovery of forage over the short and potentially the long term.

Management Indicator Species

Abert's Squirrel

No Action Alternative

Direct and Indirect Effects to Abert's Squirrel

There would be no direct effects to this species under the no action alternative, because ponderosa pine habitat would remain unchanged. Deferring the proposed actions would maintain the dense mid-seral ponderosa pine stands within the project area. Under this alternative, the potential for a large-scale loss of habitat from a high intensity, stand replacing wildfire would also remain. 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. These effects would be indirect long-term effects, and although not limiting, undesirable in nature. The project area would continue to succeed naturally but without the natural effect of fire and could therefore lack components outside the areas' historical range of variation.

Cumulative Effects to Abert's Squirrel

The cumulative effects boundary consists of the management area acres (MAs 3, 4, and 6); the time frame for the analysis is twenty years. Considering the MAs 3, 4, and 6 proposed for treatment (and across the Forest-wide available habitat), it is likely the proposed action will have little to no impact on the current trends in the above species population and it is possible one would see localized adverse and beneficial habitat trends. On a Forest wide basis there would likely be no change in the species' current stable population trend.

Proposed Action Alternative

Direct and Indirect Effects to Abert's Squirrel

Within the project area, approximately 150 acres of the early seral stage vegetation would be thinned and burned, which would improve habitat suitability for Abert's squirrels. The proposed action will reduce the best nesting habitat to lower quality nesting habitat by approximately 8%. Canopy closures and basal areas will be reduced overall but will continue to average 50% canopy cover. Higher basal areas within MSO PACs, PFAs and steep slopes will be maintained due to those species habitat requirements and complying with Forest Plan standards.

Acres of VSS 3 and 4 consisting of more open and closed canopy types were used in this analysis versus the Forest Habitat Capability Model. The guideline in the Forest Plan calls for at least 20% of the project to be within VSS 3 and 4, of both of the two canopy cover types (open and closed) in 10K blocks. Currently, within the project area, 82% of the forested area is in VSS 3 and 4 of both canopy types (33,980 acres of VSS 3 and 4, B and C canopies). Within each 10K block both existing condition and predicted condition after implementation of proposed action will exceed the Forest Plan guidance of 20% in VSS 3 and 4, (Table 56). Overall the project will increase this type of habitat.

Table 56. Acres and percentage of habitat in 10K blocks of VSS 3 and 4 B and C canopy types

10K Name	Acres in entire block	Existing Condition Acres VSS 3 and 4, B & C Canopy (also No action alternative)	Existing Condition %	Proposed Action Acres VSS 3 and 4, B & C Canopy	Proposed Action %
Blind Lake	13,736	7,939	58%	8,150	59%
Buck Mountain	10,757	8,373	78%	9,042	84%
Jacks	11,032	8,578	78%	9,077	82%
Jones Mountain	13,598	8,111	60%	8,425	62%

Cumulative Effects to Abert's Squirrel

The cumulative effects boundary consists of the management area acres (MAs 3, 4, and 6); the time frame for the analysis is twenty years. Considering the MAs 3, 4, and 6 proposed for treatment (and across the Forest-wide available habitat), it is likely the proposed action will have little to no impact on the current trends in the above species population and it is possible one would see localized adverse and beneficial habitat trends. On a Forest wide basis this project would treat less than 11% of the MAs Forest wide for Abert's squirrel and the area would be characteristically changed but not eliminated. Through project design, the proposed action is geared to improve habitat for the above species. Balancing the local adverse and beneficial effects along with cumulative effects would keep the habitat trends at the current level. When considered with the past prescribed burns, the Proposed Action would contribute to thinning dense stands of mid-seral ponderosa pine (unsuitable habitat), and promote an increased growth rate of the remaining trees within the analysis area. The increased growth rate would provide larger trees and create areas with interlocking crowns faster. Overall, the Proposed Action would contribute to the reduction in the risk from catastrophic fire thus helping to maintain Abert's squirrel habitat within the analysis area over the long term.

American pronghorn

No Action Alternative

Direct and Indirect Effects to American Pronghorn

The No Action alternative would have no direct effects on the American pronghorn. This alternative would have an adverse long-term indirect effect by allowing woody vegetation; primarily pinyon-juniper to continue to encroach into the project area's approximately

2,500 acres of grassland and meadow habitat (MA 9 and 10). This would reduce the availability and quality of the species' habitat over time. Tree density within existing pinyon-juniper woodlands would also increase, further reducing the availability and quality of pronghorn habitat. The denser cover would also provide predators with hiding/ambush cover. Finally, encroachment and increasing tree densities would reduce forage availability, i.e. forbs and shrubs, due to competition with pinyon and pine trees for resources and space, and due to increased shading of the plants. The project area would continue to succeed naturally but without the natural effect of fire and could therefore lack components outside the areas' historical range of variation. This alternative would have a minor contribution to the pronghorn's declining Forest-wide population and habitat trends, due to the limited amount of pronghorn habitat and long-term effects on grassland habitat within the project area.

Cumulative Effects to American Pronghorn

The cumulative effects boundary is the management area acres (MA 9 and 10); the time frame for the analysis is twenty years. Overall, for the MA's in question (and across the forest-wide available habitat), it is likely the proposed action will have little to no impact on the current trends in the above species population and it is possible one would see localized adverse and beneficial habitat trends. When considered with the past burns, No Action would contribute to encroached meadows and savannah grasslands that area currently being encroached by competing pine trees. Additionally, events such as the current drought, wild ungulate and domestic grazing could decrease pronghorn habitat further, especially the recovery of forage over the short and potentially the long term. Overall, the No Action alternative would contribute to the reduction in pronghorn habitat within the analysis area over the long term and would not provide important habitat that is currently being lost or converted by trees.

Proposed Action Alternative

Direct and Indirect Effects to American Pronghorn

The Proposed Action would have a minor adverse direct effect on the American pronghorn due to displacement from habitat where the proposed actions were being implemented. However, the effects would be short term and would be scattered temporarily and spatially, and would have no long-term effects on the project area's or Forest-wide population trend.

The Proposed Action would have a beneficial indirect effect by improving habitat conditions in areas currently used by pronghorn, and by increasing the suitability and availability of habitat in areas that currently provide marginal habitat for the species. The proposed "meadow maintenance" treatments would thin and/or remove ponderosa pines within grassland habitat and meadows. Periodic prescribed burns would help maintain these areas in an open land condition over the long term. It is anticipated that forbs and some shrub species (pronghorn forage) would increase in abundance and diversity with the reduction in tree densities and the reintroduction of fire. Other indirect benefits include the reduction in predator hiding cover and improving conditions (e.g. decreasing tree density/canopy cover, stimulating the growth and promoting the establishment of

ground vegetation) along travel corridors for pronghorns moving to and from meadows and grasslands. Overall, 396 acres of mountain grasslands (MA9) would be treated in this project, out of 9,049 available across the forest. This equates to roughly 4% of the Forest-wide total for the MA. Not all of the acres would be prescribed burned. The intent of treatments are to improve meadows by thinning encroaching trees, creating additional openings that have now become dense tree stands, and reintroducing fire into the ecosystem. Approximately 2,143 acres out of 160,494 of the MA 10 type (Grassland and Sparse Pinyon-Juniper above the Rim) would be treated with prescribed burning within the project area (1% of the Forest-wide MA). The same goals apply as for MA 9.

Cumulative Effects to American Pronghorn

The cumulative effects boundary consists of the management area acres (MA 9 and 10); the time frame for the analysis is twenty years. Overall, for the MA's in question (and across the Forest-wide available habitat), it is likely the proposed action will have little to no impact on the current trends in the above species population and it is possible one would see localized adverse and widespread beneficial habitat trends. The MAs have less than 5% proposed for treatment (on a Forest-wide basis) and the area would be characteristically changed but not eliminated. Through project design, the proposed action is geared to improve habitat for the above species. Balancing the local adverse and beneficial effects along with cumulative effects would keep the habitat trends at the current level. When considered with the past burns, the Proposed Action would contribute to opening the meadows and savannah grasslands that area currently being encroached by competing pine trees. However, events such as the current drought, ungulate and domestic grazing could delay project-related improvements to pronghorn habitat, especially the recovery of forage over the short and potentially the long term. Overall, the Proposed Action would contribute to the reduction in the risk from catastrophic fire thus helping to maintain pronghorn habitat within the analysis area over the long term and would provide important habitat that is currently being lost or converted by trees.

Cinnamon Teal

No Action Alternative

Direct and Indirect Effects to Cinnamon Teal

There would be no direct or indirect effects to the species under the No Action Alternative since the actions would be deferred and potential habitat for the species would not be affected because there are no actions proposed at or within the Stoneman Lake crater. This alternative would not affect the Forest-wide population trend for cinnamon teal. The project area would continue to succeed naturally but without the natural effect of fire and could therefore lack components outside the areas historical range of variation.

Cumulative Effects to Cinnamon Teal

The cumulative effects boundary consists of management area acres (MA 12); the time frame for the analysis is twenty years. Because there are no actions proposed and there no effects, there are no cumulative effects for No Action Alternative.

Proposed Action Alternative

Direct and Indirect Effects to Cinnamon Teal

There would be no direct effects on cinnamon teal from the Proposed Action since there are no proposed actions specifically associated with Stoneman Lake. No treatments are proposed in MA 12.

Cumulative Effects to Cinnamon Teal

The cumulative effects boundary consists of the management area acres (MA 12); the time frame for the analysis is twenty years. No treatments are proposed in MA 12. Overall, within the MA in question (and across the forest-wide available habitat), it is likely the proposed action will have little to no impact on the current trends in the above species population.

Elk, Mule Deer, and Turkey

No Action Alternative

Direct and Indirect Effects

Deferring the proposed project activities would have no direct effects to big game because the habitats would not be altered. Indirect effects include the continued increase in tree densities, especially in small diameter trees the continued encroachment of trees into open habitats, and the continued risk of habitat alteration or loss from stand replacing wildland fires. These effects would decrease the use of the project area by elk and deer, especially for calving. However, stand replacing wildfires in ponderosa pine would increase the availability of early seral ponderosa pine habitat used by elk and deer, while the same disturbance would decrease habitat availability for wild turkey. Overall, the No Action alternative would maintain the current quality of habitat available for elk, deer, turkey and bear. The project area would continue to succeed naturally but without the natural effect of fire and could therefore lack components outside the areas' historical range of variation.

Cumulative Effects

The cumulative effects boundary for the above species is at the GMU 6A and 5BS scale; the time scale for effects ranges up to 10 years; 3-5 years for burning and up to 10 years for thinning. Direct and Indirect effects are miniscule in nature and therefore are not measurable; therefore there are no cumulative effects for the No Action Alternative.

Proposed Action Alternative

Direct and Indirect Effects

There could be some localized displacement of elk during project operations, but since implementation would be spaced both temporarily and spatially, the effects would be localized. There would be ample habitat nearby that elk could use during project implementation. Thinning and/or burning would thin out dense ("doghair") thickets,

increasing their usefulness as calving habitat for elk. Treatments would also enhance plant growth and vigor, improving foraging habitat for elk. The project would not affect the availability of early seral ponderosa pine habitat within the project area, and may make the limited amount of this habitat stage more useable where thinned. Conversely, the proposed action would not create additional early seral ponderosa pine habitat.

Changes to Forest wide habitat for elk, mule deer and turkey have been analyzed for the Proposed Action Alternative (Table 57). Habitat will be changed but not eliminated.

Table 57. Changes in Forestwide Habitat for Elk, Mule Deer and Turkey with the Proposed Action, by Management Area

Management Area	Forest wide Habitat Acres	Changed Acres with the Proposed Action Treatment	Forest wide % Change
MA 3	511,015	38,827	8%
MA 4	46,382	726	2%
MA 5		No treatment – No changes	
MA 6	67,146	582	1%
MA 7	273,815	1,207	0.4%
MA 8		No treatment – No changes	
MA 9	9,049	396	4%

Elk = MA 3, 4, 6, 7, 8 Mule Deer = 5, 6, 7, 8, Turkey = MA 3, 4

The proposed actions would improve elk habitat, especially foraging habitat within the analysis area, which may beneficially affect Forest-wide population trends. Elk populations are currently governed by the number of hunting permits distributed by the Arizona Game and Fish Department, and are currently at levels similar to those present when the Coconino National Forest Plan was issued.

Mule deer would benefit from proposed project activities. Thinning would open up dense stands that would promote increased shrub, grass, and forb production in the understory vegetation layer. Prescribed burning would reduce heavy accumulations of small logs and other fuels, adding nutrients to the soils further promoting the development of browse species. Mule deer would greatly benefit from the increases in understory vegetation.

While the proposed action would improve habitat suitability for mule deer and potentially increase the species' population within the project area, the improvements are unlikely to measurably affect the species' Forest-wide population trend, which is currently declining. For both elk and mule deer there could be some negative effects by opening up stands as this could potentially increase hunter success from roads. Cover has been analyzed previously and the habitat recommendations to minimize loss to cover will benefit elk and mule deer.

Project activities would improve overall habitat conditions for wild turkeys by creating openings in the canopy, restoring open land habitats (e.g. meadows and grasslands),

stimulating oak reproduction and growth, and by promoting ground cover vegetation. Spring burning in turkey nesting habitat could cause abandonment of nests, and may kill young poults unable to get away from the fire. When and where possible, spring burns would not be conducted in turkey nesting habitat to avoid affecting breeding wild turkeys. Once poults are fairly mobile however, hens and poults will often forage in recently burned areas, since insects are often abundant in newly burned and revegetated areas. The blackened soils from spring burns could also result in an earlier green-up due to warmer soils, while the ash would provide additional soil nutrients that would be available to plants over several years. Fall burning would temporarily displace turkeys present in areas of project implementation. Fall burning would also reduce the availability of forage, such as acorns and insects, within the burn areas. However, there would be ample habitat nearby that turkey could use during project implementation. Fall burn(s) would have benefits on ground vegetation and wild turkey the following spring. Spring and fall burning could reduce the number of logs, the amount of woody debris, and the density of the shrubby understory, which may reduce the availability of nesting habitat, and would thin or remove doghair thickets that provide important loafing areas. Measures would be taken during a burn to retain these components for wild turkey when and where possible. However, since the burn would create a mosaic of burned and unburned areas, potential nesting and/or loafing habitat would still be available although at a lower availability. Also, since the burns would be staggered temporally and spatially across the project area, any potential effects would be localized.

Large, overstory trees on canyon slopes, yellow pines and trees >18 inches dbh would not thinned so project activities would have minimal effects on turkey roosts. Although habitat on the analysis area would be enhanced for wild turkey, likely resulting in localized increased productivity, the improvements would not be at a large enough scale to affect the overall Forest-wide habitat or population trends. Therefore, the project would not change the current slightly declining habitat trend and the stable population trend for wild turkey.

The Proposed Action would have an overall beneficial effect on elk, mule deer, wild turkey by reducing the risk of stand replacing wildfires within the project area.

Cumulative Effects

The cumulative effects boundary for the above species is at the GMU 6A and 5BS scale and also includes Forest-wide management acres. Effects are anticipated to last 3-5 years for burning and up to 10 years for thinning. When considered with past, present and reasonably foreseeable future vegetation management actions, the proposed action would most likely have short term displacement effects on elk, mule deer, and wild turkey. The Proposed Action would contribute to the reduction in the risk of high intensity stand replacing wildfires in the species' habitats by reducing the availability of hazardous fuels, ladder fuels, and canopy connectivity, while increasing crown-to-base height. The Proposed Action would also contribute to the development and health of the project area's oak/mast, shrub, and ground vegetation (e.g. grasses and forbs) habitat components thereby improving habitat for the species. On the other hand, prescribed burning, both spring and fall, would contribute to and/or maintain a lower concentration of snags, logs

and woody material in the treated areas than desired. Logs and woody debris are important elements in wild turkey nesting habitat, and foraging habitat. Snags provide future logs. Additionally, the Proposed Action will open some existing dense stands, therefore increasing hunter induced mortality (increasing hunting success) to wildlife in localized areas.

Overall, the MAs in question (and across the Forest-wide available habitat), it is likely the proposed action will have little to no impact on the current trends in the above species' populations and it is possible one would see localized adverse and long-term beneficial habitat trends. The MAs have no more than 16% Forest wide being proposed for treatment (primarily by prescribed fire) and the areas would be characteristically changed but not eliminated. Through project design, the proposed action is geared to improve habitat for the above species. Balancing the local adverse and long-term beneficial effects along with cumulative effects would keep the habitat trends at the current level.

Hairy Woodpecker and Pygmy Nuthatches

No Action Alternative

Direct and Indirect Effects

There would be no direct effects to the species under the No Action Alternative since the actions would be deferred and habitat for both species would not be affected. The analysis area currently meets the Forest Plan guidelines for snags (see Habitat Components: Snags for further discussion on snags within the project area). This alternative would not affect the Forest-wide population trends for the hairy woodpecker or pygmy nuthatch. The project area would continue to succeed naturally but without the natural effect of fire and could therefore lack components outside the areas' historical range of variation.

Cumulative Effects

The cumulative affects boundary is the management area acres (MA 3, 4, and 6); the time frame for the analysis is twenty years. Because there are direct or indirect effects, there are no cumulative effects for the No Action Alternative.

Proposed Action Alternative

Direct and Indirect Effects

The effects of the Proposed Action on snags would apply to the hairy woodpecker and the pygmy nuthatch.

Cumulative Effects

The cumulative effects boundary is the management area acres (3, 4, and 6); the time frame for the analysis is twenty years. When considered with past, present and reasonably foreseeable projects or activities, the Upper Beaver Creek Project's proposed treatments would have a minor (and immeasurable) adverse cumulative effect on the species within

the analysis area. When considered with past burns and wildfires, the Proposed Action would contribute to the overall reduction in snag densities throughout the analysis area. The Proposed Action would also contribute to the reduction in the risk from catastrophic fire thus helping to maintain the snag component within the analysis area over the long term.

Overall, to the MAs in question (and across the forest-wide available habitat), it is likely the proposed action will have little impact on the current trends in the above species' populations. No more than 11% of the Forest wide Management Area acres are being proposed for treatment (primarily by prescribed fire) and the areas would be characteristically changed but not eliminated. Overall, the proposed action with cumulative effects would keep the habitat trends at the current level.

Juniper (Plain) titmouse

No Action Alternative

Direct and Indirect Effects

Under this alternative, the Forest would not help meet or maintain the population objectives for the juniper titmouse that prefer a more open forested condition since deferring the proposed actions would not improve habitat conditions for these species. By not reducing the potential for stand replacing wildfire, the No Action Alternative could lead to a reduction in available habitat for the juniper titmouse, and consequently a significant decrease or the loss of the species within the project area. High tree densities would continue to limit the growth of large diameter trees thereby limiting the replacement of large diameter snags and other elements such as logs, cover and old growth. This effect would be indirect but generally undesirable in nature. The project area would continue to succeed naturally but without the natural effect of fire and could therefore lack components outside the areas' historical range of variation.

Cumulative Effects

The cumulative effects boundary consists of the management area acres (MA 7 and 8); the time frame for the analysis is twenty years. Past prescribed burns in the project area and vicinity have thinned out dense stands and have started to create openings in stands which will have a positive benefit to habitat. Though there would be no direct effects from the No Action Alternative, the indirect effects of no action would lead to a reduction in habitat quality for this species as stated above.

Proposed Action Alternative

Direct and Indirect Effects

Juniper Titmouse prefers a more open stand of pinyon-juniper. The species prefers mid to late successional habitat, with varying degrees of understory to mid-story vegetation. According to the literature, juniper titmouse is considered a pinyon-juniper obligate species. Within the proposed project area there are approximately 9,000 acres of

transition habitat and 440 acres of mature pinyon-juniper habitat. Again, the Forest-wide trend for late seral pinyon-juniper habitat is stable (USDA Forest Service 2002b).

The majority of the proposed thinning treatments would have no effect on juniper titmice as there are no proposed thinning treatments within pinyon-juniper habitat. However, thinning transition habitat (pinyon-juniper mixed with ponderosa pines) where adjacent to pinyon-juniper would increase potential nesting and/or foraging habitat for the species. There are no proposed thinning treatments within the "pure" pinyon-juniper habitat.

Because the proposed prescribed burns would also be conducted in pinyon-juniper woodland, creating a more open pinyon-juniper habitat through fire-caused mortality, and increasing the understory and hence prey species diversity would benefit the juniper titmouse.

The proposed action would reduce the risk of stand replacing wildfire in pine, pine-oak and pinyon-juniper habitat by reducing fuels, through thinning and/or prescribed burning. This would help maintain species' habitats and populations in the project area over the term.

Cumulative Effects

The cumulative effects boundary consists of the management area acres (MA 7 and 8); the time frame for the analysis is twenty years. When considered with past, present and reasonably foreseeable projects or activities, the proposed treatments would have a beneficial cumulative effect on juniper (plain) titmouse. When considered with past prescribed burning, the proposed prescribed burning treatments would contribute to the improvement of habitat conditions for this priority species. Past burns created small (< one acre) openings within dense conifer stands while wildfires created larger openings and/or reduced the amount of canopy cover through tree mortality. The Proposed Action's thinning and prescribed burns will contribute to these effects by maintaining these openings, creating new openings and to some degree reducing canopy cover in the project area.

Overall, the MAs in question (and across the Forest-wide available habitat), it is likely the proposed action will have a small but positive impact on the current trends in the above species' populations. Less than 1% of the Forest wide Management Area acres are being proposed for treatment (primarily by prescribed fire) and the areas would be characteristically changed but not eliminated. Through project design, the proposed action is geared to improve habitat for the above species. The Proposed action along with cumulative effects would lead to a small but positive impact on the current habitat trend.

Mexican Spotted Owl

The Mexican spotted owl is analyzed in the Threatened and Endangered species section.

Northern Goshawk

The northern goshawk is analyzed in the Regional Forester's Sensitive Species section.

Big Game

The effects to big game species of elk, mule deer and wild turkey have been analyzed in the Regional Forester's Sensitive Species section.

Black Bear

No Action Alternative

Direct, Indirect and Cumulative Effects

Deferring the proposed project activities would have no direct effects to black bear because the actions would be deferred and habitats would not be altered. Overall, the No Action alternative would maintain the current quality of habitat available for black bear. The project area would continue to succeed naturally but without the natural effect of fire and could therefore lack components outside the areas' historical range of variation. The cumulative effects boundary for the above species is at the GMU 6A and 5BS scale. Because there are no actions proposed, there are would be no cumulative effects for the No Action Alternative.

Proposed Action Alternative

Direct and Indirect Effects

Since the vast majority of bears present in the project area are transients, using the drainages as travel corridors, the Proposed Action would have minimal effects on the species overall. The habitat in drainages that is important to bears for cover would not be treated, and would not curtail use by bears. The benefits of thinning and burning that increase understory vegetation would improve forage for bears, e.g. new green shoots would provide spring food for bears. There would be a minor overall improvement in the quality of habitat available for black bear because prescribed fire and thinning should increase shrub, grass, and forb species that are used as food. The size of the project treatment area however would not be large enough to affect the stable Forest-wide population trend for bears. Project activities would not lead to a downward trend in the population of bears.

Cumulative Effects

The cumulative effects boundary for the above species is at the GMU 6A and 5BS scale. Effects are anticipated to last 3-5 years for burning and up to 10 years for thinning. When considered with past, present and reasonably foreseeable future vegetation management actions, the proposed action would most likely have short term displacement effects on black bear. The Proposed Action would contribute to the reduction in the risk of high intensity stand replacing wildfires in black bear habitats by reducing the availability of hazardous fuels, ladder fuels, and canopy connectivity, while increasing crown-to-base

height. The Proposed Action would also contribute to the development and health of the project area's oak/mast, shrub, and ground vegetation (e.g. grasses and forbs) habitat components thereby improving habitat for the species. On the other hand, prescribed burning, both spring and fall, would contribute to and/or maintain a lower concentration of snags, logs and woody material in the treated areas than desired. Logs and woody debris are important elements in black bear foraging habitat. Snags provide future logs. However, since the availability of snags and logs and woody material would increase over time, the benefits of reducing the threat of stand replacing wildfires would outweigh negative effects of prescribed burning. See also snags and logs above and mitigations measures listed therein and also below. Additionally, the proposed action will open some existing dense stands therefore increasing hunter induced mortality in localized areas.

Through project design, the proposed action is geared to improve habitat for the black bear. By minimizing the local adverse effects, the beneficial effects along with other projects' cumulative effects would keep the habitat trends at the current level.

Migratory Birds

No Action Alternative

Direct and Indirect Effects

A century of fire suppression and selective timber harvest has resulted in the loss of open meadows and open forested stands through tree encroachment. Past management practices in the analysis area have resulted in few large trees, snags, and Old Growth habitat being available. The majority of the pine and pine-oak habitat is in Vegetative Structural Stages 3 and 4 (young forest and mid-aged forest, respectively), while the pinyon-juniper habitat is in VSS 5 (mature forest). The Forest-wide trend for late seral (mature) pinyon-juniper habitat is stable (USDA Forest Service 2002b). High elevation grassland types are typically stable to declining.

Under this alternative, the Forest would not help meet or maintain the population objectives for priority species that prefer a more open forested condition (six of the eight species) since deferring the proposed actions would not improve habitat conditions for these species. However, this alternative would have a beneficial indirect effect on the cordilleran flycatcher and black-throated gray warbler since they prefer habitats with a dense canopy or heavy conifer cover, respectively, which would be retained. By not reducing the potential for stand replacing wildfire, the No Action Alternative could lead to a reduction in available habitat for all priority species, and consequently a significant decrease or the loss of the species within the project area. High tree densities would continue to limit the growth of large diameter trees thereby limiting the replacement of large snags and other elements such as logs, cover and old growth. See the affected environment and effects analysis for *Habitat Components*. This effect would be indirect but generally undesirable in nature. The project area would continue to succeed naturally but without the natural effect of fire and could therefore lack components outside the areas' historical range of variation.

Cumulative Effects

The cumulative effects boundary is the Upper Beaver Creek Project area (including the 0.5 mile project buffer); the time frame for the analysis is twenty years. When considered with past, present and reasonably foreseeable projects or activities, the No Action Alternative would have a no effect to a slightly negative cumulative effect on six of the eight priority species within the analysis area: olive-sided flycatcher, purple martin, pinyon jay, gray vireo, juniper titmouse, Swainson's hawk. Past prescribed burning should contribute to the improvement of habitat conditions for these priority species. For the cordilleran flycatcher and black-throated gray warbler, the no action could have no effect to a slight beneficial cumulative effect since they prefer habitats with a dense canopy or heavy conifer cover, respectively.

Proposed Action Alternative

Direct and Indirect Effects

Pine and Pine-Oak Priority Species: all three species (Cordilleran flycatcher, olive-sided flycatcher, and purple martin) require large trees and snags for nesting or perching. Note that snags used by these species also include large dead limbs and limbs of partially-dead trees. The olive-sided flycatcher and purple martin prefer a more open canopied forest, with adjacent open land habitat. The cordilleran flycatcher prefers a denser canopy closure, especially in drainages that create a cooler microclimate. The Proposed Action would enhance the vertical structural component of the ponderosa pine and pine-oak habitats, especially where thinning and/or prescribed burning creates openings in the canopy that allow a mid-story structure to develop. The increased growth on the remaining trees would improve the large tree component of the analysis area over the long term. Though large snags would be protected where and when available, some snags would be lost through prescribed burning resulting in a short-term decrease in their availability. Refer to the effects analysis for snags, logs and down wood and old growth.

Creating a more open pine or pine-oak forested habitat would benefit olive-sided flycatchers and purple martins, while a decrease in standing dead snags would be unfavorable in the short-term. It should be noted however, that natural fire is the preferred fire for olive-sided flycatchers. Prescribed fire, (although helpful to open areas currently being encroached), may not fully restore the area to its full potential for flycatchers. Reducing any fire potential may limit additional habitat preferred by flycatchers. By using the WUI interface and by decreasing fuel loads however, it is the hope of this project to allow fire use in the area that will enable a more natural process to occur.

The loss of dense conifer habitat through thinning would decrease the overall availability of habitat for the Cordilleran flycatcher; however, sufficient habitat would remain for this species, especially in drainages and draws, to maintain viable populations. Additionally, the small diameter oak component needed by Cordilleran flycatchers will not be targeted by thinning. It is true that some of the smaller oak will be killed by prescribed burning but this activity will also sprout new oak. Overall, the project design mitigations and prescriptions are meant to concentrate on maintaining and developing uneven aged stands

having a "clumpy-groupy" structure. Maintaining or increasing large diameter trees. A mosaic treatment is to be implemented as well.

High Elevation Grassland Species:
Swainson's hawk requires large trees and snags for nesting or perching. Note that snags used by these species also include large dead limbs and limbs of partially-dead trees. This species also prefers a more open canopied forest, with adjacent open land habitat. Swainson's are not known to exist in the project area but could forage in the Pinyon-Juniper and open grassland/savannah and meadows in the lower elevations of the project area. The Proposed Action would enhance the vertical structural component of the ponderosa pine and pine-oak habitats, especially where thinning and/or prescribed burning creates openings in the canopy that allow a mid-story structure to develop. The increased growth on the remaining trees would improve the large tree component of the analysis area over the long term. Though large snags would be protected where and when available, some snags would be lost through prescribed burning resulting in a short-term decrease in their availability (see snag, log, cover and old growth analysis above).

Creating a more open pine or pine-oak forested habitat would benefit the species by adding more foraging element outside the more traditional meadows and grasslands. Moreover, the treatments are intended to open existing meadows and grasslands to their historic range using thinning and fire to target encroaching trees. This treatment will likely benefit any habitat that may be used by Swainson's.

Pinyon-Juniper Priority Species: Of the fives species, the gray flycatcher, gray vireo, juniper titmouse (analyzed in MIS section of this report), and pinyon jay prefer a more open stand of pinyon-juniper, while the black-throated gray warbler prefers denser habitat. All five species prefer mid to late successional habitat, with varying degrees of understory to mid-story vegetation. According to the literature, gray vireo and juniper titmouse are highly associated with pinyon-juniper habitat with the titmouse considered a pinyon-juniper obligate species, while black-throated gray warbler, gray flycatcher, and pinyon jay will occur where ponderosa pine is present within and/or adjacent to pinyon-juniper habitat. The latter habitat is referred to here as the transition habitat type. The Forest-wide trend for late seral pinyon-juniper habitat is stable (USDA Forest Service 2002b).

The proposed 2,680 acres of thinning treatments in transition habitat would have a beneficial indirect effect on the gray flycatcher and pinyon jay by creating a more open pinyon-juniper/ ponderosa pine mixed forest. Conversely, opening up the canopy through thinning would have an adverse effect on the black-throated gray flycatcher for the same reason. The majority of the proposed thinning treatments would have no effects the gray vireo and on juniper titmice as there are no proposed thinning treatments within pinyon-juniper habitat. However, thinning transition habitat (pinyon-juniper mixed with ponderosa pines) where adjacent to pinyon-juniper would increase potential nesting and/or foraging habitat for the species. There are no proposed thinning treatments within the "pure" pinyon-juniper habitat.

The proposed prescribed burning treatments would have similar effects on the gray flycatcher, pinyon jay and black-throated gray warbler for essentially the same reasons as the thinning. A benefit for all three species would be enhancing or establishing the understory layer, which would increase prey species populations. Because the proposed burns would also be conducted in pinyon-juniper woodland, creating a more open pinyon-juniper habitat through fire-caused mortality, and increasing the understory and hence prey species diversity would benefit the gray vireo and juniper titmouse.

All Species: The proposed action would reduce the risk of stand replacing wildfire in pine, pine-oak and pinyon-juniper habitat by reducing fuels, through thinning and/or prescribed burning. This would help maintain species' habitats and populations in the project area over the long term. See effects for olive-sided flycatchers to address the loss of "natural fire" as a possible outcome of this project.

Cumulative Effects

The cumulative effects boundary is the Upper Beaver Creek Project area (including the 0.5 mile project buffer); the time frame for the analysis is twenty years. When considered with past, present and reasonably foreseeable projects or activities, the Upper Beaver Creek Project's proposed treatments would have a beneficial cumulative effect on six of the eight priority species within the analysis area: olive-sided flycatcher, purple martin, pinyon jay, gray vireo, juniper titmouse, Swainson's hawk. When considered with past prescribed burning, the Upper Beaver Creek Project would contribute to the improvement of habitat conditions for these priority species. The Proposed Action could have adverse cumulative effects on the cordilleran flycatcher and black-throated gray warbler since they prefer habitats with a dense canopy or heavy conifer cover, respectively. Past burns created small (< one acre) openings within dense conifer stands while wildfires created larger openings and/or reduced the amount of canopy cover through tree mortality. The Proposed Action's thinning and prescribed burns will contribute to these effects by maintaining these openings, creating new openings and to some degree reducing canopy cover in the project area.

Comparison of Alternatives for Wildlife

Table 58. Comparison of Alternatives for Wildlife

Habitat Component and/or Species	No Action Alternative	Proposed Action Alternative
Snags	No Direct or Indirect effects. No cumulative effects.	Short-term losses of snags would occur through the prescribed burning treatments, resulting in a reduction of habitat for wildlife species that utilize snags. Over the long-term, the proposed action (both burning and thinning) is predicted to contribute to more snags across the landscape and also larger snags, therefore increasing the overall forest wide trend. Additionally, by following mitigations and project design features, potential snag loss can be drastically decreased.
Logs/Downed Woody Debris	No Direct or Indirect effects. No cumulative effects.	Loss of logs and woody debris would occur through the prescribed burning treatments, an adverse effect. This would result in a reduction of hiding and nesting cover for small mammals, as well as other organisms that contribute to ecosystem. By following mitigations and project design features, potential log and woody debris loss can be drastically decreased.

Habitat Component and/or Species	No Action Alternative	Proposed Action Alternative
Cover	No Direct or Indirect effects. No cumulative effects.	There would be a minor adverse effect on cover within the ponderosa forest type at individual sites, but overall, there will not be a loss below Forest Plan guidance. Cover would be maintained within the analysis area as a whole. Additionally, by following mitigations and project design features cover along identified key areas will be avoided.
Old Growth	Slight adverse indirect effects from limiting large diameter tree growth due to current dense trees stocking.	Treatments would contribute to Old Growth development in the previously-treated dense stands, and start the process towards old-growth conditions in the remaining dense stands within the analysis area. The treatments would prove more beneficial within the pinyon-juniper, since the amount of existing Old Growth within this forest type is very low. Old Growth would be increased across the entire analysis area over time.
Bald Eagle (Threatened and Sensitive)	No direct, indirect or cumulative effects.	There would be a minor adverse effect on large trees within the ponderosa forest type (due to the loss of snags and logs), but a minor beneficial cumulative effect in the pinyon-juniper type. Snag and log retention and recruitment project design features are proposed for the project to reduce impacts from prescribed burning. Foraging areas along ridgelines, tanks and other migration areas will be emphasized to maintain wildlife objectives. By following project design features, adverse effects have been minimized. See also old growth, snags and logs section above
Chiricahua leopard frog (Threatened)	No quantifiable Direct and Indirect effects and no cumulative effects.	By following project design features, forest plan standards and guidelines, recovery plans and/or peer reviewed papers, adverse effects have been minimized. Individual frogs may be temporarily displaced but overall, the proposed action is not likely to affect this species since any effects to them will not be measurable.
Mexican Spotted Owl (Threatened and MIS)	No quantifiable Direct and Indirect effects and no cumulative effects.	Indirect adverse effects would be evident from spring (breeding season) burning throughout the project area. It would be more evident the closer to a PAC. Additionally, short term adverse effects to MSO habitat and prey would be evident. Over the long-term, MSO habitat would be less susceptible to catastrophic wildfire and the prey base would recover. Additionally, by following project design features, forest plan standards and guidelines, recovery plans and/or peer reviewed papers, adverse effects have been minimized.
Mexican Spotted Owl Critical Habitat	No quantifiable Direct and Indirect effects and no cumulative effects.	There would be minor reductions in shade canopy from thinning, but this would be a short term adverse effect. Though snags and down woody debris would be reduced initially by prescribed burning, the Forest Plan standard for snags is likely to be maintained over the long term producing a short term adverse and a long term neutral effect. Down wood is anticipated to be reduced over the short and long term an adverse effect; implementation of Project Design features to maintain an adequate log component would keep effects to a low level. Effects to prey species would have a short term adverse effect but over the longer term components important for prey species such as logs, down wood, hardwoods and plant cover would be maintained or increased resulting in a neutral or beneficial effect for prey species. Canyon habitat would not be effected therefore there should be no effect.
Northern Goshawk (Sensitive and MIS)	Slight adverse indirect effect by maintaining the current VSS distribution.	Short term indirect adverse effects to goshawk habitat and the prey base by temporary displacement and smoke disturbance during the breeding season. Long-term indirect effects are expected to be beneficial by opening the habitat for prey and by obtaining varying age classes and diameter classes for goshawk.
Peregrine Falcon (Sensitive)	No quantifiable Direct and Indirect effects and no cumulative effects.	Short term indirect adverse effects to peregrine by smoke disturbance and loss of snags for perching. However, proximity of known eyries well outside of project implementation area and/or will not incur treatment, therefore, overall, the proposed action is not likely to affect this species since any effects to them will not be measurable.
Common Black Hawk (Sensitive)	No quantifiable Direct and Indirect effects and no cumulative effects.	Short term indirect adverse effects to this hawk species by short term loss of prey and loss of snags for perching. Long term beneficial effects are expected by increasing habitat for prey species. By following project design features, adverse effects have been minimized. Overall, the effects to the species will not be measurable.
Ferruginous Hawk (Sensitive)	No quantifiable Direct and Indirect effects and	

Habitat Component and/or Species	No Action Alternative	Proposed Action Alternative
	no cumulative effects.	
Western Burrowing Owl (Sensitive)	Indirect adverse impact by allowing encroaching trees to encroach into owl habitat and by maintaining or increasing the number of trees used by predators.	Indirect adverse effect by temporary displacement in the short term. Long-term, the amount of available suitable habitat for this species will increase by treating encroaching trees that are reducing suitable habitat and which favors predators. Overall, beneficial effects.
Mammals –voles, shrews and mice (Sensitives)	Indirect adverse impact by allowing encroaching trees to encroach into small mammal habitat and by maintaining or increasing the number of trees used by predators.	
Bats (Sensitives)	No quantifiable Direct and Indirect effects and no cumulative effects.	See snags above. Indirect adverse effects by smoke disturbance. By following project design features adverse effects have been minimized.
Northern Leopard Frog (Sensitive)	No quantifiable Direct and Indirect effects and no cumulative effects.	Individual frogs may be temporarily displaced but overall, the proposed action is not likely to affect this species since any effects to them will not be measurable. By following project design features (see those for Chiricahua leopard frog), forest plan standards and guidelines, recovery plans and/or peer reviewed papers, adverse effects have been minimized.
Invertebrates (Sensitive)	Indirect adverse impact by allowing trees to encroach into invertebrate habitat	Indirect adverse effect by temporary displacement in the short term. Long-term would increase the amount of available suitable habitat for this species by treating encroaching trees that are reducing suitable habitat; overall, a beneficial effect.
Abert's squirrel (MIS)	No direct, indirect or cumulative effects.	Short term adverse effects by temporary displacement of individuals. Thinning dense stands of mid-seral ponderosa pine would reduce unsuitable habitat, and promote an increased growth rate of the remaining trees within the analysis area, a long term beneficial effect. The increased growth rate would provide larger trees and create areas with interlocking crowns faster.
American Pronghorn (MIS)	Indirect adverse impact by allowing trees to encroach continuation into pronghorn habitat and by maintaining or increasing numbers of trees current level or used by predators.	Indirect adverse effect by temporary displacement in the short term. Long-term, the amount of available suitable habitat would increase by removing trees that have encroached into suitable habitat for this species, and which favors predators. Overall, a beneficial effect.
Cinnamon Teal (MIS)	No direct, indirect or cumulative effects.	No direct, indirect or cumulative effects.
Elk, Mule Deer and Turkey (MIS)	No quantifiable Direct and Indirect effects and no cumulative effects.	Improved development and health of the project area's oak/mast, shrub, and ground vegetation (e.g. grasses and forbs) habitat components thereby improving habitat for the species, a long term beneficial effect. On the other hand, prescribed burning, both spring and fall, would contribute to and/or maintain a lower concentration of snags, logs and woody material and cover in the treated areas than existing. Existing dense stands would be opened up, therefore increasing hunter induced mortality (increasing hunting success) to wildlife in localized areas, an overall adverse effect.
Hairy Woodpecker and Pygmy Nuthatch (MIS)	No quantifiable Direct and Indirect effects and no cumulative effects.	Short-term losses of snags would occur through the prescribed burning treatments. Over the long-term, treatments area predicted to contribute to more snags in all size classes across the landscape therefore increasing the overall forest wide trend. Following mitigations and project design features will decrease potential snag loss.
Juniper Plain Titmouse (MIS)	Slight adverse indirect impact by a continuation of encroaching trees into titmouse habitat.	Indirect adverse effect by temporary displacement in the short term. Long-term would increase the amount of available suitable habitat for this species by treating encroaching trees that are reducing suitable habitat.
Black Bear (SOC)	No quantifiable Direct and Indirect effects and no cumulative effects.	Project design features for all wildlife, and the absence of treatment in canyons used as migration corridors, adverse effects have been minimized. Long term, shrubs, berries and other forage will

Habitat Component and/or Species	No Action Alternative	Proposed Action Alternative
		beneficially affect bears. Individual bears may be temporarily displaced but overall, the treatments are not likely to affect this species since any effects to them will not be measurable.
Migratory Birds	Slight adverse indirect impact by allowing trees to encroach into habitat favored by four of the six birds. Conversely, for the other two birds, there will be no quantifiable Direct and Indirect effects and no cumulative effects.	Indirect adverse effect by temporary displacement in the short term. Long-term the available suitable habitat for four of the 6 species would increase by thinning or removing trees that have encroached into habitat. Adverse effects on two of six species (Cordilleran Flycatcher and Black-throated Gray Flycatcher) from opening up some dense stands; therefore decreasing suitable habitat over the long term.

Fisheries

The following section describes the affected environment and effects of the alternatives for fisheries resources. The analysis presented is summarized from the following report which is incorporated by reference: *Fisheries Specialist Report and BAE, For the Upper Beaver Creek Watershed Fuels Reduction Project*, by D. Renner, 2008 (PR #215).

Affected Environment

As the project name implies, the watershed that is primarily affected by this project is Beaver Creek, specifically Wet Beaver Creek. A small part of the project area drains into West Clear Creek. Due to the small percentage (6%) that drains to West Clear Creek, any effect to West Clear Creek would be discountable and therefore will not be analyzed in detail. Wet Beaver Creek contains species or suitable habitat for both federally threatened and endangered species and Regional Forester's Sensitive Species. Additionally due to the distance downstream from the project area, it is unlikely that there would be any measurable effects to the Verde River or it associated biota. Therefore the Verde River will not be analyzed further.

Beaver Creek

As the project name implies the majority of the project area is within the Beaver Creek 5th code watershed. The Beaver Creek 5th code is comprised of 20 6th code watersheds, most of which do not contain perennial streams. The upper 6th code watersheds that are affected by the project are, Jacks Canyon and Brady Canyon, both of which comprise the headwaters for Wet Beaver Creek; Rarrick Canyon which through Red Tank Draw also contributes to Wet Beaver Creek; and Rattlesnake Canyon, Woods Canyon, and Bar M Canyon which all contribute to Dry Beaver Creek. The confluence of Dry Beaver and Wet Beaver is the start of Beaver Creek. The USGS gauge (#09505200) for Wet Beaver Creek near Rimrock, AZ has a median annual flow for Beaver Creek of 21.65 cfs from 1962 to 2007. There are two wildernesses in the Beaver Creek 5th code watershed, both of which are downstream of the Upper Beaver Creek project area. The first is Munds Mountain Wilderness which contains parts of Woods Canyon, Rattlesnake and Dry

Beaver Creek 6th code watersheds. The second is the Wet Beaver Wilderness which is primarily in the Wet Beaver Creek 6th code.

Fish Community

The fish community of the Wet Beaver Creek is dominated by non-natives, which include channel (*Ictalurus punctatus*) and flathead catfish, largemouth (*Micropterus salmoides*) and smallmouth bass, bluegill (*Lepomis macrochirus*), green sunfish, yellow bullhead, common carp (*Cyprinus carpio*), and red shiners (*Cyprinella lutrensis*). The fish assemblage also includes a few native species as well. The native species list includes roundtail chub, and Sonora and desert suckers, both of which are present in Wet Beaver Creek and Beaver Creek. The federally endangered Gila Chub (*Gila intermedia*) occurs in two streams (Walker Creek and Red Tank Draw) and potentially occupies Wet Beaver albeit likely in low densities. While Walker Creek is not downstream from any project areas associated with the Proposed Action Alternative, there is the potential for Red Tank Draw and Wet Beaver Creek to be affected by the proposed actions.

Summary – Beaver Creek

The Beaver Creek 5th Code watershed comprises 277,088 acres. This project will affect 16.7% of this area. Of the 46,262 affected acres, the majority (~80%) drains to Wet Beaver Creek, of which 26% drains to Gila Chub habitat in Red Tank Draw and then to Wet Beaver. The remainder or about 12% drains to Dry Beaver Creek. The fish population of concern is located in Red Tank Draw and Gila Chub occupy this intermittent stream. While the stream does not run water year round to be considered perennial, there are perennial pools that enable Gila Chub and non-natives to persist in the system. Red Tank Draw is directly downstream of the project area, any increase in sediment into the system could fill pools, decreasing important habitat for this imperiled species.

Threatened and Endangered and Regional Forester's Sensitive Species

The Threatened, Endangered and Regional Forester's Sensitive Species (TES) List for the Coconino National Forest was reviewed and a list of TES species was created for this project based on known occurrence or, in the absence of survey data, the presence of suitable habitat. There is only one federally listed species downstream from the Upper Beaver Creek Project area the Gila Chub. The remaining four species are on the Southwestern Regional Foresters sensitive species list as of October, 2007 (Table 59). Full descriptions of the species, their habitat and occurrence are found in the project record (PR #213).

Species which occupy or that have habitat in the Verde River such as: Colorado Pikeminnow (*Ptychocheilus lucius*), Razorback Sucker (*Xyrauchen texanus*), loach minnow (Rhinichthys {=*Tiaroga*} *cobitis*), and spikedace (*Meda fulgida*), will not be considered further in this document as any effects from the project are not anticipated to reach these species' habitat in the Verde River.

Table 59. Threatened, endangered, or Regional Forester's Sensitive fishes, occurrence and habitat in the project area or vicinity.

Species Name	Status[1]	Occurrence[2]	Habitat and Presence in the Project or Analysis Area
Gila chub *Gila intermedia*	Endangered	**Δ**	Not found within the project area. They are found downstream from the project area in Red Tank Draw & Wet Beaver Creek.
Roundtail chub *Gila robusta*	WC, FS-S	**Δ**	Not found in the project area. Roundtail chubs are present in Wet Beaver Creek.
Longfin dace *Agosia chrysogaster*	FS-S	**Δ**	Not found in the project area. Longfin dace are present in Wet Beaver Creek.
Desert sucker *Catostomus clarki*)	FS-S	**Δ**	Not found in the project area. Present downstream in Wet Beaver Creek.
Sonora sucker *Catostomus insignis*	FS-S	**Δ**	Not found in the project area. Sonoran Suckers are present in Wet Beaver Creek and there are incidental reports of Sonoran suckers observed to be present in Red Tank Draw.

[1]**Status:**
- **WC**=Wildlife of Special Concern in Arizona (1996 Arizona Game & Fish Department classification pending revision to Article 4 of the State Regulations)
- **FS-S**=Forest Service Sensitive Species

[2]**Occurrence:**
O=Species known to occur in the project area, or in the general vicinity of the area.
Δ= Species occurs downstream of project area

Management Indicator Species

Macroinvertebrates

As a group, aquatic macroinvertebrates (macroinvertebrates) are identified in the Coconino National Forest Land and Resource Management Plan (as amended) as a management indicator for high and low elevation late-seral riparian areas Descriptions of macroinvertebrate monitoring and bioassessment methods and findings are found in PR #215.

As of December 2006 macroinvertebrate sampling on streams either on or close to the Coconino National Forest by ADEQ spans an 11-year time from 1992 to 2003. This analysis examined 10 streams, 5 coldwater (above 5,000 ft), and five warm water (below 5,000 ft). The nearest sampling sites to the project area are on the Verde River above the confluence with West Clear Creek and on Wet Beaver above the USGS gage; both are warm water streams. Across the Forest, four of the warm water sites had an upward trend and one had a downward trend in the Index of Biological Integrity (IBI) based solely on a simple linear regression line analysis. However, since the equation explained less than 70% of the variation in data for these sites, the confidence in these trends is low. For the coldwater sites, three had downward trends with high confidence and two sites had

upward trends with low confidence. Warm water sample sites have had high amounts of variation over the sample period. This variation could have a variety of causes, from changing environmental factors such as, flooding and drought cycles, microhabitat variation between collections (Heino et al. 2004), and contributing upland condition and the associated runoff effects to water quality. Full details of the bioassessments and macroinvertebrate data are found in the project record (PR #215).

Environmental Consequences

Units of Measure

The primary environmental consequence to aquatic habitat and associated species from timber and vegetation treatments is increased ground disturbance which has the potential to increase the rate of soil erosion over natural background levels. Therefore this analysis will focus on the predicted ground disturbance and its effect in regards to the following:

- Changes in sediment and erosion
- Alterations to channel morphology - increased sediment has the potential to alter stream channel morphology.
- Changes to stream temperatures - alterations in morphology can change the width to depth ratio of channels and shallower wider channels can lead to more drastic diurnal fluctuation in stream temperature and higher and lower temperature extremes.
- Effects on riparian vegetation - loss of upland watershed vegetation can lead to flashier hydrographs which erode stream channels, lowering the water table impacting riparian vegetation.
- Changes to macroinvertebrate assemblage - alteration in channel morphology or increases in sediment can alter the macroinvertebrate assemblage.

No Action Alternative

Streams – Beaver Creek Watershed

Direct and Indirect Effects

If the No Action Alternative is selected there would be no direct effects to any streams in the project area. If the No Action Alternative is selected, the risk of a large wildfire would not be reduced. A large scale fire would have negative consequences on all associated streams and there would be increased sediment and ash reaching stream channels. Fires that have occurred in the project area all have been small and low in intensity, consuming primarily dead and downed fuels. If the No Action Alternative is selected there would be no indirect effects to stream habitat and aquatic biota.

Threatened and Endangered Species

Gila Chub -- Direct and Indirect Effects

If the No Action Alternative is selected there would be no foreseeable ground disturbing activities in the watershed. Therefore, there would be no direct or indirect effects to Gila Chub or its habitat.

Regional Forester's Sensitive Species

Roundtail Chub, Desert Sucker and Sonora Sucker – Direct and Indirect Effects

The No Action Alternative would not result in any ground disturbing activities which would alter the natural sediment balance of the watershed. Therefore, this alternative would not affect this species.

Management Indicator Species

Macroinvertebrates – Direct and Indirect Effects

If the No Action Alternative were selected, no vegetation management or fuels reduction activities would occur so there would be no direct or indirect effects to macroinvertebrates.

Beaver Creek Watershed and Aquatic Species – Cumulative Effects

The cumulative effects boundary consists of the Beaver Creek 5th code watershed. The time frame for analysis is 20 years based on vegetation and coarse woody debris recovery from disturbed sites. There would be no cumulative effects because there would be no direct or indirect effects of implementing the No Action Alternative.

Proposed Action Alternative

General Direct Effects of Vegetation Management and Prescribed Fire

Direct effects of vegetation management on stream systems would be minor because BMPs to protect soil and water quality would be implemented, along with project – specific design features such as stream buffers (Region 3 FSH 2509.22). Key BMPs include providing an adequate buffer on streams from harvest operations, designation of all channel crossing locations by mechanized equipment, and designation of skid trails, that avoid crossing stream channels (ephemeral and intermittent). Limiting vegetation management activities from impacting stream courses should lead to minor or inconsequential direct effects to stream habitat and their associated biota. While prescribed fire has the ability to have direct effects to stream channels, the proposed action and design features that would be implemented does not allow ignitions to occur within riparian areas or along stream channels. Fire would however be allowed to back downslope into these areas. If riparian areas are burned, there is the potential for some ash and localized erosion to occur, however these effects should be minor in amount and extent.

General Indirect Effects of Vegetation Management and Prescribed Fire

Most effects to aquatic habitat and biota are the result of upland terrestrial changes that result in changes to sediment and water transport in the watershed. The primary negative impacts to aquatic systems and their associated biota from vegetation treatment and prescribed fire come as indirect effects. These indirect effects include: increased sediment movement and erosion to channels, loss of riparian vegetation, altered macroinvertebrate assemblages, lowering of groundwater tables resulting in decreased perennial flows, increased stream temperature, larger peak flows, increased sedimentation to stock tank impacts, and changes in channel form (Bisson et al. 2003, Swank et al. 1989).

Sedimentation and erosion are natural processes and ecosystems have evolved to handle the natural background levels and the episodic events of fire (Bisson et al. 2003). However, when land management activities alter the natural levels in a watershed, deleterious effects to the habitat and biota can occur. These effects can be compounded when a system's natural resiliency has been degraded by past activities, such as fire suppression, drought, road building, grazing, etc. Vegetation management can contribute to the deterioration of soil stability and porosity, increasing erosion and compaction. These factors can lead to increased sedimentation into streams and changes in the hydrograph, which is the timing and volume of flow in a watershed.

Sediment adversely impacts stream fishes directly through a variety of means (Anderson 1996; Argent and Flebbe; 1999, Bisson and Bilby 1982, Rice et al. 2001, Lisle 1989, Miller and Benda 2000, Wood and Armitage 1997).

The watershed hydrograph can be altered by vegetation removal and fire (Swank et al. 1989, Ziemer et al. 1991). The erosive energy of floods can cause stream channel down cutting or incision causing water to drain from floodplains into the channel resulting in lower ground water tables (Agee and Skinner 2005, Lertzman et al. 1998, Ziemer et al. 1991). This results in a narrowing or loss of riparian vegetation since they are left in drier soils. Additionally, with less water entering upslope and riparian soils, less water is available to provide late season flows. Therefore, the higher flows during precipitation events are often followed by low or no flow during the drier weather periods (Rinne and Miller 2006).

The effects of hydrograph alterations can result in deleterious effects to aquatic biota (Gregory et al. 1991). In turn, macroinvertebrates are a primary food source for aquatic vertebrates (icthyofauna and herptefauna) and alterations to the food web at the lower levels will have repercussions to these higher-level consumers. Additionally, riparian plant communities with rooted plants retard stream bank erosion, filter sediments out of the water, build and stabilize stream banks and stream beds, and provide shade and nutrients for aquatic species. In fact, healthy riparian areas act as sponges during high water periods and raise water tables maintaining stream flow during dry seasons, resulting in more flow throughout the year (Elmore and Kauffman 1994, Kauffman et al. 1997). The loss of riparian vegetation therefore can result in a negative feedback loop where

conditions continue to break down until active management is undertaken to repair or retard degraded areas.

Streams – Beaver Creek Watershed

Direct and Indirect Effects

There will be no direct effects to any of the primary streams in the Beaver Creek 5th code watershed. All activities related to the project are in the watershed upstream of perennial streams and streams that contain perennial pools. While there may be limited affects to some of the ephemeral and intermittent stream channels within the project area any effects that concern aquatic biota will be discussed under indirect effects.

The primary detrimental indirect effect to stream courses downstream from the project area would be increases in the sediment load from ground disturbing activities. The proposed action also has the potential to have a beneficial indirect effect on affected stream courses by reducing the scale and consequence of a wildland fire occurring in the watershed. However it is inappropriate to assess the effects of the proposed action on the occurrence and effect of a hypothetical fire in contrast to the known effects of vegetation treatment. Therefore this analysis will focus on the effects from vegetation treatment and fuel reduction activities.

The streams likely to be affected include: Wet Beaver Creek, Red Tank Draw, and Dry Beaver Creek. The majority (about 60%) of the project area drains to Wet Beaver Creek. Detrimental increases in sediment to Wet Beaver Creek are unlikely as mitigations to protect Chiricahua and Northern leopard frogs provide a 200 foot buffer (100 feet on either side of the stream course) for intermittent stream channels. This buffer in combination with soil and water BMPs will limit the amount of sediment from the 2-3% of the project area that has soil disturbance (PR #147). Additionally, Wet Beaver Creek is a perennial stream that has the capacity to handle small increases in sediment without detrimental effects to channel morphology, stream temperature, riparian vegetation or its macroinvertebrate assemblage.

Red Tank Draw is downstream from about 23% of project area, and 30% of the watershed is within the project area. Red Tank Draw is a perennial pool system where during drier periods all that persists are pools, critical to the persistence of aquatic biota in the system. Any increase in sedimentation has the potential to detrimentally affect aquatic biota and the perennial pools. The hydrologic role of pools changes with stream flow; during high flow periods, pools are scoured by flows over or around instream obstructions such as boulders or logs. During low flow periods, pools collect fine sediments and can fill in. While the proposed action incorporates mitigations and BMPs that should limit any increase in sediment from reaching stream courses, some will eventually reach the system. Any increase in sedimentation in a perennial pool system has the potential to result in adverse effects. These effects could alter channel morphology by decreasing available pool habitat (fewer and shallower pools). Shallower pools could result in greater temperature extremes in remaining pools, thereby affecting the continued viability of aquatic biota in the stream. Any increase in sediment from the proposed action would be insufficient to effect riparian vegetation or the existing macroinvertebrate assemblage.

Dry Beaver Creek is downstream from about 11% of the project area. However, the area affected only comprises about 3.5% of the total watershed for Dry Beaver Creek. Therefore any increase in sediment from the project area would be immeasurable and inconsequential. The proposed action will therefore have no effect to the sediment balance of the system or to channel morphology, stream temperature, riparian vegetation, or the macroinvertebrate assemblage.

Threatened and Endangered Species

Gila Chub -- Direct and Indirect Effects

Gila chub are present in Red Tank Draw and have the potential to be present in Wet Beaver Creek due to its connectivity with Walker Creek and Red Tank Draw. However any presence in Wet Beaver Creek would be incidental and is not considered occupied habitat. Due to the small potential for sediment to affect Wet Beaver Creek any effect to the species in this system would be inconsequential. Due to Red Tank Draw's sensitive perennial pool nature where any increase in sediment over natural background levels has the possibility to incur adverse effects, the proposed action has a potential to effect the population in this stream. Approximately 30% of the Red Tank watershed is within the project area and any loss of pool habitat would be a detriment to this species. Although increases in sediment from ground disturbance in the watershed should be reduced by onsite mitigations and the use of BMPs, mitigations and BMPs are not 100% effective at eliminating sediment.

Regional Forester's Sensitive Species

Roundtail Chub – Direct and Indirect Effects

Roundtail chub are present in Beaver Creek and Wet Beaver Creek. The proposed action affects about 33% of the Wet Beaver Creek watershed. While there may be increases in sedimentation from ground disturbance in the watershed, mitigations and BMPs would limit the sedimentation and it is unlikely that any amount that ends up in the stream would be sufficient to negatively affect populations of roundtail chub.

Desert and Sonora Suckers – Direct and Indirect Effects

Both desert and Sonora suckers are present in Wet Beaver creek. While increased sediment from the project area has potential to reach areas occupied by these species the amount of sediment will not be sufficient to adversely affect these species.

Longfin Dace – Direct and Indirect Effects

Longfin Dace occupy a portion of Wet Beaver Creek. Increased sediment could adversely affect this species if it were great enough to reduce important side channels and stream margin habitat. Due to mitigations keeping activities away from ephemeral and intermittent channel in the headwaters and proper implementation of BMPs the sediment that is derived from the project area will not be great enough to negatively affect these important habitats.

Management Indicator Species

Macroinvertebrates – Direct and Indirect Effects

Aquatic macroinvertebrates are found in all aquatic habitats. The assemblage of species is a forest MIS due their utility in assessing water quality (Barbour et al. 1999). Macroinvertebrate assemblages vary by elevation, stream gradient, and channel unit type (i.e., pool or riffle). For this reason, the ADEQ has developed different IBI's for warm water and cold water streams (below and above 5000ft). The comparison of IBI's for specified sites across the Forest is how trend is tracked for macroinvertebrates. The potential increased sedimentation into streams in the Beaver Creek watershed will have minimal affects on the availability of habitats for macroinvertebrate species and it is unlikely that the Proposed Action Alternative will have any adverse affects on the macroinvertebrate composition in affected streams.

Beaver Creek Watershed and Aquatic Species – Cumulative Effects

It is unlikely that past wildfires are still contributing to increased sedimentation into the watershed, therefore the contribution of past activities on the cumulative effects are minor. Current actions that have the potential to influence the natural balance of sediment and erosion in the watershed are ongoing grazing activities, the presence and maintenance of the road network and ground disturbance from off road travel within the project area. Future activities that have the potential to affect aquatic biota includes planned grazing, and the implementation of the travel management rule. Grazing can increase watershed erosion by removing ground cover and compacting soils thereby altering the natural sedimentation rates from a watershed. Road networks alter the hydrology of a watershed by concentrating overland flow which results in concentrated flow and increased site specific erosion, often resulting in increased sediment into stream channels. While grazing is forecast to continue in the watershed, the implementation of the Travel Management Rule and what we know about the Proposed Action for the Managing Motorized Travel EIS will likely decrease the road network. This will reduce sediment derived from roads and it will eliminate unauthorized off road vehicle use resulting in less ground disturbance throughout the watershed. It is likely that the implementation of this rule will result in a cumulative decrease in the amount of anthropogenic derived sediment in the watershed. However, until the EIS is completed and the decision is made it is inappropriate to assess the level of decrease in the road network for this watershed.

Alternative 2 disturbs approximately 2-3% of the ground within the cumulative effects boundary area that may be available as sediment, depending on the method of logging and the corresponding fuel treatment. The direct and indirect effects of sedimentation from the proposed vegetative treatments and prescribed burning would result in a minor increase in cumulative effects to Beaver Creek watershed and Red Tank Draw. The cumulative effects would be greatly moderated by implementation of project design features and application of BMPs to protect soil and resources and water quality.

Comparison of Alternatives for the Fisheries Resource

Table 60. Comparison of alternatives for fisheries resource

Watercourse and Species	No Action Alternative	Proposed Action Alternative
Wet Beaver Creek	No Direct or Indirect effects would occur. No cumulative effects.	The proposed action would likely result in small increases in fine sediments to the stream. However this increase would be minimized by implementation of mitigation measures and utilization of BMPs.
Species: Roundtail chub Sonora and Desert suckers, Longfin dace, and potentially Gila chub	Species present would not be affected either positively or negatively.	Not likely to affect any of these species since any effects to the stream will not be measurable.
Red Tank Draw	There will be no quantifiable Indirect or Direct effects to Red Tank Draw. No cumulative effects.	There is potential for the proposed action to result in slight increases in sediment production in the watershed. Red Tank Draw is a perennial pool system and small decreases in pool habitat could have deleterious effects on aquatic biota dependent on those pools. While the potential exists for some pool filing to occur, the potential for the effect to occur and the magnitude of the effect can't be estimated.
Species: Gila Chub	There will be no quantifiable Direct and Indirect effects and no cumulative effects.	There is potential for negative effects to Gila chub if the proposed action results in a loss of available pool habitat. In Red Tank Draw, perennial pools are critical for species persistence and loss of pool area (depth and volume) could reduce viable habitat for this species.

Sensitive Plants

The following section describes the affected environment and effects of the alternatives for the botany resource which includes Regional Forester's sensitive species. The analysis presented is summarized from the following reports which are incorporated by reference: *Botany Specialists Report, Upper Beaver Creek Watershed Fuel Reduction Project* by C. Crisp, 2007, (PR# 189); and the *Biological Assessment and Evaluation, Upper Beaver Creek Watershed Fuel Reduction Project* by C. Crisp, 2007, (PR# 153).

Affected Environment

The Threatened, Endangered, Candidate and Sensitive Species (TECS) Lists for the Mogollon Rim and Red Rock Ranger Districts were reviewed and potential TECS plants were identified. No Threatened, Endangered or Candidate plants as protected by the Endangered Species Act or their potential habitats exist in the Project Area.

The Upper Beaver Creek Watershed Fuel Reduction Project area contains potential or occupied habitat for two Forest Service Region 3 Sensitive plant species. These include Flagstaff beardtongue (*Penstemon nudiflorus*) and Arizona sneezeweed (*Helenium arizonicum*). The remaining sensitive plant species on the two district lists were considered, but were withdrawn from further analysis because there is no suitable or potential habitat for the species within the project area. The species and reasons for no further consideration are listed and described in the *Botany Specialists Report, Upper Beaver Creek Watershed Fuel Reduction Project* by D. Crisp, 2007, (PR# 189); and the *Biological Assessment and Evaluation, Upper Beaver Creek Watershed Fuel Reduction Project* by C. Crisp, 2007, (PR# 153).

Flagstaff beardtongue grows in dry pine forests, pine/oak, pine/oak/ juniper and pinyon juniper forests. It occurs on dry slopes, in openings and along edges of openings and in forested areas. Many locations of Flagstaff beardtongue have been detected from past surveys in the project area.

Several historic locations for Arizona sneezeweed within the project area were documented from past records such as herbaria sheets, observations and limited surveys. Several populations of Arizona sneezeweed have been located from recent surveys. Most locations for this species are confined to drainages and meadow areas in the project area. Habitat conditions, surveys conducted, and locations where these two plants have been found are documented in the *Botany Specialists Report, Upper Beaver Creek Watershed Fuel Reduction Project* by D. Crisp, 2007, project record (PR# 189) and the *Biological Assessment and Evaluation, Upper Beaver Creek Watershed Fuel Reduction Project* by D. Crisp, 2007, (PR #153).

Environmental Consequences

No Action Alternative

Direct and Indirect Effects

There would be no risk from management actions to existing suitable habitat for Flagstaff beardtongue, or Arizona sneezeweed, or to populations or individuals of these species since none of the management actions in the proposed action would occur.

The absence of vegetation treatments and prescribed burning would have indirect impacts on the two species by moving the vegetation further away from desired conditions. Under the no action alternative, no tree removal will occur and tree density and canopy closure will continue to increase, reducing the availability of resources such as light and water to understory plants including Flagstaff beardtongue, resulting in the reduction or elimination of understory plants including Flagstaff beardtongue. Increases in tree density will have a lesser effect on Arizona sneezeweed since it tends to grow in drainages, around water sources and in meadows. However, the continued presence of overstocked timber stands and their continued growth may affect the moisture regime in the suitable habitat for Arizona sneezeweed.

The No Action Alternative will indirectly affect the status of Flagstaff beardtongue and Arizona sneezeweed within the project area by increasing risk of severe wildfire. This would affect Flagstaff beardtongue and Arizona sneezeweed by raising the risk of loss of individuals and increasing risk of damage to habitat within the project area. Severe wildfires often result in deaths of all plants including TES plant species, loss of seed banks (Korb et al., 2004) and volatilization or removal of nutrients (Ballard, 2000; Choromanska and DeLuca, 2002). These effects generally have long term effects on the plant community. Plants eliminated due to large, hot-burning wildfires may take years re-establish and long-term alteration of habitat will occur.

Cumulative Effects

The cumulative effects boundary is the Upper Beaver Creek project area and the timeframe for analysis is twenty years. With no management activities taking place, there would be no direct effects to plant populations and thus there would be no cumulative effect of the project on top of past and ongoing activities in the project area. However, increased stand density, canopy closure and increased fire risk could detrimentally affect existing plant populations.

Proposed Action Alternative

Direct and Indirect Effects

Direct effects to individuals and groups of Flagstaff beardtongue and Arizona sneezeweed could occur through damage or destruction of individuals or groups. However, these effects can be mitigated to non-significant levels using Best Management Practices and mitigation measures as detailed in Chapter 2, Proposed Action Alternative Design Features, Sensitive Plants. Mitigation measures such as avoiding existing populations and minimizing the disturbance to potential habitats will reduce the effects of management actions to non-significant levels. Known locations of sensitive plants have been fully documented and mapped in *Botany Specialists Report, Upper Beaver Creek Watershed Fuel Reduction Project* by C. Crisp, 2007, (PR# 189) and the *Biological Assessment and Evaluation, Upper Beaver Creek Watershed Fuel Reduction Project* by D. Crisp, 2007, (PR #153). Plant populations will need to be relocated and marked by Botanists or field crews prior to implementation to mitigate the effects of management actions to these Region 3 Sensitive Species. A few individuals of each species may be lost where they occur in presently unknown, unsurveyed locations, but these losses will not negatively affect the range-wide population trends for each species.

Indirect effects of the proposed action on Flagstaff beardtongue include possible alteration of habitat. Alteration of habitat may be mitigated though careful planning and implementation of management activities. Prescribed fire may be beneficial to Flagstaff beardtongue. Burning is a disturbance that can release nutrients, reduce plant competition, and increase the amount of available sunlight light. Observations by me and various botanists (B. Phillips, personal communication; Greg Goodwin, 1979) suggest that members of the genus *Penstemon* respond positively to burning. Fire areas where this has been observed include the Stage Prescribed Fire on the Kaibab National Forest and the Burnt Fire which occurred in 1973 in the Cinder Hills area of the Coconino National

Forest. However, additional studies by Fulé et al. (2000) suggested that the population of *P. clutei* was lower in the first three years after a burning experiment. Therefore, the effects of burning may initially be negative by reducing the numbers of individuals but will beneficial in the long term by releasing nutrients, reducing competition and by increasing available nutrients.

Slash piles may have negative direct and indirect effects on all understory vegetation including Flagstaff beardtongue and Arizona sneezeweed. Slash pile construction could be a possible negative direct effect if the pile is placed in or near existing populations of Flagstaff beardtongue or Arizona sneezeweed. These effects can be mitigated by avoiding placing slash piles directly on existing plants and by constructing piles at least 10 to 20 feet away from existing populations. Pile burning will create locally severely burned areas at pile sites, which is a negative indirect effect. Consequences include but are not limited to the reduction or loss of the seed bank on these sites (Korb, 2001; Crisp, 2004); death or reduction of soil organisms on the pile sites (Raison, 1979; Ballard, 2000; Korb et al., 2004) and development of hydrophobic soil (Ballard, 2000). Slash pile sites are more prone to invasion from noxious or invasive weeds than surrounding areas and may contribute to the persistence and spread of noxious or invasive weeds in treated areas. Noxious or invasive weeds may have adverse effects on all native plants including Flagstaff beardtongue and Arizona sneezeweed by competing with native species for resources and altering habitat. A mitigation for these effects is to use previously disturbed areas including old pile sites or previously used decking areas where available instead of creating new sites within the forest. Additionally, pile sites should be monitored after burning occurs to identify and treat infestations. The Proposed Action Alternative includes design features to reduce impacts to sensitive plant populations from slash pile construction and burning (Chapter 2, Proposed Action Alternative Design Features, Sensitive Plants).

Prescribed burning may have direct and indirect effects to on all understory vegetation including Flagstaff beardtongue and Arizona sneezeweed depending on fire severity. It is expected that most broadcast and prescribed burning will be of low severity with low soil heating, retention of most ground litter and little or no change in mineral soil. Additionally, at least 50% of trees would exhibit no visible damage with remainder of fire-damage limited to scorched trees, shoot-kill or root-kill. Over 80% of the fire damaged trees would be expected to survive. Prescribed burning can release nutrients, reduce plant competition, and increase the amount of available sunlight light available to all understory plants including Flagstaff beardtongue and Arizona sneezeweed. In some cases, fire severity may be higher in limited areas depending on variables such as management goals, weather, fuel conditions and topography. In these cases moderate to high fire severity may occur. In these areas, there could be limited negative direct effects through deaths scattered individuals or groups of Flagstaff beardtongue or Arizona sneezeweed if they occur at that particular location. Limited deaths of small groups of plants in these cases would not significantly contribute to the overall populations of these species within the project area or over the ranges of each species. The indirect effects of higher fire severity in these areas would be similar to those for slash pile burning. Known

locations of Flagstaff beardtongue and Arizona sneezeweed would be protected from disturbance from project activities.

Beneficial indirect effects to both Flagstaff beardtongue and Arizona sneezeweed include reduction of tree canopy and stand density. Treatments that reduce the tree canopy and lower the stand density will benefit all understory plants including Flagstaff beardtongue and Arizona sneezeweed by allowing more sunlight, increasing available nutrients and temporarily decreasing interspecies competition as well as intra species (between tree) competition.

Cumulative Effects

Cumulative effects to Flagstaff beardtongue and Arizona sneezeweed may include past and ongoing management actions by the U.S. Forest Service such as grazing, timber sales, watershed research, and prescribed burning within the project area as described above in the discussion for the No Action Alternative. Also considered are effects of past wildfires in the project area. The effects of these actions are unknown because many were initiated before the species were added to the Sensitive Species list.

Past potential cumulative effects include fire suppression and alteration of the historic fire regime through the elimination of fire. These actions have resulted in increased forest densities and have reduced or eliminated understory vegetation including rare species such as Flagstaff beardtongue and Arizona sneezeweed.

The management actions proposed for this project will have no significant negative cumulative effects on the overall distribution and abundance within the project area or within the total range of Flagstaff beardtongue and Arizona sneezeweed, provided the design features for Sensitive Plants described in Chapter 2 of the EA are incorporated into the project design and implementation. The management actions will not significantly contribute to the cumulative effects discussed above, provided they are mitigated as recommended. The project will have beneficial direct and indirect effects on Flagstaff beardtongue and Arizona sneezeweed by reducing fire risk and therefore the threat of severe wildfire within the potential habitat of Flagstaff beardtongue and Arizona sneezeweed within the project area. Additionally, all understory plants including Flagstaff beardtongue and Arizona sneezeweed will benefit from the reduction of tree density and canopy in certain areas of the project by reducing competition for nutrients, light and growing space.

Comparison of Alternatives for Sensitive Plants

Table 61. Comparison of Alternatives for Sensitive Plants

Environmental Indicator or Unit of Measure	No Action Alternative	Proposed Action Alternative
Damage and destruction to known and unknown individuals, groups and habitat for Flagstaff beardtongue and Arizona sneezeweed	No effects. However, increasing risk of wildfire could in turn increase the risk of loss or damage to populations and habitat for the two species.	Known populations would be protected during project implementation. Some loss of unknown populations would occur through project activities, mainly from prescribed burning. However, restoring a fire-adapted ecosystem may increase habitat for Flagstaff beardtongue. Stream course protection measures and BMPs would protect Arizona sneezeweed found in drainages.

Noxious or Invasive Weeds

The following section describes the affected environment and effects of the alternatives for the noxious or invasive weeds which either exist or could be introduced by the project. The analysis presented is summarized from the following report which is incorporated by reference: *Botany Specialist's Report, Upper Beaver Creek Watershed Fuel Reduction Project* by C. Crisp, 2007, (PR# 189).

Affected Environment

Surveys have detected several of noxious or invasive weed species in the Upper Beaver Creek Watershed Fuel Reduction Project area. Weed infestations range from a few scattered plants to localized but severe infestations. Weed species that have been identified in the project area include the following:

- Leafy Spurge (*Euphorbia esula*)
- Russian knapweed (Acroptilon repens)
- Spotted knapweed (Centaurea maculosa)
- Scotch thistle (Onopordum acanthium)
- Dalmatian toadflax (Linaria dalmatica)
- Bull thistle (Cirsium vulgare)
- Cheatgrass (Bromus tectorum)

Further details on the noxious or invasive weed species known within the project area, along with locations and proposed treatments are documented in the *Botany Specialist's Report, Upper Beaver Creek Watershed Fuel Reduction Project* by C. Crisp, 2007, (PR #189). Noxious weed infestations have been treated both manually and by herbicides over the past several years. These treatments are part of the control program for noxious or invasive weeds authorized by the *Final Environmental Impact Statement for Integrated Treatment of Noxious or Invasive Weeds, Coconino, Kaibab and Prescott National Forests* (USDA Forest Service, 2005).

Environmental Consequences

No Action Alternative

Direct and Indirect Effects

Under the no action alternative, no noxious or invasive weed treatments would occur in the project area except those accomplished by other projects such as limited manual control by Forest Service Crews or control efforts by other entities such as treatment of right-of-ways by Arizona Department of Transportation, and release of biological control agents provided by APHIS.

With no treatment, the risk of severe wildfire will continue to increase in many areas of the project area. Those factors that contribute to fire hazard ratings that would be reduced through management actions such as high canopy cover, high numbers of trees per acre and dead and down fuel loading will not be reduced. The risk of wildfire transitioning to crown fires will continue to increase in many areas of the project area. Severe wildfires often result in complete removal of tree canopy, complete loss of ground cover and understory plant community and alteration of soil structure and nutrients. These conditions provide potential sites for noxious or invasive weed invasion through creation of bare soil, increased light and absence of competition from desirable plant species. Therefore, increases in fire hazard and severity that will occur with no action will also increase the risk of or invasive weed invasions in the project area.

Under the no action alternative, noxious or invasive weed treatments or mitigations that would help prevent the spread of noxious or invasive weeds would not occur as part of the management actions currently under consideration. Noxious or invasive weed populations would remain untreated and continue to expand. Control and monitoring of about 72 acres of known locations of noxious or invasive weeds would not occur. Project design features and Best Management Practices that would help control the spread of noxious or invasive weeds would not be implemented.

Cumulative Effects

The cumulative effects boundary is the Upper Beaver Creek project area and the timeframe for analysis is twenty years. Implementation of the No Action Alternative would have adverse cumulative effects because noxious or invasive weed populations would remain untreated and continue to expand. Control and monitoring of about 72 acres of known locations of noxious or invasive weeds would likely not occur, as that would be dependent of forest priorities and funding allocations. Project design features and Best Management Practices that would help control the spread of noxious or invasive weeds would not be implemented.

Proposed Action Alternative

Direct and Indirect Effects

Direct effects include disturbance from various activities such as tree removal and burning that may increase acreage or density of existing noxious or invasive weed populations in

the project area. Slash pile burning can result in localized severe disturbances that could result in increases in noxious or invasive weeds. Indirect effects of tree removal and burning include increased nutrients and sunlight which may result in increased density and acreage of weeds. Negative effects can be mitigated by incorporating Best Management Practices (Appendix B of the EA) and mitigation measures into the project design and implementation (Chapter 2, Proposed Action Alternative Project Design Features, Noxious or Invasive Weeds).

Beneficial direct effects are the treatment of noxious or invasive weed populations within the project area and implementation of the Best Management Practices. Additionally, incorporation of treatments to control noxious or invasive weeds as part of the Proposed Action will help control weed infestations within the project area. About 72 acres of existing noxious or invasive weeds would be controlled and monitored in the project area. Amendment 20 of the Coconino National Forest Plan requires treatment of noxious or invasive weeds within all scheduled projects as part of the implementation of the project. The FEIS provides a variety of treatments including manual control by such techniques as hand-pulling and chopping weeds with hand tools, mechanical including mowing with mechanized equipment, biological control including the introduction of insects on some species, cultural including grazing and competitive seeding and herbicide treatments. Control methods to be used include manual removal, use of biological control agents and herbicide treatments. Details on control methods and prioritization of treatments and sites are found in the *Botany Specialist's Report, Upper Beaver Creek Watershed Fuel Reduction Project* by C. Crisp, 2007, (PR #189).

Cumulative Effects

The cumulative effects boundary and time of analysis are the same as the no action alternative. Control and treatment of 72 acres of existing noxious or invasive weeds in the project area would be a beneficial effect. The reduction of threats of severe landscape-scale wildfire within the project area and area-wide is also a beneficial cumulative effect. This would reduce the risk of severe disturbances which tend to increase noxious or invasive weed infestations. Reintroduction of fire in the project area is a beneficial cumulative effect for noxious or invasive weed control by reducing fire risk and eventually leading to a healthier, resilient native plant community.

Comparison of Alternatives for Noxious and Invasive Weeds

Table 62. Comparison of Alternatives for Noxious and Invasive Weeds

Environmental Indicator or Unit of Measure	No Action Alternative	Proposed Action Alternative
Disturbance, introduction and spread of seven species of noxious and invasive weeds.	No effects. However, increasing risk of wildfire could in turn increase the risk of introduction or spread of noxious or invasive weeds.	Negative effects can be mitigated. Known populations would be treated, controlled and protected from disturbance prior to and during project implementation, minimizing the spread of these populations. Measures would be

Environmental Indicator or Unit of Measure	No Action Alternative	Proposed Action Alternative
		implemented to reduce the introduction of noxious and invasive weeds during project implementation.
Control, treatment and monitoring of existing populations of noxious and invasive weeds.	Control, treatment and monitoring would probably not occur in the project area if the project was not implemented. Survey of project area for weeds probably also would not occur.	Ongoing treatments would continue. Control, treatment and monitoring would occur in the project area as part of project implementation.

Recreation, Lands and Special Uses, Recreation Visual Quality, Opportunity Spectrum, and Wilderness

The following section describes the affected environment and effects of the alternatives for the recreation resource which includes recreation sites and uses, lands and special uses, wilderness, and recreation opportunity spectrum for the area. The analysis presented is summarized from the following report which is incorporated by reference: *Recreation Specialist's Report, Upper Beaver Creek Watershed Fuel Reduction Project,* by J. Gonzales, 2007 (PR #178).

Affected Environment

Recreation Sites and Uses

Developed Sites

Two developed recreation sites occur within the project area:

- Stoneman Lake Day Use Area – vault toilet , parking lot, picnic tables, and boat ramp
- Stoneman Lake Road/FH3 Toilet and Interpretive Site

Trail Systems

The Arizona Trail runs through the northeast corner of the project area, by Allen Lake. The Arizona Trail is suitable for horse, hiker and mountain bike use, where motorized use is excluded. There are no other formally designated Trails that run through the project area, but there are a variety of livestock trails in the project area.

Dispersed Recreation

Dispersed recreation is characterized by the common themes of summer activities, winter activities, consumptive use of forest resources, and educational/personal development type activities. The area provides a moderate degree of solitude and many opportunities for

picnicking and camping at user-created sites throughout the area. None of the sites have developments other than those put there by visitors, and occupancy takes place largely on weekends during the summer and fall.

An estimated 70% of the visits to the area occur during the summer season (Memorial Day to Labor Day). It is estimated that a full 90% of the users are Arizona residents, with many users returning to their favorite sites or settings on an annual basis. Recreational activities include: hiking; viewing wildlife; hunting; dispersed car-camping; backpack camping; orienteering; horseback riding, caving, rock climbing, photography, picnicking; taking scenic drives; bicycling; shooting; and gathering in family or social groups. Off Highway Vehicle (OHV) use has increased dramatically in the last several years as neighboring Forests implement tighter restrictions on the use of jeeps, 4x4's and "quads". Family-oriented groups tend to gather at dispersed campsites, and explore from their campsite along old roads or off through the woods, making their own trails.

The local hunting seasons last from about mid-August through December and account for much of the fall use in the area. The area is part of the Arizona Game and Fish hunt "Unit 6A", and is popular for turkey, elk and deer hunting during various seasons. Tags are limited and the hunting unit is larger than the analysis area, so the actual numbers of hunters who use only the analysis area for hunting during any given season is variable and unpredictable at best.

The winter snow pack generally limits access from most recreational users from mid-December to mid-March, and snowmobile and cross-country skiing are increasing as popular uses in the area. During normal winters, snowmobiles are the only vehicles that access the area.

Gathering forest resources often combines subsistence needs with the pursuit of recreational experiences. Consumptive use within the watershed include: firewood cutting; post and pole cutting; Christmas tree cutting; collecting boughs and cones; collecting and transplanting wildlings; hunting; gathering antlers; collecting food and medicinal resources such as berries, nuts, mushrooms, and bracken fern; and collecting biological specimens for research.

Lands and Recreation Special Uses

Recreational guides and outfitted service providers are authorized under *temporary special use permits*, on an annual basis, and currently include guided hunting, and ATV services in portions of the analysis area. In addition, a Western Power Administration 345 KV powerline is located on the southeastern boundary of the analysis area, and the Flagstaff to Happy Jack powerline occurs on the eastern edge of the analysis area. The Discovery Channel Telescope/Lowell Observatory is another special use authorized within the project area. The telescope is under construction.

Wilderness

The Wet Beaver Wilderness is located to the south and southwest of the analysis area, but is outside of the project area.

Wild and Scenic Rivers

There are no potential or eligible wild and scenic rivers in or adjacent to the analysis area. Environmental effects to Wild and Scenic Rivers were therefore not analyzed.

Inventoried Roadless Areas

There are no Inventoried Roadless Areas (IRAs) in or adjacent to the analysis area. Environment Environmental effects to IRAs were therefore not analyzed.

Recreation Opportunity Spectrum

The Coconino Forest Plan lists the Recreation Opportunity Spectrum (ROS) classes as Roaded Natural (RN) and Semi-Primitive Motorized (SPM) throughout the project area.

Roaded Natural represents a moderate level of development and moderate to high social interaction within a modified physical setting that is not dominated by evidence of humans. New facilities are minimal, subtle and in harmony with the natural environment. The environment may be modified but would appear natural. Automobile and road access would be acceptable in these areas. The visitor would likely experience a moderate to high feeling of safety with relatively low opportunities for challenge. An example of an area that would fall within this ROS class might be a bicycle or equestrian trail system.

Semi-Primitive Motorized represents an area with the lowest level of development, highest opportunity for solitude, and the greatest opportunity to escape from the sights and sounds of humans. The environment would appear natural. New facility development would be minimal and rarely noticeable. Only foot traffic would be permitted in these areas. The visitor would likely experience a moderate-high feeling of self-reliance with moderate opportunities for challenge. An example of an area that might fall within this ROS class might be a hiking trail or natural area with no trails. RN and SPM areas within the project area are identified on maps in the *Recreation Specialist's Report for the Upper Beaver Creek Watershed Fuel Reduction Project* by J. Gonzales, 2007 (PR #178).

Visual Quality Objectives

Visual Quality Objective (VQO) designations in the analysis area include Retention and Partial Retention along the Stoneman Lake Road (FR213) and its viewshed. A Partial Retention VQO requires that management activities remain visually subordinate to the characteristic landscape. A Retention VOQ provides for management activities which are not visually evident.

A designation of Modification covers most of the remainder of the project area. A Modification VQO specifies that management activities may visually dominate the original characteristic landscape. However, activities of vegetative and landform alteration must borrow from naturally established form, line, color, or texture so completely and at such a scale that its visual characteristics are those of natural occurrences within the surrounding area of character type.

However, SPM (ROS) areas are required to have at least a Partial Retention VQO, therefore the northern and southwest portions of the planning area are in fact Partial Retention. Mountain grasslands (MA4) are designated in the LMP to be managed for VQO's of Partial Retention and Modification, with portions adjacent to major travel routes managed as Foreground Retention. The VQOS for the project area are identified on maps in the *Recreation Specialist's Report for the Upper Beaver Creek Watershed Fuel Reduction Project* by J. Gonzales, 2007 (PR #178).

Environmental Consequences

No Action Alternative

Direct and Indirect Effects

Use of developed sites is expected to remain at current low use levels. Trail use is expected to remain at the low use level. Conflicts between motorized and non-motorized uses are expected to continue or accelerate. Dispersed activities will continue as before, the increased pressure and degradation of riparian areas near popular dispersed camp sites may make them less desirable over time as use continues to increase. Conflicts between recreationists will continue, as off road vehicle use and extended occupancy of popular sites increases. There would be no changes to or any direct or indirect effects to developed sites, trails, dispersed recreation, lands and recreation special uses under the No Action Alternative.

Implementation of the No Action Alternative is not expected to have any direct or indirect effects on Wilderness. ROS and VQO will remain within Land Management Plan guidelines unless stand replacement wildfire affects a large proportion of the analysis area. Locations and results of unplanned fire ignitions are impossible to predict however so, for the purpose of this analysis, the No Action Alternative is not expected to have any direct or indirect effects on ROS or VQO in the analysis area.

Cumulative Effects

The boundary for cumulative effects analysis is the project area. The timeframe for past and ongoing projects is 20 years. The past, present and recently foreseeable projects that affect recreation are the thinning and burning projects, as well as the Travel Management rule and Managing Motorize Travel EIS. Since there are no direct or indirect effects, there will be no cumulative effects with implementation of the No Action Alternative on recreation sites, wilderness, lands and special uses, VQO's and ROS.

Proposed Action Alternative

Direct and Indirect Effects

Facilities at developed sites would be protected from adverse effects from management activities of thinning and prescribed burning. Trail use is expected to remain at the low use level. Conflicts between motorized and non-motorized uses are expected to continue or accelerate. The proposed action includes activities adjacent to the Arizona Trail within the analysis area. Implementation of Proposed Action Alternative Design features for

Recreation and Special Uses and Public Safety listed in Chapter 2 of the EA would protect developed sites and the trail.

Dispersed recreation activities will continue as before; the increased pressure and degradation of riparian areas near popular dispersed camp sites may make them less desirable over time as use continues to increase. Conflicts between recreationists will continue, as off road vehicle use and extended occupancy of popular sites increases. Vegetation treatments and prescribed burning/fuel treatments, occurring over time and space, will mostly go unnoticed by the recreating public. The only anticipated negative effect that the Proposed Action Alternative will have on dispersed recreation is when prescribed burning coincides with hunting seasons. This impact would be a temporary and short term impact to hunters. This alternative is not expected to be significant negative impact dispersed recreation within the analysis area.

Coordination with Lowell Observatory and other special uses and lands permitees will occur prior to implementation of project activities as set forth in project design features in Chapter 2 for Recreation and special Uses. The Proposed Action Alternative will not impact existing land and recreation special uses in the analysis area, as long as the mitigation measures are followed.

Prior to project implementation of thinning or prescribed burning in areas adjacent to the Wet Beaver Wilderness, the wilderness boundary would be identified and delineated on the ground (Chapter 2, Proposed Action Alternative Design Features, Wilderness). Project activities would therefore not impact the wilderness.

The prescribed burning and vegetation treatments would eliminate many thickets of small suppressed trees and provide a more park-like appearance to the forest and increase grass and forb richness and diversity after completion of proposed treatment activities. Most forest visitors prefer the park-like appearance. Over the longer term the indirect effects would be an improvement in the forest's visual quality and aesthetics. Vegetation treatments will generate accumulations of slash and prescribed burning will cause some crown scorch, temporarily reducing forest aesthetic values. This will be a short term negative direct and indirect impact. The Proposed Action Alternative will not directly or indirectly result in a change to ROS or VQO class designations.

Cumulative Effects

The boundary for cumulative effects analysis is the project area. The timeframe for past and ongoing projects is 20 years. The past, present and recently foreseeable projects that affect recreation are the thinning and burning projects, as well as the Travel Management rule and Managing Motorize Travel EIS.

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The proposed action would have minor, short term and temporary negative direct and indirect effects to dispersed recreation activities, hunting, and visual quality. These impacts are only a small increase in cumulative effect from the project with respect to past and current similar activities. Over time, effects would be reversed. There would be an overall improvement in the forest visual quality and scenery. Increases in dispersed

recreation, hunting, and OHV use will eventually be more tightly managed by prohibition of off-road motorized vehicle use, closure of some roads in the project area and designated of dispersed camping areas with implementation of the Motorized Travel Management EIS that is currently in the planning process. Since direct or indirect effects resulting from project activities will be mitigated by project design features, there will be no cumulative effects on wilderness, recreation sites, trails, lands and special uses.

Comparison of Alternatives for Recreation Resources

Table 63. Comparison of Alternatives for Recreation Resources

Environmental Indicator or Unit of Measure	No Action Alternative	Proposed Action Alternative
Recreation Opportunity Spectrum, Visual Quality and Wilderness		
Changes to Visual Quality Objectives (VQO's) or Recreation Opportunity Spectrum (ROS)	VQO or ROS designations will remain the same. Visual quality may change if a significant large wildfire occurs in the area.	Temporary and short term reductions in visual and aesthetic quality from the presence of slash piles and evidence of crown scorch from prescribed burning. No permanent or temporary changes in VQO's and ROS designations. Improvement in ROS and visual quality from thinning and prescribed burning, giving the forest a more open and park-like appearance and increasing grass and grass and forb richness.
Changes to Wilderness values or designations	No impacts or changes to Wilderness designations or values.	No impacts to Wilderness with implementation of project design feature.
Recreation, Lands and Special Uses		
Impacts on dispersed recreation activities, trails, lands and other special uses.	No change in the current situation for dispersed recreation and activities. Trails, lands and other special uses would not be impacted.	Minor impacts to dispersed recreation and activities during project implementation, but no significant deviations from the current situation. Impacts to lands and special uses minimized with implementation of project design features.

Rangeland Resources

The following section describes the affected environment and effects of the alternatives relating to grazing areas and grazing management. The analysis presented is summarized from the following report which is incorporated by reference: *Range Specialists Report for the Upper Beaver Creek Watershed Fuel Reduction Project*, by G. Hase, 2007, (PR #163).

Affected Environment

The Upper Beaver Creek Watershed Fuel Reduction Project area includes portions of the following grazing allotments:

- Apache Maid allotment: approximately 24,482 acres.
- Beaver Creek allotment: approximately 21,353 acres.
- Walker Basin allotment: approximately 2,644 acres.

- Windmill allotment: approximately 29 acres.

Within the project area there is approximately 17 miles of grazing allotment boundary fence (barbwire fence), approximately 70 miles of pasture and waterlot fencing (barbwire and electric fence), and approximately 10 miles of Highway Right of Way fence (FH-3; barbwire fence).

Environmental Consequences

No Action Alternative

Direct and Indirect Effects

There will be no direct effects to the existing condition of the herbaceous understory if the No Action Alternative is selected. However, the future condition of the herbaceous understory within the project area will be indirectly affected if the No Action Alternative is selected. Under the No Action Alternative, the site occupancy of conifer species will continue to increase. This anticipated increase is due to many factors; primarily, a combination of domestic/wild ungulate grazing and fire suppression. These activities will maintain low levels of mortality to conifer species seedlings due to moderated competition with browsed herbaceous plants and lack of lethal surface fires. Conifer species seedling establishment and subsequent growth within existing forb and grass dominated openings will result in a decrease in the size of openings and decrease production of the herbaceous understory because of shading. Additionally, increasing canopy cover within existing forested areas will limit the presence and growth of understory plants within the project area as a whole. All of these factors combined will ultimately lead to a general decline in herbaceous understory production and a coinciding decline in grazing capacity. Under this alternative, there will be no direct or indirect effects to range fences.

Cumulative Effects

The boundary for cumulative effects analysis is the project area. The timeframe for past and ongoing projects is 20 years. The past, present and recently foreseeable projects that affect rangeland projects are the thinning and burning projects, as well as the Travel Management rule and the Managing Motorize Travel EIS.

No vegetation management, fuel reduction or prescribed burning activities are anticipated to occur within the project area as a result of separate project activities. Grazing management strategies are not anticipated to change within the project area. Additional future actions which are anticipated to occur within the project area include: restrictions on off-road travel, road closures, hunting and fishing, recreational development at Stoneman Lake, annual road maintenance, powerline maintenance, and wedge fencing of tanks that have leopard frogs. None of these future actions are anticipated to cause significant cumulative effects on the herbaceous understory production or composition within the project area. Under this alternative, there are no cumulative effects to range fences.

Proposed Action Alternative

Direct and Indirect Effects

Direct and indirect effects to the herbaceous understory are expected to result from the decrease of conifer canopy in the areas that will be thinned and burned. Thinning and burning on about 16,000 acres will result in openings that will be occupied with a diverse mix of grasses and forbs. The low intensity prescribed burning involved in these activities will maintain herbaceous under story plants where they are currently sufficient and increase herbaceous understories where they have been limited by conifer competition. Low intensity prescribed burning will improve herbaceous production, diversity, and nutrient content (palatability) by reducing thinning residues and naturally accumulated conifer litter and duff that inhibit seed germination and by cycling nutrients from litter and thinning residues back into the soils (Covington and Fox 1991, Moore and Deiter 1992).

Broadcast and burning on about 28,000 acres, and maintenance burning over about 44,000 acres will invigorate the existing herbaceous understory. Broadcast burning with low intensity fire will improve herbaceous production, diversity, and nutrient content (palatability) by reducing naturally accumulated conifer litter and duff that inhibit seed germination and by cycling nutrients from litter and duff back into the soils.

Direct effects to range improvements (fences) are not expected to occur. Fences will be protected, to the extent possible, from project activity and any damage that may occur will be repaired or reconstructed. The Proposed Action incorporates protection measures for range fences and livestock in Chapter 2, Proposed Action Alternative Design Features, Range. There are no anticipated indirect effects to range fences.

Cumulative Effects

The boundary for cumulative effects analysis is the project area. The timeframe for past and ongoing projects is 20 years. The past, present and recently foreseeable projects that affect rangeland projects are the thinning and burning projects, as well as the Travel Management rule and the Managing Motorize Travel EIS.

Beneficial cumulative effects are expected to the herbaceous understory from the Proposed Action Alternative activities of thinning and prescribed burning when considered additively to other past, ongoing and future foreseeable actions. Within the project area, there will be an increase in openings as overstory trees are removed and an associated increase in herbaceous production. Prescribed burning will also act to improve herbaceous understory production and palatability. As a result of the improved herbaceous production and palatability, wild ungulates (primarily elk) will be attracted to the project area, potentially resulting in over-utilization of the herbaceous understory. Off-road travel restrictions will reduce stress on livestock than what was occurring with off-road travel. There are no cumulative effects to range fences.

Comparison of Alternatives for Range Resources

Table 64. Comparison of Alternatives for Range Resources

Environmental Indicator or Unit of Measure	No Action Alternative	Proposed Action Alternative
Herbaceous understory conditions	Herbaceous understory conditions will not be improved and will gradually degrade over time as conifer canopy cover increases.	Improvements would be made to herbaceous understory conditions from the treatments of thinning, and prescribed burning, about 44,000 acres project wide.
Condition of range fences	No changes to range fences	Fences damaged by logging or prescribed burning would be repaired according to Project Design Features.

Heritage Resources

The following section describes the affected environment and effects of the alternatives relating to heritage resources. The analysis presented is summarized from the following reports which are incorporated by reference: *Heritage Resources Specialist's Report for the Upper Beaver Creek Watershed Fuel Reduction Project, 2008,* by M. Swift, 2008 (PR #203) and *A Cultural Resources Clearance Report for the Upper Beaver Creek Watershed Fuel Reduction Project, CNFR#2005-45A*, by M. Swift, L. Powell, and P. Pilles Jr. 2008, (PR #169).

Affected Environment

The Upper Beaver Creek Watershed Fuel Reduction Project area contains a variety of non-renewable historic and prehistoric archaeological sites that reflect past land uses. A total of 57 archaeological sites have been recorded within the project area including 22 prehistoric sites, 26 historic sites, and 9 combination prehistoric/historic sites. The previous surveys verify the Forest Land Management Planning Site Density Prediction Model projection of a low site density (0-9 sites per square mile) in all areas of the project.

Archaeological evidence indicates that prehistoric use was focused on seasonal hunting, gathering, and food processing activities, with limited agriculture on the eastern fringe of the project area. Water sources in the area including precipitation run-off, springs and Stoneman Lake supported a diverse vegetative habitat attracting game animals which in turn attracted prehistoric people to the area to exploit the subsistence resources. Known prehistoric sites include lithic scatters, artifact scatters, field house sites and an agricultural field. Based upon the lithics and ceramics observed, prehistoric sites date from the Paleo-Indian to Proto-historic time periods.

Historic sites within the project area include cabin and ranch sites, two locations of the McDonald Sawmill, spring developments, and miscellaneous sites. Linear sites include the ditches that drain into Stoneman Lake, a segment of the Allan Lake Railroad line, the

Palatkwapi/Chavez Trail and Wagon Road, the Flagstaff-Tonto Basin Wagon Road, and four National Forest telephone lines. In addition there are several sites associated with US Government activities including the Apache Maid Ranger Station cabin site, the Long Valley/Happy Jack Ranger Station, the Buck Mountain Fire Lookout Tower, and the Bottle Butte Lookout Tree. In addition, a former resort which was under a Forest Service special use permit is in the project area.

The Upper Beaver Creek Watershed Fuel Reduction Project area may have traditionally been used by Native American tribes and the area has potential for contemporary use, though such use has not been reported to the Coconino National Forest to date.

Approximately 10,417 acres have been previously surveyed and 584.6 acres are newly surveyed within the project area. Therefore, a total of 11001.6 acres, or 22.9%, of the project area (47,988 acres of NFS land) has been inspected.

Environmental Consequences

Analysis of effects and protection measures developed to minimize effects follows R3 Southwestern Region First Amended Programmatic Agreement regarding Wildland Urban Interface and Other Large scale hazardous fuels reduction projects (USDA Forest Service Southwestern Region et al. 2004).

No Action Alternative

Direct and Indirect Effects

If the No Action Alternative is implemented, the only likely natural disturbance to sites would occur during a wildfire. The nature and severity of fire effects to archaeological sites is difficult to predict and is dependant upon the variables of fire intensity, duration, and heat penetration into the soil. The fire intensities predicted under the No Action Alternative have the potential to destroy surface components of historic sites containing wood, as well as deform metal and shatter glass artifacts. Direct effects would include loss of surface features or architectural components, and the consequent loss of scientific information. Effects to prehistoric sites would include burning of surface artifacts, cracking or shattering obsidian, chert and pottery items, spalling of the surface of ground stone tools and architectural features, and alteration or destruction of obsidian hydration rinds, destroying their dating potential and the associated loss of scientific information. Effects to structural components such as rock walls or rock faces include discoloration, cracking, and spalling, making the rocks susceptible to accelerated deterioration. Implementing the No Action Alternative could also result in severe post-fire erosion and damage to the sites from burned trees falling onto sites. Erosion effects the spatial distribution of cultural materials on the surface of a site and alters the information potential. In addition, structural loss or damage can result from severe erosion episodes.

Cumulative Effects

The boundary for cumulative effects analysis is the project area. The timeframe for past, and ongoing projects is 20 years. The past, present and recently foreseeable projects that

affect cultural resources are the thinning and burning projects, as well as the Travel Management rule and the Managing Motorized Travel EIS.

Cumulatively, there are no direct effects from implementing no action. However, the No Action alternative could result in indirect effects that adversely affect the integrity of historic and pre-historic sites within the project area. Cumulatively, the No Action alternative could result in conditions that Adversely Affect the integrity of historic and pre-historic sites within the project area. Potential for damage resulting from wildfires will increase with time as forest fuels accumulate, decreasing the ability of firefighters to safely protect highly flammable sites such as historic cabins. Erosion and tree-fall resulting from severe fires could compromise the integrity of known and unknown sites.

Proposed Action Alternative

Direct and Indirect Effects

Potential direct effects to sites in the project area include ground disturbance and subsequent displacement of artifacts as a result of mechanized thinning and piling, and chipping slash. Burning slash and broadcast burning natural fuels could also have the direct affect of destroying combustible elements of historic sites such as wood cabins, features, and artifacts. Such disturbance could have the indirect affect of diminishing the research potential of unprotected sites in the project area. The archaeological clearance document for this project specifies the following: (1) Mechanized equipment is not permitted within sites; (2) Hand thinning is permitted in sites, but slash must be hand-carried outside site boundaries; (3) To preserve wood elements and heat-sensitive artifacts, burning is not permitted within sites containing such elements; and (4) District archaeologist or para-archaeologist must delineate site protection areas in advance of burning so fuel concentrations can be hand removed from sites, sites can be lined and structures protected if warranted. The District Archaeologist or para-archaeologist will monitor burning of site areas and will recheck sites after vegetation treatments to assess protection methods.

This will result in the project having no adverse effect on sites in the project area. Furthermore, reducing fuel loads using methods that are non-ground disturbing on and around archaeological sites are effective for reducing the severity of potential wildfire damage to these non-renewable resources. Consultations with tribes resulted in no specific concerns about the effects of the proposed treatment activities. No Traditional Cultural Properties or traditional use areas are known in the project area. However, the Palatkwapi Trail is a location of tribal concern. Tribal access would not be affected by the proposed project.

The activities described in the Proposed Action, in conjunction with the appropriate resource protection measures, will not detrimentally affect cultural resources, and could result in a beneficial effect on the cultural resources by reducing the potential effects of wildfire.

Cumulative Effects

The boundary and time frame for cumulative effects is the same as for the No Action Alternative. The clearance conditions prescribed in the Cultural Resources clearance report and resource protection measures outlined in this report mitigate any of the project's potential adverse effects.

Comparison of Alternatives for Heritage Resources

Table 65. Comparison of Alternatives for Heritage Resources

Environmental Indicator or Unit of Measure	No Action Alternative	Proposed Action Alternative
Protection of historic and prehistoric archeological sites	Probability of high severity fire occurrence increases with time. Wooden structures may be damaged or destroyed by fire. Post-fire erosion could damage sites.	Probability of high severity fire is decreased. Sites are protected and monitored according to the Heritage Clearance Report. Sites, including sites with wooden structures, are protected from potential prescribed fire damage. Post-fire erosion is minimized.

Air Quality

The following section describes the affected environment and effects of the alternatives relating to air quality. The analysis presented is summarized from the following report which is incorporated by reference: *Air Quality Specialist's Report for the Upper Beaver Creek Watershed Fuel Reduction Project, 2007,* by J. Thumm, 2007 (PR #186).

Affected Environment

The analysis area is on the border of the Little Colorado River Airshed and the Verde River Airshed. Prevailing southwest winds and the topographical nature of the analysis area typically cause smoke from burns in this area to carry north and east into the Little Colorado Airshed during the day and flow down slope into the Verde River Airshed at night.

Environmental Consequences

No Action Alternative

Direct and Indirect Effects

There would be no direct changes in short-term or long-term affects to air quality as a result of implementing the No Action Alternative. However, this alternative does increase the long-term potential for a high intensity surface fire within the project area. This alternative also increases the long-term potential for crown replacing wildfire within the project area. Both types of fire would generate considerable amounts of smoke and airborne particulates, but these wildfires generally occur during unstable atmospheric conditions when optimal smoke dispersal conditions exist.

Emissions from a wildfire are generally double that of a prescribed fire. Smoke emissions were calculated using **FOFEM** (First Order Fire Effects Model) http://www.fire.org. while distance smoke particulates may travel use **SASEM** (Simple Approach Smoke Estimation Model) model http://frames.nbii.gov/metadata/tools/SASEM_4.0.html). A

Figure 5: Smoke Emissions for particulate matter (PM10 and PM 2.5) for prescribed fire versus wildfire

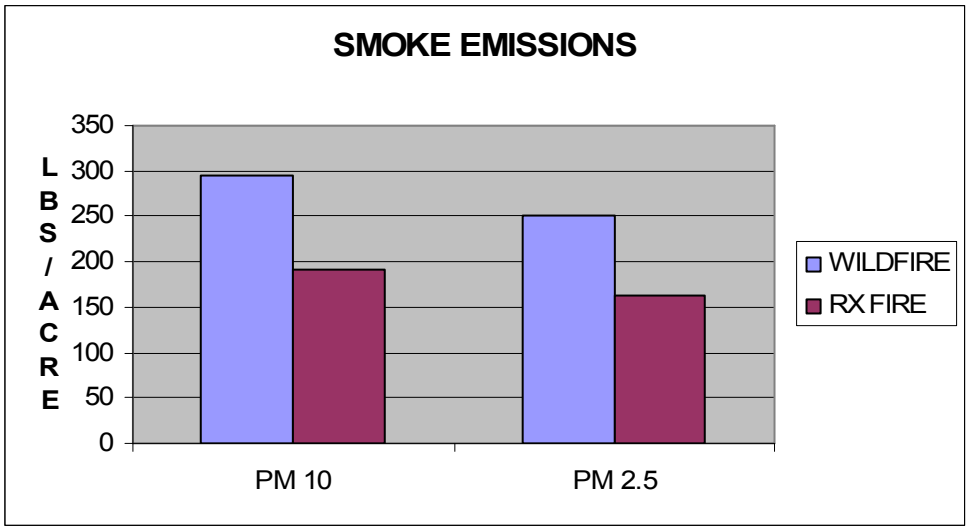
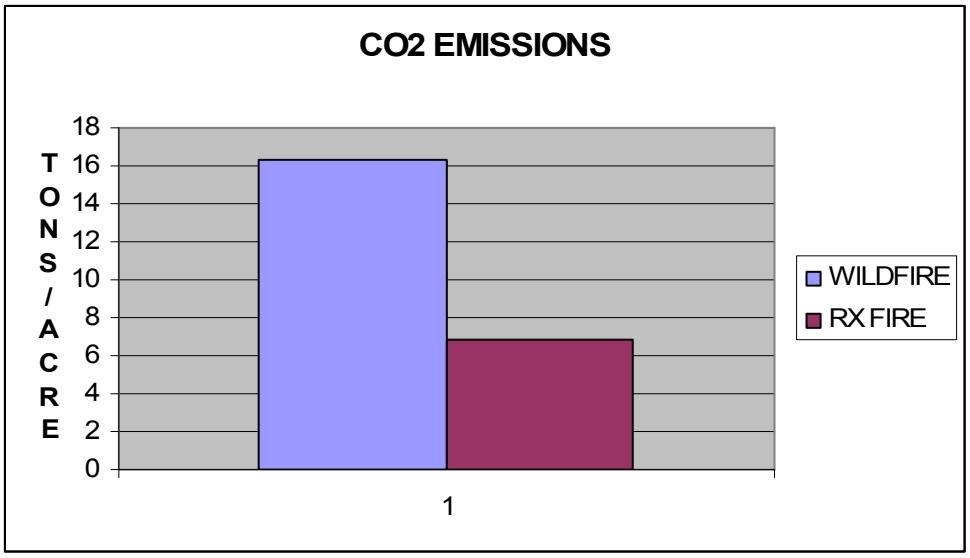


Figure 6: CO2 emmisions for prescribed fire versus wildfire



prescribed fire in forested fuels is generally a surface fire and is implemented when fuel moistures are higher and do not consume all of the forest litter. A wildfire that occurs

when conditions are drier may consume more of the forest litter and portions of the above ground canopy.

Cumulative Effects

The analysis area for cumulative effects is the Upper Beaver Creek Fuel Reduction Project Area and the Little Colorado River and Verde River Airsheds. If the No Action Alternative was implemented, no prescribed burning would take place and there would be no cumulative air quality impacts.

Proposed Action Alternative

Direct and Indirect Effects

Broadcast and/or pile burning would generate smoke and airborne particles, decreasing air quality on a short-term basis but should not exceed air quality standards. Air quality standards can be found at http://www.epa.gov/oar/particlepollution/standards.html. Some of these impacts can be reduced through standard smoke management practices. These standard practices are incorporated into the Air Quality project design features listed in Chapter 2. There are also numerous smoke reduction techniques that are utilized. These practices vary from different burn areas and time of year but include ungulate grazing and firewood sales to name just a few. Smoke impacts can be minimized by timing and scheduling the burn to be completed during periods of favorable atmospheric conditions.

Impacts would be greatest the actual day and night of ignitions. During the day of the burn smoke is heaviest but is usually lifted higher into the atmosphere and winds mix the smoke over a larger area so does not impact localized areas as heavily. As night falls so does the smoke which then settles into areas closest to the burn more heavily. Smoke would be heaviest in the early morning hours and as day time heating increased smoke would then begin to dissipate. Smoke decreases each day after initial burning, but can last for several weeks after ignitions based on fuel moistures and precipitation events.

Much of the smoke that is generated by broadcast burning in the Upper Beaver Creek Project area will move to the north and east with predominant southwest wind direction. Some burns may be implemented with winds from other directions but would be done to facilitate safety on Forest Highway 3 and would generally be done under better ventilation conditions or reduced acreage.

Residents in the Stoneman Lake area, Long Valley Ranger Station, and other developments in the project area will receive smoke impacts depending on there proximity to a given burn area. The smoke would be heaviest closer to the burn site and dissipate as you moved further away from the actual area burned. Smoke will settle the most in the Stoneman Lake when burn areas are in close proximity because of its topographical features. The closest town is Camp Verde which is 20 miles to the southeast. Camp Verde will be mostly impacted at night as smoke settles. Nighttime flows of smoke are usually downhill, and flow down drainage into the areas of west clear creek and beaver creek which would eventually have smoke drain into the Verde Valley. Within the project area we will look to burn approximately of 8,000 acres annually. On average we will

broadcast burn 300 acres per day, which equates to a maximum of 25 days annually that smoke may impact the Verde Valley. However, smoke emissions to the Verde Valley will be minimized as much as possible. The design feature to utilize spring burning where possible and burning larger blocks daily will limit the amount of days that smoke affects the Verde Valley. These design features are expected to decrease the total possible days of smoke impacts to the Verde Valley. The closest downwind town is Winslow which is about 45 miles to the northeast of the project area. Winslow will be impacted during daylight hours but smoke should be very diffuse over these areas as they are further from burn area.

By conducting ignitions during the early portion of the day, nighttime smoke impacts of burning are minimized. This provides maximum consumption time and smoke dispersion before nighttime inversions develop. Public notification through various media and personal communication would be conducted prior to burning to allow smoke sensitive individuals the opportunity to take any necessary precautions. Public notification to local residents, Discovery Channel Telescope/Lowell Observatory, and power companies will occur in advance of prescribed burning. For the Discovery Channel Telescope/Lowell Observatory impacts will be most direct when burning within a one mile radius of the telescope site. Smoke will likely impact the telescope site the most during daylight hours and dissipate as darkness falls. If the telescope is not open during daylight hours smoke impacts should be minimal.

Cumulative Effects for Air Quality

The cumulative effects boundary is the same as for the no action alternative. Cumulative effects of smoke from prescribe burning would be short-term, but would increase in magnitude as the number of treatment acres increase for any given day of ignitions or multiple days of ignitions. These impacts can also be magnified by emissions from prescribed burning on adjacent areas including other national forest lands (Kaibab, Prescott and Tonto National Forests), state lands, private property and other project areas on the Coconino National Forest. Approval for daily prescribed burning activities must be requested from and approved by the Arizona Department of Environmental Quality (ADEQ). The ADEQ would approve the requested acreage, reduce the approved acreage from that requested, or not approve prescribed burning depending upon a variety of factors including cumulative effects of smoke emissions from multiple jurisdictions thereby mitigating most of the potential for severe smoke impacts to the entire Little Colorado River Airshed and the Verde River Airshed.

Comparison of Alternatives for Air Resources

Table 66. Comparison of Alternatives for Air Resources

Environmental Indicator or Unit of Measure	No Action Alternative	Proposed Action Alternative
Air Quality Impacts	No impacts to air, the environment or public health. Significant negative impacts if a wildfire occurs.	Emissions from pile burning, broadcast and maintenance burning would have short term impacts to air quality, the environment and public health. These would be minimized by smoke management practices and required coordination with ADEQ.
Exceedances of ADEQ and National Air Quality Standards	Air quality standards may be exceeded in the event of a large wildfire.	Emissions from pile burning, broadcast and maintenance burning would meet air quality standards. Wildfires occurring after treatment would likely meet standards.

Economics

The following section summarizes the economic analysis of the alternatives considered. The analysis presented is summarized from the following report which is incorporated by reference: *Economic Analysis Report for the Upper Beaver Creek Watershed Fuel Reduction Project, 2007,* by D. Fleishman, 2007 (PR #137).

The following is an economic analysis for the Upper Beaver Creek Watershed Fuels Reduction Project. All dollars are in current dollars, with the exception of projected costs that have had a 4% per annum cost increase applied.

Benefits

Within the project area, there are 241 parcels (1,135 acres) within Casner Park, Double Cabin, Goswick, Hollingshead, K.T. Ranch, Mule Park and Stoneman Lake. Of these, 117 are classified as residential (441 acres). The total cash value in 2005 of all private parcels is about 22 million dollars (Coconino County Assessors Office, 2006 data analysis. This value does not include other special use sites such as Lowell Observatory- Discovery Channel Telescope (30 million dollars), the 345 KV transmission line (no estimate of value available), Buck Mountain Lookout and facilities at the Long Valley Ranger Station offices in Happy Jack (2 million dollars). These total about **$57,000,000** in improvements.

Additional benefits will be gained through receipts returned from the sale of wood products. Approximately 158,000 CCF (CCF = 100 cubic feet) are available for sale if all stands that are slated for harvest are sold commercially. Base rates are $10/ccf, for a total value of approximately **$1,580,000**. This assumes all available volume cut is sold. Total benefits of property, infrastructure and value of all products are about **$58,580,000.**

Costs

Direct costs to implement the project include timber sale preparation cost, slash disposal costs for machine piling and lop and scatter, burning cost (broadcast and piles), and road maintenance (blading cost) costs for the northern portion of the area, as well as road reconstruction costs for the portion of the analysis area south of Mesa Tank, and the road system west associated with the 229 road, west of the 943/229 junction (Appendix A outlines all roads to be used). Costs are outlined in the attached spreadsheet. Total costs of all of the proposed projects (thinning and burning) are approximately **$13,641,000** if all acres that are planned for harvest are cut**.**

Conclusion

Total project implementation and project implementation without a commercial harvest have a benefit/cost ration of 4.3:1 (Table 67).

Table 67. Cost/Benefit Ratio for the Proposed Action Alternative.

	Proposed Action Alternative
Total Benefit	**$58,580,000**
Total Cost	**$13,641,000**
Benefit/Cost Ratio	**4.3:1**

The benefit cost ratio only includes monetary benefits and costs. There are additional non-monetary benefits of implementing the project, including, but not limited to, the reduction of the risk of stand replacing wildfire, the improvement in understory diversity on wildlife habitat, the stability of the watershed through the reduction of stand replacing wildfire, and a maintained road system that reduces the potential of sedimentation and erosion, and improves recreation access. Although there is not a dollar value assigned to protecting the 345 KV powerline, not having to de-energize the powerline during a potential wildfire during the summer is not only an economic benefit for the Phoenix metropolitan area, but is a public safety benefit as well.

Additionally, there are non-monetary costs involved with the project, including, but not limited to, impacts to wildlife and recreationists during implementation, impacts from smoke in the Little Colorado and Verde Valley airsheds and soil impacts from harvesting and burning. These costs are minimized through project design features. Overall, the project has a very positive economic benefit/cost ratio.

Comparison of Alternatives for Economics

Table 68. Comparison of Alternatives for Economics

Environmental Indicator or Unit of Measure	No Action Alternative	Proposed Action Alternative
Potential loss of infrastructure and facilities	$57,000,000 in 2006. $84,374,000 in 2018 assuming 4% annual appreciation, and loss due to wildfire.	Risk of potential loss is lowered.
Total Benefit Total Cost Total Cost/Benefit Ratio *(Assuming 2008 dollars and assuming the entire project is implemented)*	No benefits	Total Benefit: $58,580,000 Total Cost: $13,641,000 Benefit/Cost Ratio: 4.3 to 1
Jobs	No net increase in jobs	Small increase in jobs in the logging & agricultural sector.

Environmental Justice

The Forest Service examined the social, economic, and environmental impacts of this project and determined that none of the alternatives considered in this analysis would have a disproportionate impact on any minority or low-income population in the immediate area, within the surrounding counties, or in the Northern Arizona region. The overall economy of the Coconino, Navajo, and Gila County area is diverse, including its low income and minority populations. The economy is strongly tied to the tourism industry and associated commerce and service industries. The forest products industry is a much smaller component of the economy. Implementation of thinning and fuels reduction treatments would realize indirect benefits to the local economy from jobs and employment. As stated in the Economic Analysis above, market benefits would be realized to the private lands and landowners by treating hazardous fuel accumulations in the Upper Beaver Creek WUI. Other non-market benefits to the forest health and structure would be realized as well. The project would have low potential exposures to environmental human health hazards, namely particulates from prescribed burning. This would be minimized by utilizing standard smoke management practices during prescribed burns. Exposure to hazardous components in smoke from prescribed burning would be much less than that from wildfire.