Chapter 3. Affected Environment and Environmental Consequences

This chapter summarizes the physical, biological, social, and economic environments on the Coconino National Forest and the effects of implementing each alternative on that environment. It also presents the scientific and analytical basis for the comparison of alternatives presented in the "Alternatives" chapter.

Recreation

Introduction

This section focuses on the impact of changes to motorized use on the Forest to those who depend on or prefer access and recreation in areas not accessible by main routes on the Forest. In some instances, designation of motorized use or access would result in a positive impact on forest users, while this same change may result in a negative impact to forest users with different preferences (Albritton and Stein 2007). Since forest visitor satisfaction is largely perception-based, this analysis focuses on how changes in motorized use will affect three main elements that are integral to the experience of forest visitors: forest access, motorized recreation opportunities, and user conflict.

Methodology for Analysis

Estimates of recreation use are derived from the national visitor use monitoring surveys done on the Forest in 2005 (USDA Forest Service 2009). These inventories are conducted for all national forests on a 5-year cycle that started for the Forest in 2000. The national visitor use monitoring data does not explicitly explore all aspects of motorized recreation on the national forest but does provide some basic information for motorized use.

This report also draws from other sources of data about motorized use on National Forest System lands in Arizona. A 2003 inventory of off highway vehicle (OHV) use statewide by county, conducted by Arizona State University resulted in two reports (Silberman 2003 and Arizona State Parks 2003) that provide more focused information defining OHV trends within the state of Arizona and indirectly on the national forests in the state.

Recreation Setting – Recreation Opportunity Spectrum (ROS)

The Coconino National Forest manages for a multitude of recreational experiences by designating areas according to the recreation opportunity spectrum. The recreation opportunity spectrum addresses the appropriateness, frequency and duration of human sounds and sights within the forest by considering the probability or prevalence of human sounds and sights o in discretely defined settings. Recreation opportunity spectrum classifications are based on the magnitude and nature of this human influence. The recreation opportunity spectrum divides the Forest into the following setting classes: primitive, semi-primitive nonmotorized; semi-primitive motorized; roaded natural; rural; and urban areas.

More information about recreation opportunity spectrum classifications and analysis methodologies can be found in the Recreation specialist report.

Existing Conditions

General Recreation Trends – Over the last several decades the number of people participating in outdoor activities has been increasing. Between 2000 and 2007, the number of people participating in outdoor activities throughout the nation increased by 4.4 percent (Cordell 2008).

Overall, the data on recreation trends tell us that the total amount of outdoor recreation has increased through 2007, but that nature-based recreational activities may have actually decreased when looking at a per capita basis. This data illustrates two distinct, yet opposite trends that are occurring at the national scale. There is no comparable data source to determine whether these trends are occurring at the local scale of the Coconino National Forest.

Recreation Trends on the Coconino National Forest – Recreation use of the Forest has grown rapidly over the last two decades commensurate with the growth of the population in the southwest region. Data collected from 2005 shows that the Forest is host to about 4.6 million visitors a year (USDA Forest Service 2009, p. 7). Almost half of these visits are to developed parts of the forest such as campgrounds, Snowbowl ski area, or highly developed day use sites such as Bell Rock, Lake Mary, or Grasshopper Point (USDA Forest Service 2009, p. 7). Visitors to these sites only depend on access via main roads. None of these visits would be affected by changes made in the Coconino Travel Management EIS decision, regardless of which alternative is chosen.

For most Forest visitors, the use of a motor vehicle is an integral part of their time spent on the Forest. Access to and within the Forest will likely define the location, experience, and opportunities for those who visit the forest. Almost all activities one could pursue on a national forest involve driving on forest roads. Whether it is to access a trailhead or ski area, collect firewood, or just for the pleasure of driving, motor vehicle use generally has a major influence on where and how the public uses public land. Different uses, however, vary in their dependence on forest roads and differ in the type of route being used. For example, OHV use depends not only on major roads to access trailheads, but also can include the use of many unmaintained routes, trails, and often open country where there is no established route. In fact, studies show that common OHV user preferences include less-populated routes with challenging terrain (Albritton and Stein 2007; Snyder et al. 2008), which also means that these routes are the less maintained level 2 and level 1 roads or unauthorized trails and off-road use.

As a result of the different types of uses on the Forest, demand for motor vehicle use can be categorized between those uses that almost entirely depend on main forest routes (maintenance levels 3, 4, 5) and those activities that are more likely to depend on back-country (less maintained level 2 and level 1 routes). For the purposes of this analysis, we assumed that activities including fishing, camping, hiking, viewing natural features or historic and prehistoric sites, and other common recreational activities would primarily depend on major forest roads for access to trailheads, water play access sites, campgrounds, campsites, and other developed and undeveloped recreational opportunities. We also assumed that OHV use primarily depends on less maintained roads and unofficial and official trails, but also uses main Forest roads to access these areas. Activities such as driving for pleasure, relaxing, hunting, firewood collection, and others are not as easy to categorize as they are highly dependent on an individual's preferences and are assumed to generally use both main Forest routes and backcountry routes.

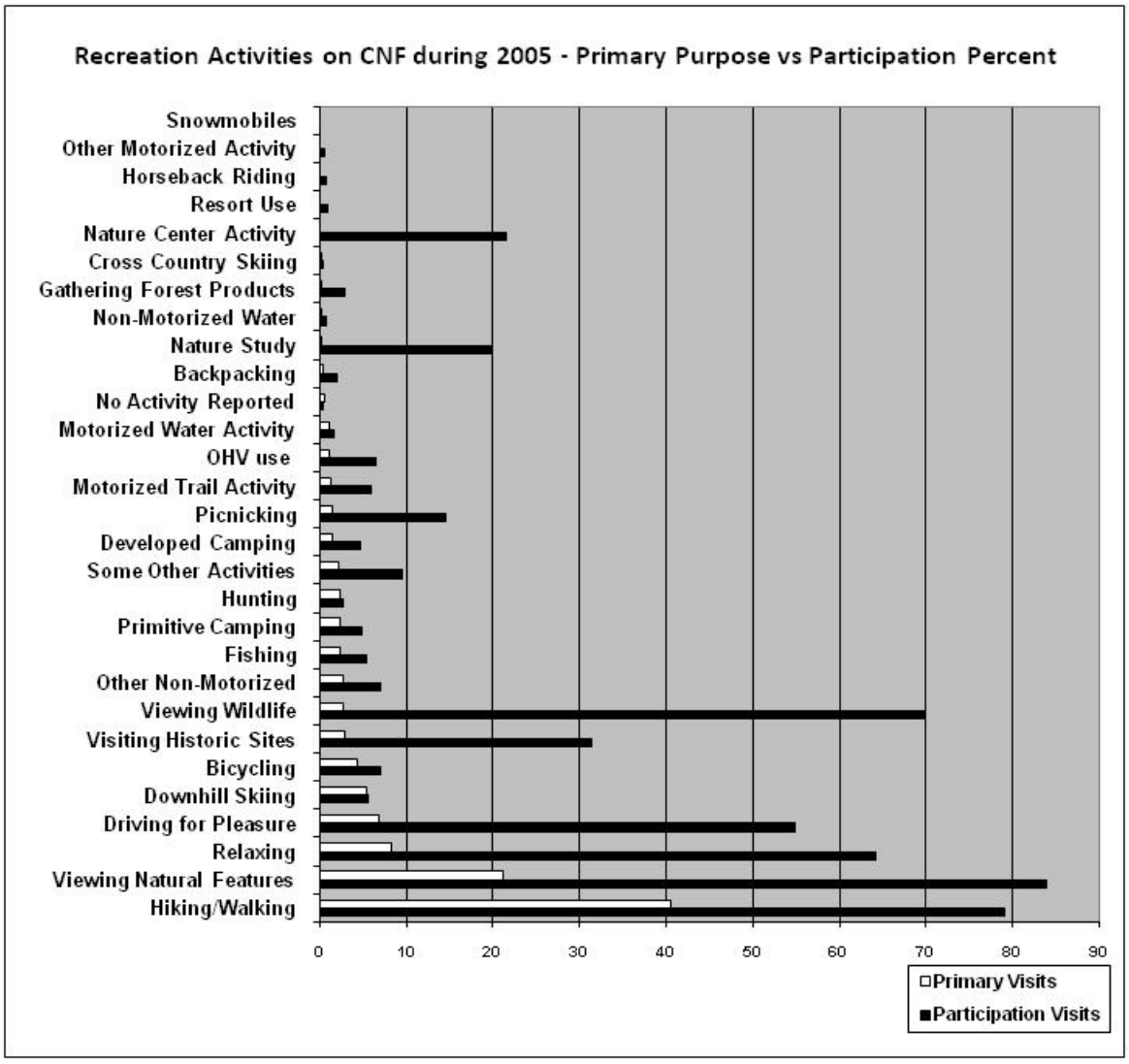

Figure 2. Recreation activities on the Coconino National Forest (CNF), primary purpose vs. participation visits (USDA Forest Service 2009)

The rise in motorized activity over the past two decades represents a rapid change in one factor affecting forest recreation settings; the prevalence of motorized activities and the evidence of such activities that threaten to diminish user expectations for, and enjoyment of, more primitive setting attributes in some areas of the Forest. The continued rise in motorized activity in the more primitive settings threatens to disrupt and displace, or at least to diminish, the experiences sought by many forest users.

Many motorized users are attracted by opportunities for solitude, challenge, and risk on the Forest just as many nonmotorized users are. Presently there are ample opportunities across the Forest for such setting attributes for all users. However, the proliferation of motorized use has tended to diminish solitude opportunities for nonmotorized users in some areas. For example, there are numerous accounts (from Travel Management Rule public meetings, and responses to the original proposed action) of hunters who favor quiet stalking, or "still" hunting techniques being disrupted by the arrival of motorized vehicles in areas the hunter had accessed on foot or by horseback.

These accounts are supported by a 2005 study by the Arizona Game and Fish Department found that 54 percent of survey participants identified "OHV disruption" as a barrier to participation in hunting (Arizona Game and Fish Department 2005).

If one compares national visitor use monitoring data from all northern and central Arizona national forests, it appears that the Coconino is not only one of the more popular forests, but serves a particular niche, which is that it is heavily used by non-local visitors (greater than 50 miles from the Forest) for nonmotorized recreational purposes. The Coconino National Forest received approximately three times the use of the Apache-Sitgreaves and the Prescott National Forests and 22 times the use of the Kaibab National Forest.

Additionally, the Coconino National Forest includes the highest amount of nonmotorized recreational use, which may be negatively impacted by motorized uses. To quantify the amount of nonmotorized use that could be negatively affected by motorized use on each forest, the percent of users participating in nonmotorized recreation activities were weighted and combined to form an index. Each of the percentages for visitors participating in backpacking, nature study, viewing wildlife, and viewing natural features was given equal weight and added to produce one number represented by a nonmotorized recreational use index. This shows that the Coconino National Forest serves a special niche in Arizona for nonmotorized recreational uses above and beyond nearby national forests. The Recreation specialist report contains more information on recreational uses on neighboring national forests for comparison.

Visitors to the Forest use motorized vehicles for many reasons including access to engage in various popular activities. The primary activities that account for most of the motorized use of the Forest are discussed below.

Driving For Pleasure and Viewing Scenery

The large majority (over 70 percent) of motorized use on the Forest comes from those who drive for pleasure (USDA Forest Service 2009, AHRRC 1990). Each year many people enjoy the beauty of the Coconino National Forest, driving the forest's many miles of scenic and challenging roads, including not only the many paved and gravel roads suitable for passenger cars, but the rougher back roads, too. Survey respondents from the Flagstaff area responded that they preferred driving paved roads only slightly more than driving on primitive roads when driving for pleasure (AHRRC 1990). However, less than a quarter of all visitors to the Forest said they use National Forest System roads, instead reporting they stayed on the main roads and scenic byways (60 percent) such as 89A through Oak Creek Canyon, Lake Mary Road, or State Road 260. These people are seeking solitude and relief from stressful city life, and peaceful forest settings viewed from their vehicles provide this relief.

Many users drive the forest roads watching for wildlife, some are seeking out interesting archaeological sites, but many are simply driving for the experience of seeing wild forest lands, perhaps with an occasional glimpse of a distant spectacular landform, canyon or mountain. Most people stay on the roads, but a minority of users prefers to view features on the landscape up close, and rather than leaving their vehicles at established roads and walking to see things, they drive cross-country to the feature.

OHV Use

Today, many individuals and families come to the Forest with their trailers and trucks loaded with all-terrain vehicles (ATVs) for the sole purpose of riding in the forest, enjoying the challenge of riding rough trails and country, and seeing new areas; "relaxing" in the forest. Surveys show that the large majority of ATV users (over 81 percent) on the Forest prefer to ride on existing, well-defined roads; not off-road (USDA Forest Service 1999). However, it is clear that although ATV and utility-terrain vehicle (UTV) riders are satisfied riding on high-clearance level 2 roads, there is also a desire for designated and maintained trails specifically for ATV and UTV use on National Forest System land (Flood 2005, USDA Forest Service 1999).

These same surveys, however, show that most users are generally unfamiliar with ATV rules and requirements on the Forest (USDA Forest Service 1999). As a result, ATV use on the Forest often results in impacts such as rutting and loss of vegetation, noise affecting other users and property owners, or impacts to wildlife.

The largest impacts and recreation conflict is observed adjacent to communities where landowners and their children frequently ride on the adjacent Forest. Given that "it isn't breaking the law" because of the "open unless posted closed" policy that is currently in place; this still results in substantial and long-term impacts where ATV use forms permanent trails and motocross tracks, often with "constructed features" such as jumps and banked turns that are very visible on the otherwise natural appearing landscape (figure 3).

Figure 3. Unauthorized OHV play area near Stoneman Lake

The Forest includes a preponderance of high-clearance roads used by OHVs, but in general lacks areas specifically designed or designated for off-road OHV use or for trail riding. Regardless, the Forest still provides for a variety of OHV activities including OHV trail riding (single-track and ATV/UTV); jeeping; hill climbs (see figure 4); observed trials; motocross tracks and mudbogs; and tot lots. The Recreation specialist report contains more information on these OHV activities.

Figure 4. Hill climb at Cinder Hills OHV area

In addition to the aforementioned opportunities and uses on the Coconino National Forest, the surrounding public lands including the Kaibab National Forest, Prescott National Forest, Tonto National Forest, Apache-Sitgreaves National Forest, BLM lands, and private lands include additional opportunities. Many of these surrounding areas provide for specifically designated OHV areas and routes. See the Recreation specialist report for more information on these areas.

Dispersed Camping

Forests in the Southwestern Region receive some of the highest dispersed use in the nation (English 2009), likely due to the open vegetation and year-round sun. Forest areas atop the Colorado plateau are more popular during the warmer seasons, while those below the Mogollon Rim are more popular during the colder seasons. From simple car-camping with tents, to overnight camping with larger vehicles such as motor homes, or "RVs", camping outside of developed campgrounds in areas without amenities is desirable for many people, and the demand for this type of motor-based recreational use is approximately equal to those that prefer camping in developed campgrounds (USDA Forest Service 2009). This type of camping experience is sought in many places, including along roads in remote locations, near lakes, creeks and rivers, or in quiet and secluded parts of the forest (figure 5).

During summer, thousands of people come to the forest each weekend seeking relaxation and relief from the heat of the southern half of the state. Much of this use occurs on weekends, particularly holiday weekends. Predictably, areas easily accessed by major roads in the higher elevations receive some of the highest dispersed camping use, including sites reached by Highway 87 in the Baker Butte area, places along NFS Road 300 along the Mogollon Rim, and in the scenic forest and canyon areas on the south side of West Clear Creek Wilderness. As use increases in these easily accessed areas, more remote areas are also experiencing heavier use (such as those farther north and east along the Highway 87 corridor).

Figure 5. Dispersed camping with RVs is very popular among the pines and tall grass at Mormon Lake

With the forest's "open unless posted closed" policy on cross-country travel with motorized vehicles, recent population increases in the state have resulted in gradual increases in roads and dispersed campsites and areas, with subsequent increases in the amount of damage to the land and other resources. Many dispersed campsites are located in prime camping areas with good views, near water, or in shaded forest areas. Many of the sites have been used for a long time, since they were established generations ago and are used again and again by succeeding generations of campers. With overall increases in use, and with some sites losing their attractiveness due to overuse, lack of maintenance, loss of vegetation and cover, new sites are sought in other areas, with new roads established to reach the new camping areas. At the same time, older areas are expanded. Examples of this type of expanding and new use may be readily found along Ashurst Lake Road, NFS Road 300 along the Mogollon Rim, NFS Road 794 on the west side of the San Francisco Peaks, near Mormon Lake, and in other high-use areas.

Hunting

It is estimated that almost 120,000 hunters use the Forest each year for hunting all types of game from quail to bear (USDA Forest Service 2009). Most hunting occurs in the fall when the majority of elk and deer hunts are permitted. Generally, these hunts result in motorized use after Labor Day. As motorized use from the summer recreation season dies down, hunter traffic increases in concert with firewood cutters resulting in regular traffic in the months of October and November on many of the less used high-clearance (level 2) forest roads (Burbridge and Neff 1978).

In areas where the most traffic normally occurs during hunting season, such as Anderson Mesa, a typical route scenario might be a road, created by repeated passage with a vehicle, with no formal engineering or construction and little or no maintenance. Such a road becomes deep, rocky and

rough, and so a new track is started adjacent to the old one until that new track, too, cuts deep and then another new one is started nearby. The sequence is predictable and occurs throughout much of the forest with varying effects across different soil types and terrain features. Too often, the result is wide sections of road that are sometimes three, four, or more vehicles in width, with increased damage to soil and vegetation.

Motorized retrieval of big game (elk, bison, deer) following a successful hunt is a long-standing tradition on the Forest. It is estimated that 80 to 90 percent of successful elk hunters on the Forest drive to their kill (Burbridge and Neff 1978). The open nature of the vegetation and the generally gentle topography along with the present policy for cross-country motorized travel encourages motorized retrieval. Most hunters take advantage of motorized retrieval unless topography makes it too difficult. Some hunters go to extremes in their retrieval efforts, using ever more powerful and flexible high-clearance machines often with cable winches to retrieve animals from very rugged terrain, incurring considerable rutting and damage to vegetation in the process. Generally though, damage done to forest resources during the retrieval of big game is incidental to the general use of the Forest for motorized cross-country travel.

On the Forest, “big game” generally refers to elk and deer. Based on the alternatives being considered in this analysis and discussions with Arizona Game and Fish Department, motorized retrieval of big game animals is most relevant for elk. Although it occurs for other species, it is not as important (see alternatives considered but eliminated from detailed study in Chapter 2). The total of elk permits issued on the Forest is about 40 percent of the total permits issued statewide, and game management units 6A and 5BS are two of the highest permitted units in the State (Arizona Game and Fish Department 2010). The Recreation specialist report contains more information about elk permits and average vehicle trips involved.

Antler Gathering

A relatively new use in the last decade or so, antler, or “shed” gathering, has become popular with many people. This activity occurs mostly in the spring when deer and elk shed their antlers, and usually just after snowmelt or spring thaw when forest roads and surrounding grounds are often saturated with water.

People seeking valuable antler sheds for profit comb forest lands as they “grid-search” areas for elk and deer sheds that can pay as much as $15 per pound on commercial markets. Frequently the resulting impacts may be relatively light, as skilled and conscientious shed hunters act responsibly by using their vehicle only during dry periods, when the impacts may just be the flattening of vegetation, which will probably grow back next season. But often the muddy roads and surrounding lands are damaged by wheel ruts from the irresponsible use of ATVs and trucks of people searching for antlers, ruining the roads and causing long-term damage to lands and resources. Even when the ground is not wet; the repeated passage of vehicles back and forth across the landscape compacts soil and damages young plants.

We have no data on the extent of motorized traffic caused by shed hunters, but know that it is an increasingly popular activity.

Rock Climbing

Traditional rock climbing and sport climbing use has increased greatly in recent years as the area population has increased, and has been expanding out from original popular climbing areas

adjacent to urban centers and subdivisions such as Flagstaff, Sedona and others, to more remote areas. Today, numerous climbing guides are available that lead local people and people from all over the world to all types of climbing areas in the forest, including popular, high use areas that are reached by relatively high standard roads, to the newer, more remote and challenging climbing sites that are in backcountry areas.

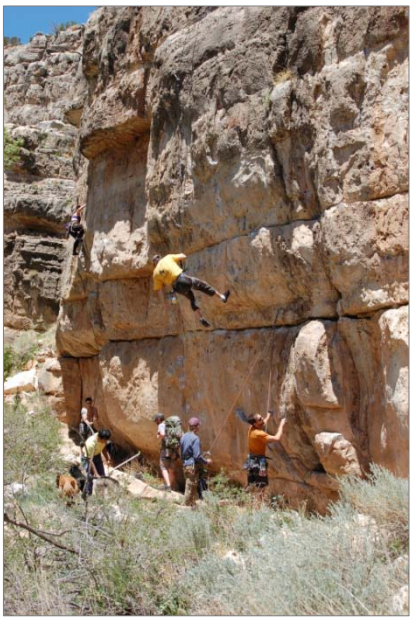

Figure 6. Rock climbing at Jacks Canyon, 2011

While often these uses of forest roads to access climbing areas occur during fair weather when roads aren't damaged, high amounts of regular use in undeveloped areas lead to impacts over time. Frequently, new roads are started to approach new climbing areas, and as the word spreads about the areas, motorized use increases and the resultant impacts to roads and resources occurs as well. Areas such as Jack's Canyon, Sycamore Canyon Rim, Anderson Mesa, Red Rocks, Mount Elden, Oak Creek Canyon, Priest Draw, and Pumphouse Wash are used more each year. These areas often exhibit the types of resource and road impact problems associated with access and related activities associated with climbing such as dispersed camping.

We have no data to quantify the amount of motorized traffic caused by rock climbers but the effects of such traffic are evident near popular rock climbing sites.

Figure 7. Off-road impacts from dispersed camping occurring at Jack's Canyon, 2011

Special Events and Group Events

While large groups have used the Forest for a long time, today these groups are larger and more numerous than before. They are also using the forest for much more varied purposes. Today the forest is used for weddings, archery shoots, Medieval reenactments, family gatherings and reunions, motorcycle races, motorcycle trials, mountain bike races, running events, church

groups, field dog trials, and bicycle racing. While some of these events are motorized and some are not, participants nearly always come by motorized vehicle. These can impact areas across the Forest where the events are permitted by expanding existing parking areas in remote locations, creating new routes and "two-track" roads in areas where events are held. The Forest has worked to provide appropriate locations for large groups across the forest, but without adequate resources to properly manage the areas, they often become overused, with resource damage occurring.

Environmental Consequences to Recreation

Summary of Effects Common to the Alternatives 3 and 4

Implementation of either alternative 3 or 4 would have a general effect on recreation resources, activities, and patterns of use across the Forest. The greatest impacts would be on decreasing user conflict between motorized and nonmotorized users, while also decreasing opportunities for forest visitors that prefer motor vehicle use for access to more isolated areas or for enjoyment of OHV recreation. The existing, long-standing policy of unrestricted motorized access across most of the Forest, along with the generally open vegetation and gentle terrain found there, has accommodated a large and growing population of people whose primary recreation activity on the forest is driving vehicles across the landscape.

Under either alternative, access to most of the general Forest area would be slightly decreased. The large majority of access would be maintained via the thousands of miles of proposed designated road in the alternatives. However, under alternatives 3 and 4, forest users would lose the freedom to travel "cross-country," which is valued by many motor vehicle enthusiasts. Loss of motorized cross-country access would diminish the enjoyment of motorized recreation enthusiasts, would limit cross-country access opportunities for some people with disabilities, would limit the opportunities for motorized big game retrieval, and would limit options for motorized access to some favored dispersed recreation and camping sites and areas.

While the number of forest visitors dependent on motorized cross-country travel is large and growing, most forest visitors use main travel corridors maintained for passenger car travel (maintenance levels 3-5) when visiting the forest while "driving for pleasure," viewing forest scenery and wildlife, or visiting popular sites or areas. The proposed designated road system under either of the alternatives provides motorized access to all existing developed recreation sites and to most of the more popular areas and sites on the Forest. Even under the most restrictive alternative, approximately 80 percent of the Forest outside of designated wilderness is within ½ mile of a designated route. Therefore, access required to facilitate most recreation or other activities would not change as a result of implementing the Travel Management Rule under either alternative.

People seeking the more primitive recreation setting attributes (solitude, natural quiet, little evidence of other people, less "administrative presence," etc.) of forest landscapes would likely have more opportunities for finding those than at present with the implementation of either alternative 3 or 4. Additionally, the presence of motorized use and noise would be more predictable throughout the forest (since it would be restricted to designated routes and areas), facilitating a recreational experience away from the sights and sounds of motorized vehicles. Open road densities (road length/area of roads open for public travel) would decrease significantly with either of the alternatives, but the extent of the road system would be similar to

the present extent. The general effect across the landscape would be to increase the distance between open roads.

Alternative 1 –Direct, Indirect and Cumulative Effects

Forest Access

Under this alternative, approximately 93.3 percent of the Forest would be accessible to within ½ mile of an existing forest service system road outside of wilderness. If unauthorized routes are also included, the only places you could not access without a vehicle are the areas that are already inaccessible due to topography, vegetation, or rough terrain. An additional 5.7 percent of the Forest is between ½ to 1 mile from system roads outside wilderness, and only 0.2 percent of the Forest is more than 2 miles from a system road outside of wilderness. The Hackberry Mountain/Towel Creek area would be the only area on the Forest outside of wilderness that would remain more than 2 miles from a system road (see map 5 in map packet).

Under current conditions, the ability to get away from roads is rather limited outside of designated wilderness. Given that unrestricted off-road travel is allowed on most parts of the Forest and there are likely several more hundred miles of routes that have not been inventoried, even areas that are more than ½ mile from a road may still be within the sights and sounds of motor vehicles.

Under Alternative 1 approximately 4,834.9 miles of roads would be open for high elevation forests and meadows, 2,606.8 miles of roads would be open in pinyon-juniper woodlands or desert vegetation types, and 25.6 miles of roads would be open in riparian forests and wetlands.

Since there are no designated dispersed camping corridors under this alternative, there is no clear quantitative value for the accessibility of dispersed camping opportunities in each vegetation type. However, this alternative would continue to allow full access to motorized dispersed camping as currently occurs.

This alternative would not add any restrictions on off-road vehicle use for retrieval of elk or any other species of hunted animal. It is estimated there are an average of 2,922 off-road vehicle trips each year for retrieval of elk, which would continue. Access for motorized retrieval of big game would be unaffected.

Under this alternative, forest access would not change as there would be no additional restrictions on motor vehicle use. Since there are no direct or indirect effects on forest access, there would be no cumulative effects.

Motorized Recreation Opportunities

Under the current alternative, no motorized trails would be closed to motor vehicle use. This would mean between 126 miles to over 200 miles (Coconino Trail Riders 2007) of motorized trails (outside of the Cinder Hills OHV area) would remain open specifically for OHV motorized recreation. Though many of these trails currently occur on roads (e.g., much of the Lenox trail, a small portion of the Challenger Trail) they would provide the minimum 25 to 60 interconnected miles of motorized trails needed to allow for a full day motorized recreation opportunity for enduro riders, while also allowing for the rough and unmaintained technical jeeping provided by short, boulder canyons. Motorized recreational opportunities on the Forest would likely meet

demand since current management would allow for unrestricted motorized use across most of the Forest.

This alternative would not add any restrictions on off-road vehicle use for dispersed camping. Thus, off-road vehicle use or vehicle use on closed roads for access to dispersed campsites would remain unchanged.

Under this alternative, motorized recreation opportunities would not change as there would be no additional restrictions on motor vehicle use. Since there are no direct and indirect effects on recreation opportunities, there would be no cumulative effect.

Hunting – Hunting is many things: a recreation activity, an important sociocultural element, a means of obtaining food, and the primary method used by wildlife management agencies for controlling game populations. Most measures indicate that hunting participation peaked between 1980 and 1985, and has gradually declined thereafter (Brown et al. 2000). Recent information from the Arizona Game and Fish Department shows that applications for big game hunting permits have fallen 22 percent since 2006, despite state efforts to expand and improve hunting opportunities (Holden 2011).

Although this decline is likely due to a number of reasons, a 2005 hunter needs assessment by the Arizona Game and Fish Department Hunter and Shooting Recruitment and Retention Team found that approximately 54 percent of respondents cited OHV disruption and 51 percent of respondents cite overcrowding as barriers to hunting (Arizona Game and Fish Department 2005).

This alternative would exacerbate these problems of OHV disruption and perceived crowding by continuing to allow unrestricted motor vehicle use across most of the Forest. The Forest currently includes areas closed to motorized travel during hunting season, including the Rattlesnake Quiet Area and the Pine Grove Hunting Area, which are both supported by hunters and heavily used during hunting season for big game. However, these areas offer no refuge to elk and deer (and to hunters seeking solitude) due to the great amount of hunters using these areas (Burbridge and Neff 1978).

This alternative would continue to allow hunters high levels of access to the Forest and ability to retrieve downed game, both of which have been cited as important elements in hunter satisfaction (Arizona Game and Fish Department 2005, Responsive Management 2006). Yet it would result in growing negative impacts to hunter satisfaction by providing big game hunters with few areas that are isolated from motor vehicle use, limiting their ability to achieve those elements that are most important for hunter satisfaction, including the ability to enjoy undisrupted nature and the ability to experience solitude (Hammitt et al. 1990, Responsive Management 2006). In addition, there are studies that show decreasing vehicle access in some circumstances has had the effect of increasing hunter success (Gratson and Whitman 2000), which is also an important component of hunter satisfaction.

Over the next decade, hunter satisfaction of hunting on the Forest would be cumulatively impacted by the additional OHV use that would occur, given the combined trends of increasing motorized recreation, increasing population, and increasing motorized restrictions on surrounding national forests. This would result in increased OHV disruption and crowding that have been documented as some of the main factors resulting in barriers to hunting participation (Arizona Game and Fish Department 2005).

User Conflict

This analysis looks at user conflict resulting from increasing user restrictions and diminishing amounts of motorized recreation opportunities and access for motorized and some nonmotorized users over the next 10 years in the northern and central Arizona region.

Less than 0.5 percent of the Forest outside of wilderness is designated as primitive, which is characterized by an essentially unmodified environment, where [nonmotorized] trails may be present but where the probability of isolation from the sights and sounds of people is high. Approximately 4.3 percent of the Forest outside of wilderness areas is designated as semi-primitive nonmotorized, which is characterized by few and/or subtle modifications by people, and has a high probability of isolation from the sights and sounds of people.

Despite including such a small area of the Forest, an estimated 270.8 miles of roads are in these areas that are designated to be managed for nonmotorized purposes. Approximately 10 percent of these roads are unauthorized roads that were created by repeated off-road vehicle use or by use of closed forest logging roads. Approximately 13.39 miles of motorized trail also occur in primitive and semi-primitive nonmotorized areas (see table 8).

In addition to the known roads and trails occurring in these areas, due to the 'open unless closed' policy on the Forest, these areas may be used for off-road motorized use for purposes of car camping, hunting, game retrieval or for other reasons.

Table 8. Miles of routes and acres of camping corridors in recreation opportunity spectrum areas designated for nonmotorized uses

	Primitive	Semi-primitive nonmotorized
Miles of road	55.85	214.95*
Miles of motorized trails	0.37	13.02
Acres open to off-road travel	7,111.8	66,204.37

*26.29 miles of roads in this category are unauthorized roads

Due to the current condition of over 284 miles of motorized routes in primitive and semi-primitive nonmotorized areas, and the likely growth of this number over the next several years due to continued off-road vehicle travel, this alternative is not meeting forest plan objectives. In other words, management objectives to maintain a recreational experience isolated from the sights and sounds of people (including motorized use) are not occurring in these areas. Furthermore, due to the expected proliferation of routes over time, this alternative would further move conditions away from meeting this management objective.

This alternative would result in the highest amount of conflict between motorized and nonmotorized users. Complaints from landowners, hikers, horseback riders, and even other motorized users about motorized use is a common occurrence, even when this motorized use complies with current rules.

Because the Forest is used more for nonmotorized recreational purposes than any other forest in northern and central Arizona, and that the large majority of the Forest is open to motorized use, it is not surprising that conflict between motorized and nonmotorized users is common (USDA Forest Service 2011a). Furthermore, this level of conflict is likely to grow as unrestricted

motorized use continues and increases across most parts of the Forest and as nonmotorized nature-based recreation activities continue to grow.

The large majority of research on the social impacts of OHV use shows that the impacts between motorized users and other recreationists (including other motorized uses) are asymmetric; meaning that motorized users affect other recreationists more than they themselves are affected by other recreationists. This often leads to displacement of nonmotorized recreationists (Adams and McCool 2009, Stokowski and LaPointe 2000; McCay and Moeller 1976, Lynn and Brown 2003). This impact is not only a direct result of conditions created by motorized use such as noise and dust, but also from the indirect impacts of reduced vegetation, natural areas clearly altered by human activities, and the reduction in opportunities to view wildlife.

Due to these impacts, over the past three decades as motorized use has grown, nonmotorized recreationists have been losing traditionally used areas (Adams and McCool 2009). Since it is clear that the large majority of users on the Forest pursue nonmotorized activities, and that the Forest is used for nonmotorized activities that may be negatively affected by motorized use more than any other nearby national forest, this alternative would likely continue to result in the greatest amount of user conflict.

In addition to conflict between motorized and nonmotorized recreation on the Forest, much of the conflict from motorized use is a result of motorized use on the Forest adjacent to private land where people live. Approximately 25.6 percent of all homes in Coconino County are located in the wildland-urban interface adjacent to the Forest. This is more than double the percentage found in the region, and is almost seven times that found in other western states. Yavapai County only includes 9.7 percent of homes in the wildland-urban interface (Headwaters Economics 2011). In locations such as the Airport Trail area, which occurs adjacent to the community of Ponderosa Trails (in Flagstaff) and in the Cornville area, unrestricted motorized use will continue to result in conflict between landowners and motorized users.

Not only would this alternative continue to result in conflict between nonmotorized and motorized users and landowners, but it would affect others that have deeper ties to the Forest. For example, in interviews with tribal members, it has become apparent that the current policy of motorized use on the Forest provides a great extent of access, but this access is resulting in impacts that conflict with the needs of some Native American tribes. This comment indicates that for this particular site, tribal needs for access are subordinate to the larger goal of site protection," (Russell and Adams-Russell 2006):

> "(Site name) is very sacred to us, but most everyone agrees that the road to that place is a problem because it is taking too many people into it. The place is getting torn up. It is a place that our elders like to go to, but I think we agree that the road should be closed even if it means they cannot get to it because of the damage being done. We want the place protected even if it means some people cannot get there. Without the road it will mean some of our people cannot get there, but it is important to us."

Based on this information, this alternative would continue to result in a high level of user conflict, especially between those who prefer motorized recreation experiences and those who prefer nonmotorized recreational experiences, or those who are tied to special areas negatively affected by access. Over time, this conflict would increase as the trend of motorized use and the proliferation of motorized routes increases across the Forest.

Recreation of nonmotorized and motorized use is expected to grow over the next 10 years as a function of population growth and due to the increasing trend of OHV use and nature-based recreation. This would increase recreation pressure and make it more likely for motorized and nonmotorized users to be competing for the same areas.

In addition, recreation pressure may increase in certain areas due to the diminishing amount of private land open to public use and continuing development along National Forest boundaries. For example, the 2000 Renewable Resources Planning Act reported: "the proportion of privately owned forest land open to the public and free of charge has declined from 29 percent in 1979 to 23 percent in 1989 and 15 percent in 1996" (USDA Forest Service 2001).

In Coconino County and Yavapai County, residential land area grew by 32.8 percent and 23.5 percent, respectively (Headwaters Economics 2011). This would have the effect of adding recreation pressure from motorized and nonmotorized uses on Federal lands, which are surrounded by recently developed areas. In addition, it would also result in more landowners adjacent to Forest lands that could be impacted by motor vehicle use.

Furthermore, surrounding national forests including the Kaibab and Prescott have implemented travel management restrictions throughout these forests. On the Kaibab, these restrictions began in June 2010 on the Williams Ranger District. The Apache-Sitgreaves and Tonto National Forests currently include proposals that are likely to result in additional restrictions on motorized use starting in 1 to 3 years.

Large wildfires such as the 2011 Wallow Fire would have the effect of restricting all recreational uses in some areas for up to 5 years. This would also likely displace motorized and nonmotorized recreational activities to surrounding National Forest System lands, such as the Coconino National Forest.

Motorized restrictions on surrounding lands in addition to increasing motorized and nonmotorized recreation would cumulatively increase motorized use and nonmotorized use on the Coconino National Forest, which would still allow unrestricted motorized use across most of the Forest under this alternative. This would result in an even greater amount of user conflict between nonmotorized and motorized users as well as motorized users and adjacent landowners. As a result, a growing percentage of nonmotorized users would likely be displaced or endure a decreased satisfaction from being unable to experience the forest in a seemingly intact natural environment not dominated from the sounds and sights of other forest users. Others who depend on the Forest, such as adjacent landowners and Native Americans with cultural ties, would likely experience increased impacts from the direct (noise and dust) and indirect (scenic impacts from loss of vegetation, increased access to property boundaries and cultural sites) effects of unrestricted motor vehicle use.

Alternative 3 – Direct, Indirect, and Cumulative Effects

Forest Access

Under this alternative, approximately 78.6 percent of the Forest would be accessible to within ½ mile of a road outside of wilderness. This is a very important detail: although over 50 percent of the possible motorized travel routes on the Forest would be closed, motorized access would only be decreased by less than 15 percent. An additional 17.1 percent of the Forest is between ½ to 1

mile from roads outside wilderness, and 0.6 percent of the forest is more than 2 miles from a road outside of wilderness (see map 6 in map packet).

The large majority of visitors to the Forest would not be negatively impacted by implementation of this alternative because (a) forest access would only be slightly reduced, (b) the large majority of the Forest (outside of wilderness) would still be within ½ mile of a designated route, (c) all primary destinations used by forest visitors including trailheads, campsites, picnic areas, and developed day use areas would still be accessible by designated routes, and (d) less than a quarter of all visitors to the forest depend on high-clearance National Forest System roads for access (USDA Forest Service 2009).

Those visitors that depend on the secondary and tertiary high-clearance roads for access to pursue motorized recreation opportunities, hunting and game retrieval, and those who prefer to drive to isolated parts of the forest would be most affected by this alternative. Specifically, those who prefer or have traditionally hunted and retrieved game through off-road travel would no longer be able to do this under this alternative. Likewise, those who prefer or have traditionally driven along the many secondary and tertiary high-clearance vehicle roads in the high elevation forests and meadows for shooting, camping, hunting, or for just the pleasure of driving and exploration would be limited by this alternative to staying only on the designated routes.

Under Alternative 3, approximately 1,861.6 miles of routes would be designated in high elevation forests and meadows, which would decrease the current miles of routes by almost 62 percent. Approximately1,195.4 miles of routes would be designated in pinyon-juniper woodlands and desert vegetation, resulting in a decrease of 54 percent of open roads. In riparian forest and wetlands, approximately 8.4 miles of route would be designated, or a decrease of 67 percent.

Under this alternative, the miles of roads in the most used and accessed vegetation type would be substantially restricted. Most of the roads to be closed in the high elevation forests and meadows are in ponderosa pine vegetation types. This vegetation type is regularly used for access to campsites, hunting areas, and for motorized use of high-clearance roads. Access to these and other activities requiring motor vehicle use on high-clearance roads may be largely reduced as a result of this alternative.

This alternative would designate camping corridors for off-road motorized use to car camp on approximately 34,554.8 acres in high elevation forests and meadows. In pinyon-juniper woodlands and desert vegetation, approximately 9,558.7 acres of camping corridor would be designated, and 46.1 acres of camping corridor would be designated in riparian and wetlands areas. The designation of camping corridors would partially address the closure of many of the high-clearance roads by providing designated areas for off-road travel for camping. Yet, this would still result in an overall restriction on camping preferences, and would not fully address the motorized access needs of other recreational pursuits in these vegetation types.

Although dated, a 1978 study on the Coconino National Forest discussed that while hunters may support vehicle closures, virtually all elk hunters and many deer hunters expressed concern over retrieving their game without vehicle access. The study points out that this is likely a characteristic of Arizona hunters more than in other areas (Burbridge and Neff 1978). Thus, this change would result in substantial change to many individual deer and especially elk hunters that have traditionally retrieved their kill using off-road vehicle travel.

Cumulative effects on forest access consider past, present, and future activities in the northern and central Arizona region leading to the present and within the next decade. Forest access via motorized vehicles has been slowly decreasing over the past several years because of increasing areas being put under administrative closures and because of increased development of adjacent private lands, which prevent access to other land ownerships and reduce access to natural areas.

Forest closures, especially closures for motor vehicle use have been increasing on public lands over the last several years. On the Forest, a number of motor vehicle closures have been put in place for various reasons. Some of the more extensive closures include:

- In 2006, the Forest closed 47 miles of road under the East Clear Creek Watershed Health project. Between 2006 and 2007, the Mogollon Rim Ranger District physically closed 21.7 miles of these roads based on the East Clear Creek Watershed Health decision (though these roads were “closed,” portions of the road may still be in use by motor vehicles due to the Forest's "open unless closed policy"; Omana and Fleishman 2008).
- In 2010, a closure restricting all off-road motor vehicle use on approximately 20,000 acres was put in place on the Mogollon Rim due to increased OHV use and associated resource damage.
- In 2010, an emergency closure was put in place across most of the burned area in the 2010 Schultz Fire. Though some of the main roads have been reopened, much of the area is still closed to motor vehicle use for the foreseeable future.

Other adjacent national forests and public lands have also put into place or are in the process of establishing new rules restricting off-road vehicle use, such as:

- Much of the area burned in the 2011Wallow Fire will be closed to motor vehicles. The Apache-Sitgreaves National Forest has announced phased reopening of roads with the graveled passenger car roads as being the top priority. Some high-clearance roads may be closed for several years.
- In June 2011, the Kaibab National Forest began implementation of the Travel Management Rule on the Williams Ranger District, which restricted off-road vehicle travel and designated only a portion of existing roads and no motorized trails.
- The Kaibab National Forest is currently in the process of publishing a motor vehicle use map for the Tusayan Ranger District, which will have a similar result. The North Kaibab Ranger District is still involved in the travel management planning process, but will likely mirror other decisions with respect to restricting off-road vehicle travel and designating a portion of all existing routes.
- The Apache-Sitgreaves and Tonto National Forests are also currently in the process of travel management planning. Based on the status of these Forests, both include alternatives that would restrict off-road motorized use and designate a proportion of existing roads and trails. The Apache-Sitgreaves National Forest has a preferred alternative that would allow off-road motorized big game retrieval for elk and bear. The Tonto National Forest proposed action includes off-road motorized big game retrieval for elk and deer, but only in the forested portion of the Forest.
- The Bureau of Land Management is also undergoing travel management planning. Each field office is completing a comprehensive travel and transportation management program to comply with executive orders and Federal regulations requiring designation of routes by mode of travel and conditions of travel. The Lake Havasu Field Office has

released a series of alternatives for designation of routes. These alternatives would restrict off-road motorized travel and some high-clearance routes would be closed.

Implementation of Alternative 3 would result in additional closures on the Forest. These closures would incorporate the existing motorized closures that have occurred in previous years on the Forest, except for emergency closures such as those completed after the Schultz Fire. Motor vehicle restrictions and closures on the Apache-Sitgreaves, Kaibab, and Tonto National Forests would cumulatively add to those that would occur under this alternative, resulting in a cumulative decrease in access in public lands via motor vehicles throughout northern and central Arizona.

In addition to a decrease in public lands accessible by motor vehicle, the 2000 Renewable Resources Planning Act reported that "the proportion of privately owned forest land open to the public and free of charge has declined from 29 percent in 1979 to 23 percent in 1989 and 15 percent in 1996" (USDA Forest Service 2001). In Coconino County and Yavapai County, residential land area grew by 32.8 percent and 23.5 percent, respectively (Headwaters Economics 2011).

The development of private lands adjacent to national forests has been and will continue to result in decreasing access to national forest land and to natural areas that have since been developed. This decrease in access through and in private lands will contribute cumulatively with the reduced decrease in access to motorized use on public lands. In some situations, the cumulative magnitude of decrease in motorized access may become a factor in reducing the viability of public lands for certain traditional activities, such as hunting. This decreasing access to natural areas was one of the issues identified in a 2005 report in which lack of access was identified as a barrier to hunting (Arizona Game and Fish Department 2005).

Motorized Recreation Opportunities

This alternative would affect motorized trail opportunities. There are different types of motorized trails and those who prefer these different types would be affected differently under this alternative:

Opportunity for Single Track – This alternative would designate one interconnected loop of single-track trails identified in public comment. This includes the 20.5-mile Fort Valley Trail system. Other motorized single-track trail opportunities such as Wing Mountain, Airport Trail, Lenox Trail, and the Challenger Trail would no longer be open to motorized use. Other trails such as the Secret Trail would not be designated; however, portions of the Fort Valley Trail System were established as a re-route to this trail several years ago.

Opportunity for ATV Riding – In this alternative, over 2,500 miles of high-clearance level 2 roads would be designated as open to all vehicles, which would allow for ATV use. In some areas, such as the Mogollon Rim, many of the tertiary and secondary level 2 roads would be closed and the main roads would be designated for all vehicles, thus greatly reducing the interconnectivity of roads that can be used by non-street-legal ATVs.

This alternative would also include the 9.3-mile Munds Park motorized trail, which provides motorized recreation opportunity adjacent to the community of Munds Park under a previous planning process and decision. Many of the unauthorized routes used by ATVs and full-sized vehicles adjacent to other communities such as Rimrock, portions of Flagstaff, communities on

the Mogollon Rim (Starlight Pines, Goddard Estates, etc.), and Cornville would not be designated.

Opportunity for 4x4 Driving – This alternative includes designation of several routes popular for technical 4x4 driving (i.e., jeeping) including Lower Smasher Canyon, Red Tank Draw, and the 6.7-mile Casner Mountain Trail. Other unauthorized trails would not be designated, such as Upper Smasher Canyon.

This alternative would designate a number of miles of trails for different types of motorized recreation; however, it would particularly impact single-track riders and ATV riders that use some portions of the Forest, such as the Mogollon Rim. The reason for this is the amount of inter-connected single-track trail to be designated under this alternative (20.5 miles) would not meet the minimum number of miles needed for a satisfactory recreation experience (approximately 30 miles), based on surveys of riders in Colorado (Crimmins 1999).

Forest visitors that use ATVs in locations such as on the Mogollon Rim or east of Lake Mary Road and north of Mormon Lake would be restricted as well since most of the secondary and tertiary high-clearance vehicle routes and unauthorized routes would be closed in these areas. For ATV users that lack highway-legal vehicles or ATV users that do not have a license, access would be even more restricted since they would not be able to legally drive on routes designated as "open to highway-legal vehicles only," and as a result they would have very few opportunities for interconnected riding opportunities more than 10 miles in length.

Lastly, this alternative may affect all motorized users who use the forest for motorized recreation by concentrating all motorized use onto designated routes. Increased traffic and additional restriction on motorized use are known to be perceived as negative by OHV users and would reduce their satisfaction (USDA Forest Service 1999, Flood 2005, Hallo et al. 2009).

Motorized access to dispersed campsite locations is a major concern to the approximately 5 percent of the Forest visitors that use the forest in this way (USDA Forest Service 2009). Under this alternative, it is estimated that approximately 33 percent of existing regularly used dispersed campsites would be accessible to motor vehicles. In other words, approximately 66 percent of those inventoried campsites would no longer be accessible using a motor vehicle.

The remaining 66 percent of dispersed campsites could still be used for dispersed camping, but could not be accessed using a motor vehicle. The 300-foot-wide corridors designated along both sides of 581 miles of designated road and along one side of 32 miles of designated road for the sole purpose of motorized access to dispersed camping would accommodate some of the displaced motorized dispersed camping as evidence shows that most motorized dispersed camping occurs along Forest roads (USDA Forest Service 2008a). Others would find places to car camp on designated roads without designated corridors by parking alongside the road. Others may choose to park and walk in to a campsite.

The proposed strategy for access to dispersed campsites is identical for alternatives 3 and 4. The 581 miles of designated road and camping corridors along one side of 32 miles of designated road in these alternatives represents a departure from the present "open access anywhere" (exception being where closure orders prohibit camping or cross-country travel) policy reflected in Alternative 1, and would restrict camping from many popular sites throughout the forest. There would likely be ample space for a continuation of present dispersed camping practices in settings

that are desirable for most campers; but there would also likely be some unhappiness and inconvenience to people who can now drive to camp anywhere their vehicle can travel.

This alternative would also result in a concentration of motorized dispersed camping in the most desirable areas designated with dispersed campsites (areas with good scenic views, areas near water, areas near popular trailheads). This could affect forest visitors who camp by decreasing their satisfaction with camping due to crowding, increased traffic, and camping in areas that show more signs of anthropogenic change (e.g., loss of vegetative cover, litter, cut trees).

Not all hunters have the same preferences, and this alternative would benefit the experience of some hunters while decreasing the satisfaction of other hunters. By restricting motor vehicle use to designated routes and limiting off-road motorized big game retrieval to elk only in game management units 7W and 8, hunters that depend on or prefer to hunt with ATVs would likely be less satisfied. Many other hunters, however, may have an improved hunt experience due to less OHV disruption, a greater ability to get away from other hunters, and an increased likelihood of a successful hunt.

There are a number of sources that show that the number of people who want to participate in big game hunting in Arizona and throughout the country is decreasing (Holden 2011, USDI Fish and Wildlife Service et al. 2006, Brown et al. 2000). Though there is no causal evidence to explain why, there are several studies that show overcrowding, OHV disruption, and lack of adequate access likely play an important part in this decline (Arizona Game and Fish Department 2005, Responsive Management 2006).

This alternative would substantially decrease motorized use in several areas, including off-road travel associated with big game retrieval across approximately 95 percent of the Forest. This would have the effect of closing many areas of the Forest that have been established and supported by hunters in the past (Burbridge and Neff 1978). There is also evidence to suggest that decreasing motorized access would decrease the perceived “problem” of crowding, by decreasing the hunter-to-prey ratio away from roads (Gratson and Whitman 2000) and by decreasing the likelihood of OHV disruption. In other words, this alternative would be most successful at managing the behaviors of other hunters that result in user conflict. According to a hunter satisfaction study of deer hunters in Tennessee, “Management of other hunters is also important to hunter satisfaction and efficient wildlife management. Crowding and inappropriate behavior of other hunters detracted considerably from the overall satisfaction of hunters…” (Hammitt et al. 1990).

Lack of adequate access to reach desired hunting areas and to retrieve prey is also important to hunter satisfaction. This alternative would decrease the ability of hunters to access isolated parts of the forest where game thrive and would limit their ability to retrieve downed game for meat. While studies show that most hunters participate in hunting for recreation, approximately one quarter of hunters participate for meat (Duda et al. 1995). For these hunters, reduced access from this alternative would result in an impact and decrease in satisfaction.

Lastly, this alternative may result in crowding for some hunters that choose to hunt near designated routes or those hunters that have a very strong preference for motorized game retrieval. Alternative 3 would have the effect of concentrating motorized use on a fewer number of roads. Many hunters who cannot physically travel far from roads or who choose to stay near designated roads due to restrictions on motorized game retrieval would likely be crowded by

higher levels of vehicular traffic on the roads and by other hunters in the same proximity. This would limit satisfaction for these hunters.

Cumulative effects to motorized recreation opportunities are based on other activities that would limit motorized recreation opportunities in other areas of northern and central Arizona over the next several years. The primary effects of Alternative 3 on motorized recreation opportunities would be to limit these opportunities and result in less user satisfaction because of crowding and an inability to find solitude. Similar efforts to restrict off-road vehicle use and designation of a route and trail system on adjacent public lands including the Kaibab National Forest, the Apache-Sitgreaves National Forest, the Tonto National Forest, and the Havasu Field Office of the BLM have recently or are likely to occur in the next several years. This would result in a cumulative effect of increasing the concentration of forest visitors and thus crowding along designated routes and areas. The more public lands that apply these restrictions, the greater the magnitude of crowding along these designated routes and areas.

In most situations, this cumulative impact would result in a decrease in satisfaction from those who prefer motorized recreation opportunities. Specifically, single-track trail riders that have previously used portions of the Flagstaff and Mogollon Rim Districts would likely have a very large decrease in satisfaction. This is due to recent travel management decisions on the Kaibab National Forest and current Wallow fire closures on the Apache-Sitgreaves National Forest, leaving little opportunity for motorized trail opportunities that allow for single track trails of adequate length with acceptable levels of other riders.

This alternative would also likely result in a decrease in satisfaction among those who have traditionally car camped on the Forest. Similar efforts to restrict off-road vehicle use and designation of routes and dispersed camping corridors on adjacent public lands would have similar effects of concentrating users to those discussed in the paragraph above. This would negatively impact the experience of most people who have traditionally used their car to access favorite camping locations as the attributes of solitude and scenic attractiveness of their surroundings would likely be compromised.

In most cases, hunter satisfaction would increase as a result of the motorized use restrictions and this may be added to by similar restrictions on adjacent public lands. A small number of hunters that are unwilling or unable to hunt away from roads would be cumulatively impacted by similar management actions on other public lands.

User Conflict

In Alternative 3, a very large number of roads that currently exist in areas to be managed for a primitive, isolated experience would be closed.

Table 9. Miles of routes and acres of camping corridors in recreation opportunity spectrum areas designated for nonmotorized uses

	Primitive	Semi-primitive nonmotorized
Miles of road	17.76	30.86*
Miles of motorized trails	0	0
Acres of camping corridors	203.07	338.84

*0.7 miles of roads in this category are unauthorized roads

The miles of road in primitive areas would be decreased by 68 percent and the miles of roads in semi-primitive nonmotorized areas would be decreased by 86 percent. The amount of unauthorized routes in semi-primitive nonmotorized areas would be decreased by over 97 percent. This alternative would close all motorized trails in primitive and semi-primitive nonmotorized areas.

This alternative would designate approximately 562 acres of motorized camping corridor in primitive and semi-primitive nonmotorized areas. This may result in some impacts to the values of solitude and the absence of the evidence of human activity in these areas of the camping corridors, but this is estimated to be a 75 percent decrease from current motorized dispersed camping in primitive and semi-primitive nonmotorized areas.

Implementation of alternative 3 would increase the diversity of recreation settings generally across the Forest. The reduction of road densities and designation of motorized dispersed camping corridors across the Forest would result in more opportunities to find solitude, challenge and risk, natural quiet, and the absence of the evidence of human activity; setting attributes generally associated with more primitive settings and with nonmotorized recreation activities. This would help move conditions toward forest plan objectives for recreation opportunity spectrum.

This alternative would likely decrease user conflict to the greatest extent between motorized users and nonmotorized recreationists, adjacent landowners, and other forest traditional users. Due to the scarcity of designated single-track trails and scarcity of designated motorized trails in areas currently heavily used for motorized recreation, this alternative may increase conflict among motorized recreationists. Studies have shown that managerial actions can have a very strong impact on managing perceived and actual conflict between users and thus enhance visitors' recreational experiences (Reichart and Arnberger 2010). By designating routes and areas for motorized use; impacts from noise, dust, and potential safety concerns are more predictable and thus result in less actual and perceived conflict between motorized and nonmotorized users (Hunt et al. 2009, Koontz 2005, Frost and McCool 1988, Fillmore and Bury 1978, Bury and Fillmore 1974).

The large majority of research on the social impacts of OHV use shows that the impacts between motorized users and other recreationists (including other motorized uses) are asymmetric; meaning that motorized users affect other recreationists more than they are affected by other recreationists and often this leads to displacement of nonmotorized recreationists (Adams and McCool 2009, Stokowski and LaPointe 2000; McCay and Moeller 1976, Lynn and Brown 2003). This impact is not only a result of the direct effects of motorized use such as noise and dust, but also from the indirect impacts of reduced vegetation, clearly altered natural areas from human activities, and the reduction in opportunities to view wildlife.

Due to these impacts, over the past three decades as motorized use has grown, nonmotorized recreationists have been 'losing' traditionally used areas (Adams and McCool 2009). Since it is clear that the large majority of users on the Coconino National Forest pursue nonmotorized activities and that the Coconino National Forest is used for nonmotorized activities that may be negatively affected by motorized use more than any other nearby national forest, this alternative would likely decrease conflict to a great extent between motorized and nonmotorized users.

In addition to conflict between motorized and nonmotorized recreation on the Forest, much of the conflict from motorized use is a result of motorized use on the Forest adjacent to private land where people live. In Coconino County, 25.6 percent of all homes are located adjacent to the Forest in the wildland-urban interface. This is more than double the percentage found in the region, and is almost seven times that found in other areas of the west. Yavapai County only includes 9.7 percent of homes built in the wildland-urban interface (Headwaters Economics 2011). In areas such as the Airport Trail, which occurs adjacent to the community of Ponderosa Trails (in Flagstaff) and in the Cornville area, unrestricted motorized use is currently resulting in conflict between landowners and motorized users (USDA Forest Service 2011). Establishing a designated system of roads, trails, and areas while restricting motor vehicle use outside of these areas is expected to decrease these conflicts.

This alternative would also reduce conflict resulting from motorized access and impacts to sensitive cultural sites on the Forest that are important to Native Americans and others. For example, in interviews with Tribal members, it has become apparent that the current policy of motorized use on the forest provides a great extent of access, but this access is resulting in impacts that conflict with the needs of some Native American tribes (see quote on page 42).

Motorized access to and impacts from motorized use on sites of cultural significance was one of the ‘minimization criteria’ considered during the route designation process. As a result, the large majority of routes leading to undeveloped cultural sites were not designated under this alternative. Conflict from impacts to areas with cultural importance, such as that expressed above, would decrease under this alternative.

This analysis looks at user conflict resulting from diminishing amounts of motorized recreation opportunities and access for motorized and nonmotorized users over the next 10 years in the northern and central Arizona region.

Recreation of nonmotorized and motorized use is expected to grow over the next 10 years as a function of population growth and due to the increasing trend of OHV use and nature-based recreation. This would increase recreation pressure and make it more likely for motorized and nonmotorized users to be competing for the same areas.

In addition, recreation pressure may increase in certain areas due to the diminishing amount of private land open to public use and continuing development along National Forest boundaries. For example, the 2000 Renewable Resources Planning Act reported that “the proportion of privately owned forest land open to the public and free of charge has declined from 29 percent in 1979 to 23 percent in 1989 and 15 percent in 1996” (USDA Forest Service 2001). In Coconino County and Yavapai County, residential land area grew by 32.8 percent and 23.5 percent, respectively (Headwaters Economics 2011). This would have the effect of adding recreation pressure from motorized and nonmotorized uses on Federal lands, which are surrounded by recently developed areas. In addition, it would also result in more landowners adjacent to Forest lands that could be impacted by motor vehicle use.

Furthermore, surrounding national forests including the Kaibab and Prescott have implemented travel management restrictions throughout these forests. On the Kaibab, these restrictions began in June 2010 on the Williams Ranger District. The Apache-Sitgreaves, Kaibab and Tonto National Forests currently include proposals that are likely to result in additional restrictions on motorized use starting in 1 to 3 years.

Large wildfires such as the 2011 Wallow Fire would have the effect of restricting all recreational uses in some areas for up to five years. This would again, likely displace motorized and nonmotorized recreational activities to surrounding national forest system lands, such as the Coconino National Forest.

Based on these potential changes, certain types of motorized use (specifically dispersed camping) and nonmotorized use is expected to increase on the Coconino National Forest over the next 5 years. This may result in increased user conflict among motorized users due to overcrowding due to the cumulative restrictions across the region. This overcrowding because of the cumulative effects of the aforementioned loss of access and restrictions would affect those most that are most restricted by this alternative – dispersed car campers, single-track riders, and ATV riders that prefer certain areas of the Forest. Overcrowding on routes and areas designated for these uses would likely increase user-conflict among motorized users.

These same changes would cumulatively increase the amount of nonmotorized opportunities in areas with primitive and semi-primitive nonmotorized characteristics across the northern and central Arizona region. Since over the next ten year period every national forest and surrounding public lands including Bureau of Land Management lands would have published maps which show where motorized use is allowed, the likelihood of conflict between those seeking motorized recreation experiences and those seeking nonmotorized recreation experiences would largely be minimized.

Alternative 4 – Direct, Indirect and Cumulative Effects

Effects from this alternative are similar to those discussed under alternative 3.

Forest Access

Under this alternative, approximately 81.5 percent of the Forest would be accessible to within ½ mile of a road outside of wilderness. Although a majority of routes on the Forest would not be designated, motorized access would only be decreased by less than 12 percent. An additional 14.8 percent of the Forest is between ½ to 1 mile from roads outside wilderness, and 0.5 percent of the Forest is more than 2 miles from a road outside of wilderness (see map 7 in map packet).

This alternative would have the affect of only slightly decreasing motorized access throughout the Forest, but effectively decreasing motorized access in a number of areas that are already somewhat isolated from motorized use.

Under alternative 4, approximately 2,142.8 miles of routes would be designated in high elevation forests and meadows, which would decrease the current miles of routes by approximately 55 percent. Approximately1,266.7 miles of routes would be designated in pinyon-juniper woodlands and desert vegetation, resulting in a decrease of 51 percent of open roads. In riparian forest and wetlands, approximately 8.9 miles of route would be designated, or a decrease of 65 percent.

Most of the roads to be closed in the high-elevation forests and meadows are in ponderosa pine vegetation types, yet this alternative includes fewer of roads to be closed in this vegetation type as a percentage of all vegetation types compared to alternative 3. High elevation forests and meadows are regularly used for access to campsites, hunting areas, and for motorized use of high-clearance roads. Access to these and other activities requiring motor vehicle use on high-clearance roads may be largely reduced as a result of this alternative.

Under this alternative, off-road vehicle use for retrieval of elk would be allowed up to 1 mile from all designated routes. Although there are some areas of the forest more than 1 mile from designated routes, it is a very small part of the forest and these areas include only undrivable terrain (such as bodies of water or deep canyon). As a result, this alternative would continue to allow the currently estimated 2,922 off-road vehicle trips for elk retrieval that are occurring across the Forest. This alternative would restrict off-road vehicle travel to retrieve deer, or other large game species including bighorn sheep, pronghorn, and bear.

Cumulative effects on forest access from this alternative would be the same as for alternative 3.

Motorized Recreation Opportunities

Effects to motorized trail opportunities under this alternative are similar to those for Alternative 3; although this alternative would designate slightly more miles (over 2,600 miles total) of high-clearance level 2 roads as open to all vehicles, which would allow for ATV use. In addition, this alternative would include a series of interconnected high-clearance roads and trails known as the "Long Route," which provides connectivity from the southern end of the Forest to the northern end.

Under alternative 4, motorcycle riders that prefer to ride on single-track trails would have over 70 miles of interconnected single-track trail, which would exceed the minimum number of miles needed for a satisfactory recreation day use or overnight experience (approximately 30 miles for day use and 60 miles for overnight), based on surveys of riders in Colorado (Crimmins 1999).

User Conflict

In alternative 4, a large number of roads that currently exist in areas to be managed for a primitive, isolated experience would be closed.

The miles of road in Primitive areas would be decreased by 49 percent and the miles of roads in semi-primitive nonmotorized areas would be decreased by almost 83 percent. The amount of unauthorized routes in semi-primitive nonmotorized areas would be decreased by over 94 percent. This alternative would close all motorized trails in primitive areas, but would only decrease motorized trails in semi-primitive nonmotorized areas by 17 percent (table 10).

Table 10. Miles of routes and acres of camping corridors in recreation opportunity spectrum areas designated for nonmotorized uses

	Primitive	Semi-primitive nonmotorized
Miles of road	28.2*	37.43**
Miles of motorized trails	0	10.81
Acres of camping corridors	203.07	338.84

* 0.3 miles of roads in this category are unauthorized roads

** 1.5 miles of roads in this category are unauthorized roads

This alternative would designate the 50-mile Challenger Trail, almost 11 miles of which is in semi-primitive nonmotorized areas on the slopes of San Francisco Mountain. Portions of this area currently receive high amounts of nonmotorized use, and may continue to be impacted by this alternative by the noise and sights of motor vehicle use.

Conflict from impacts to areas with cultural importance, such as that expressed in alternative 3, would decrease under this alternative. However, due to the location of the Challenger Trail in the San Francisco Mountain traditional cultural property, important sources of conflict would not be decreased for some tribes that consider the mountain as a sacred site.

Roadless, Wilderness and Special Areas

This section describes the affected environment and the environmental consequences for inventoried roadless areas, special areas, and wilderness. Roadless areas are inventoried roadless areas identified in the second Roadless Area Review and Evaluation (RARE II). Areas included in this report under the term “wilderness” include congressionally designated wilderness and proposed wilderness as defined by the Coconino forest plan revision process (USDA Forest Service 2011b). Special areas are forest plan management-area land allocations that include research natural areas, botanical and geological areas, environmental study areas, experimental forests, wildlife habitat areas, and wild and scenic rivers (see figure 8).

Affected Environment

Inventoried Roadless Areas

This analysis is not meant to have any bearing on the implementation of the roadless rule. This analysis identifies environmental consequences and potential impacts to roadless values, which are considered using the following indicators (USDA Forest Service 2001a):

- High-quality or undisturbed soil, water, and air
- Sources of public drinking water
- Diversity of plant and animal communities
- Habitat for threatened, endangered, proposed, candidate, and sensitive species and for those species dependent on large, undisturbed areas of land
- Primitive, semi-primitive nonmotorized, and semi-primitive motorized recreation opportunities
- Reference landscapes
- Natural appearing landscapes with high scenic quality
- Traditional cultural properties and sacred sites
- Other locally identified unique characteristics

Roadless Areas on the Coconino National Forest

Table 11 on page 56 shows the roadless area and the number of road miles currently known in those roadless areas. More information on each roadless area is included in the Special Areas specialist report.

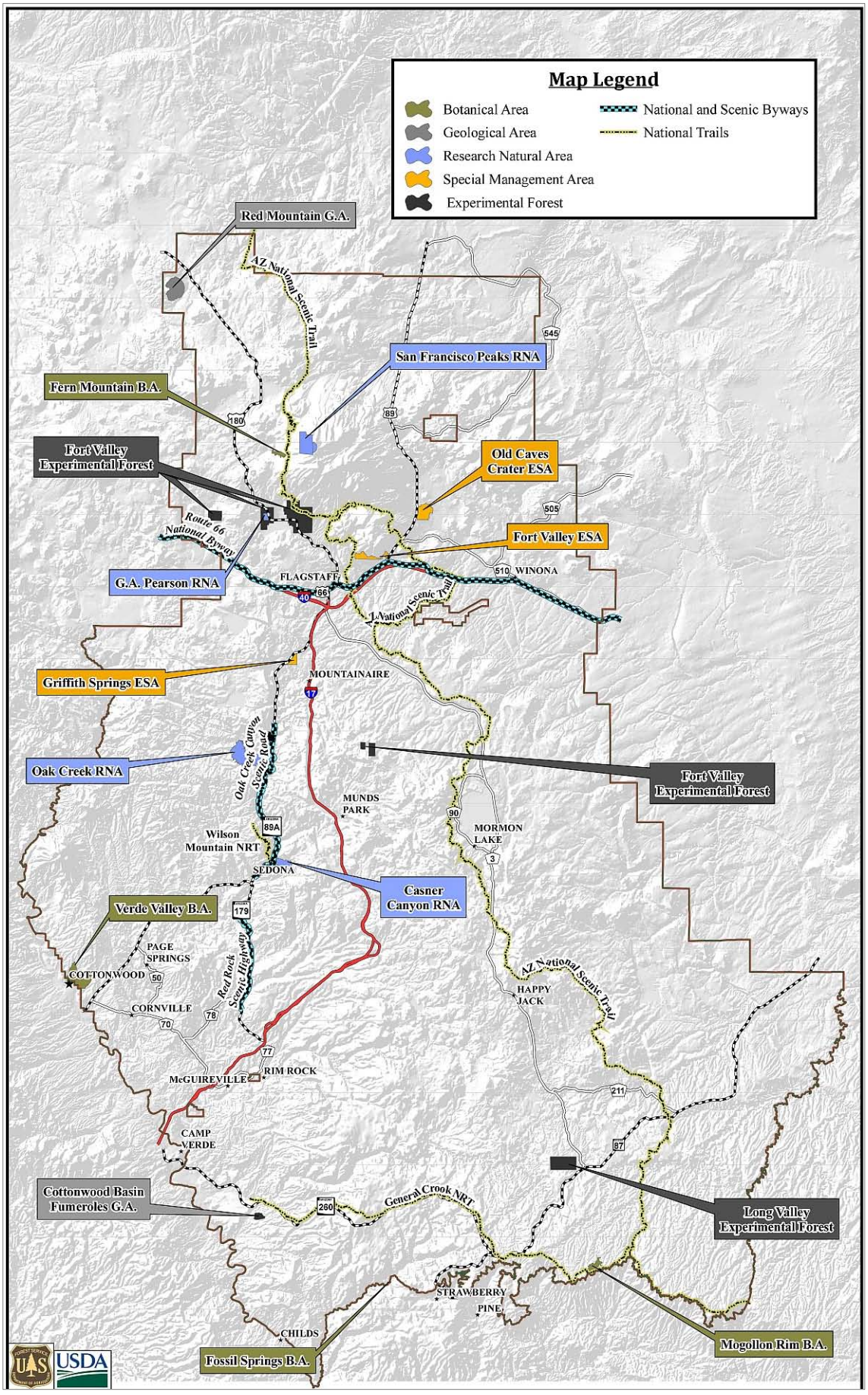

Figure 8. Designated special areas on the Coconino National Forest

Table 11. Inventoried roadless areas: acres and road miles*

Roadless area	Acres	Road miles
Padre Canyon	9,423	8.83
Lower Jacks Canyon	776	0.03
Jacks Canyon	2,855	0.40
Walker Mountain	6,375	1.78
Barbershop Canyon	1,310	0.29
Cimarron Hills	5,297	3.54**
Hackberry	17,864	6.03
Boulder Canyon	4,548	2.68
East Clear Creek	1611	0.83
Total	50,059	24.41

*There are no motorized trails in designated inventoried roadless areas

**Includes State Highway 260, which is the northern boundary of the inventoried roadless area

Special Areas

This analysis also includes a discussion of the potential effects to special areas, each of which is to be managed for one or more values based on their designation (table 12).

Research Natural Area Values: Research natural area values are specific to each such designated area, and may include selected aquatic, geologic, or vegetative elements. In the Coconino forest plan, management emphasizes protecting watershed conditions and maintaining natural ecological conditions in research natural areas so they are available for research and education that does not disturb the areas' natural condition. There is no harvest of timber products, including firewood, and research natural areas are closed to off-road driving (USDA Forest Service 1987, p. 194).

Botanical and Geological Areas: There are currently four botanical areas on the Coconino National Forest (1,746 acres) and one geological area (1,201 acres). Botanical and geological areas are managed to maintain, as nearly as possible, existing conditions and natural processes for public enjoyment, demonstration, and study. Interpretative and educational demonstration opportunities are emphasized and enhanced through selective facility development. Natural events are not rehabilitated, and off-road driving is prohibited (USDA Forest Service 1987, p. 194). In regards to motorized transportation, the forest plan states: "Manage roads adjacent to botanical areas and the Red Mountain Geological Area to prevent vehicular intrusion. Block and obliterate existing roads entering the area in the first decade," (USDA Forest Service 1987, p. 196).

Environmental Study Areas: Currently, there are three environmental study areas on the Coconino National Forest, making a total of 1,577 acres. The Coconino forest plan specifically identifies these areas for environmental educational opportunities for the public school system, youth organizations, and the public by maintaining the ecosystem and developing interpretive facilities. With respect to motorized use, the plan states, "Nonmotorized dispersed recreation is encouraged (USDA Forest Service 1987, p. 197)."

Experimental Forests: Experimental forests are areas administered by the Forest Service, sometimes with cooperators, to provide for the research necessary for the management of the land (USDA Forest Service 2008b). These areas have duel designations and management decisions do not fall under the Coconino forest plan.

Wildlife Habitat Management Areas: Wildlife habitat management areas are being considered under the Coconino forest plan revision process based on public input. Designation of a wildlife habitat management area would emphasize maintaining and restoring all native species in natural patterns of abundance and distribution and would consequently provide assurances and management direction necessary for long-term protection of the watershed's ecological integrity.

Table 12. Existing and potential special areas: acres, road miles, and miles of motorized trail

Existing special area	Acres	Road miles	Motorized trails (miles)
Elden ESA	350	2.40	0
Old Caves Crater ESA	761	8.80	0
Griffith's Spring ESA	320	0.95	0
Mogollon Rim BA	339	3.18	0
Verde Valley BA	1,209	0	0
Fern Mountain BA	186	1.44	0
Fossil Springs BA	12	0.04	0
GA Pearson RNA	150	2.87	0
Fort Valley EF	4,470	37.62	2.98
Long Valley EF	1,260	7.39	0
Red Mountain GA	1,201	0.76	0
Verde Wild and Scenic River	9,179	8.95	0
Total	19,437	74.4	2.98
Potential special area			
West Clear Creek RNA	1,007	0	0
Cottonwood Basin Fumeroles GSA	217	2.02	0
Cottonwood Basin Fumeroles BSA	1,850	7.99	0
Rocky Gulch RNA	926	1.26	0
San Francisco Peaks RNA Addition	141	0.23	0
East Clear Creek WHMA	19,751	177.16	0
Hospital Ridge WHMA	5,026	31.50	0
Jack's Canyon WHMA	17,040	39.40	0
Knoll Lake WHMA	1,013	21.92	0
Limestone Pasture WHMA	2,423	19.29	0
Pine Grove WHMA	13,601	39.74	0
Second Chance WHMA	1,444	8.49	0
Fossil Creek Wild and Scenic River	5,196	10.84*	0
Total	69,635	359.84	0
Total (Existing & Potential)	89,072	434.24	2.98

ESA = environmental study area; BA = botanical area; RNA = research natural area; WHMA = wildlife habitat management area; EF = experimental forest; GA = geological area; GSA = geologic study area; BSA = botanical study area

*Includes 2.20 miles of unauthorized roads

Wild and Scenic River Values: For a river to be eligible for wild and scenic river designation, it must be free flowing and, with its adjacent land area, must possess one or more outstandingly remarkable values. For the purpose of this analysis, wild and scenic river or outstandingly remarkable values are interchangeable. Outstandingly remarkable values are specific to each river segment any may include cultural, ecological, fish, geological, historical, scenic, recreational, wildlife, or other special and unique features. Currently, there are two designated wild and scenic rivers within the Coconino National Forest.

Wilderness Characteristics

The principal wilderness characteristics, as described in the Forest Service Handbook (FSH) 1909.12, that follow are generally, but not necessarily, listed in order of importance or desirability.

Natural

Ecological systems are substantially free from the effects of modern civilization and generally appear affected primarily by forces of nature. Effects of modern civilization are:

- the presence of nonnative species that alter the composition of natural plant and animal communities (such as nonnative plants, animals, fish, livestock, invertebrates, and pathogens);
- developments that degrade the free-flowing condition of rivers and streams (such as dams or other water diversions and impoundments);
- the presence of light pollution that degrades night sky quality and night sky quality related values;
- the presence of pollutants that degrade water quality; and,
- the health of ecosystems, plant communities, and plant species that are rare or at risk.

Undeveloped

Undeveloped refers to the degree to which the area is without permanent improvements or human habitation. A measure of undeveloped is the level of human occupation and modification including evidence of structures, construction, habitations, or other forms of human presence, use, and occupation.

Outstanding Opportunities for Solitude or Primitive and Unconfined Recreation

The area provides solitude or primitive and unconfined types of recreation, including a wide range of experiential opportunities such as physical and mental challenge, adventure and self-reliance, feelings of solitude, isolation, self-awareness and inspiration. Solitude is the opportunity to experience isolation from sights, sounds, and the presence of others from the developments and evidence of humans. The opportunity to experience isolation from the evidence of humans, to feel a part of nature, to have a vastness of scale, and a degree of challenge and risk while using outdoor skills are measures of primitive and unconfined recreation.

Special Features and Values

The area provides other values such as those with ecological, geological, scientific, educational, scenic, historical, or cultural significance. Examples include unique fish and wildlife species, unique plants or plant communities, connectivity, potential or existing research natural areas, outstanding landscape features, and significant cultural resource sites.

Many comments received on the Travel Management Draft Environmental Impact Statement included concerns that route designations near designated wilderness would result in unacceptable impacts. This report analyzes the potential impacts of route and area designations to wilderness values, but does not identify or address whether these impacts are appropriate. It is clear from the Arizona Wilderness Act of 1984, that wilderness designated under this law was not meant to preclude activities outside of the wilderness boundaries solely due to the potential impacts on wilderness values. In Sec 101, Part (d); the law states:

> "The Congress does not intend that designation of wilderness areas in the State of Arizona lead to the creation of protective perimeters or buffer zones around each wilderness area. The fact that nonwilderness activities or uses can be seen or heard from areas within wilderness shall not, of itself, preclude such activities or uses up to the boundary of the wilderness area."

Existing Wilderness Areas

Ten wilderness areas have been designated by Congress on the Coconino National Forest. More information on each wilderness area and the special attributes of each wilderness area is included in the Special Areas specialist report.

Potential Wilderness Areas

Thirteen potential wilderness areas have been identified on the Coconino National Forest as part of the Coconino forest plan revision effort. All 13 of these potential wilderness areas are analyzed in this report, since the Forest plan revision process is currently under public review and comment. More information about the potential wilderness areas is included in the Special Areas specialist report.

Table 13. Existing and potential wilderness areas: acres, road miles, and miles of motorized trails

Existing wilderness	Acres	Road miles	Motorized trails (miles)
West Clear Creek	15,502	0	0
Fossil Springs	10,436	0	0
Red Rock-Secret Mountain	47,581	0	0
Munds Mountain	18,100	0	0
Sycamore Canyon	28,884*	0	0
Strawberry Crater	10,404	0	0
Kachina Peaks	18,705	0	0
Kendrick Mountain	2,450	0	0
Wet Beaver Creek	6,173	0	0
Mazatzal*	2,589*	0	0
Total	**160,824**	**0**	**0**

Table 13. Existing and potential wilderness areas: acres, road miles, and miles of motorized trails

Potential wilderness			
Walker Mountain	6,377	1.78	0
Hackberry	26,043	12.46	0
Black Mountain	9,773	12.71	0
Cedar Bench	5,781	5.54	0
Tin Can	3,972	10.81	0
Abineau	415	0.53	0.90**
Davey's	1,779	1.31	0
Cimmaron-Boulder	15,305	4.90	0
Deadwood Draw	11,786	8.04	0
East Clear Creek	2,017	0	0
Barbershop	1,305	0	0
Railroad Draw	1,220	0.06	0
Strawberry Crater	10,404	0.72	0
Total	**96,177**	**58.86**	**0.90**
Total (Existing & Potential)	**257,001**	**58.86**	**0.90**

*Total acreage for the wilderness on the Coconino National Forest only.
**Undesignated motorized trail

Environmental Consequences to Roadless, Wilderness and Special Areas

This section describes the environmental consequences on inventoried roadless areas, designated and potential special areas, and designated and potential wilderness areas. More details on specific acreages, road and trail miles for each area are contained in the project record. For clarity, the data included in appendix B has been summarized in narrative form below.

Alternative 1 – Direct and Indirect Effects

This alternative proposes no change to the existing management of motorized travel on the Forest; therefore, existing miles of routes in each area listed in table 11, table 12, and table 13 would remain. Cross-country travel off of National Forest System roads would continue to be allowed for any purpose, including motorized big game retrieval and dispersed camping, except in closure areas. Existing restrictions and closures to motorized travel would remain in place.

Inventoried Roadless Areas – This alternative would continue to allow vehicle use on 7,484 miles of system road, and 923 miles of known unauthorized roads. This would result in over 24 miles of roads in inventoried roadless areas, with approximately two-thirds of that amount occurring in the Padre Canyon and Hackberry Inventoried Roadless Areas. Continued road use in these areas would have an impact on roadless characteristics such as reference conditions, nonmotorized recreational opportunities, and wildlife habitat and water quality. Roads allow access to pristine areas and fragment native ecosystems into smaller and smaller patches of various sizes and shapes (Strittholt and Dellasala 2001). A study performed in the Klamath-Siskiyou Ecoregion found that roadless areas contain nearly four times more heritage elements (defined as plant and animal species of special conservation interest, including rare and endangered species) and a wider array of habitat types than designated wilderness areas (Strittholt and Dellasala 2001). Though this study was conducted in a different ecotype than those on the

Forest, the same general conclusions that roadless areas contain important habitat types and ecosystems can be applied here. Thus, continuing to allow use of roads within inventoried roadless areas would continue to impact and fragment those elements.

Wildlife Habitat Management Areas – Alternative 1 would include a total of 337.7 miles of roads in potential wildlife habitat management areas, with approximately half of this amount in the East Clear Creek Wildlife Habitat Management Area. The continued existence of these roads, and especially the regular motorized traffic that would likely continue to occur, would result in disturbance to wildlife and impacts to wildlife habitat. As a result, this alternative would reduce the likeliness of wildlife habitat management goals in these areas, but especially those wildlife habitat management areas with the most roads, including East Clear Creek, Jack's Canyon, Hospital Ridge and Pine Grove Wildlife Habitat Management Areas.

Special Management Areas – This alternative would also continue to allow motorized use on a number of roads in existing and potential special management areas. Specifically, the Fern Mountain Botanical Area includes over two miles of road, the Mogollon Rim Botanical Area includes over three miles of roads, and the proposed Cottonwood Basin Fumeroles Botanical Special Area includes approximately eight miles of road. Continued regular use of these roads would impact the ability to reach management objectives of maintaining these areas as botanical reference areas because continued motorized use would increase the potential for establishment of invasive species and would allow for regular access, which may result in impacts to sensitive plants. Other special areas with more than a couple miles of roads include the Fort Valley Experimental Forest and Long Valley Experimental Forest. Impacts to these areas from current road use are limited due to the management of these areas as experimental and education areas.

Potential Wilderness Areas – Alternative 1 includes a total of 59 miles of roads in potential wilderness areas. Potential wilderness such as Cedar Bench, Deadwood Draw, and Cimarron-Boulder have approximately 5 to 10 miles of roads with regular motorized use, and potential wilderness areas including Black Mountain, Hackberry, and Tin Can include over 10 miles each of open road. These roads are expected to continue to receive motor vehicle use, which would impact wilderness values such as solitude, opportunities for primitive recreation experience, and possibly special features such as vegetation.

Wilderness Areas – In some areas where roads occur adjacent to existing wilderness, wilderness values may also be impacted. Motorized vehicles are barred from designated wilderness areas, but motorized intrusions into wilderness areas are becoming more common as people travel off-road in specialized equipment. This results in adverse impacts to natural resource values and wilderness resources. While this problem is most prevalent in wilderness areas around urban areas such as Sedona and Flagstaff, even more remote wilderness areas such as Strawberry Crater, Red Rock/Secret Mountain, and others are being impacted more by ATVs and other motorized vehicles, as unrestricted cross-country access allows riders to travel through general forest areas and often into wilderness areas where little enforcement patrolling or regulatory signing exists.

Existing wilderness such as Red Rock Secret Mountain Wilderness has over 100 miles of road within one-quarter mile of the wilderness boundary, 14 miles of which are unauthorized routes. Other wilderness areas such as Fossil Springs Wilderness, Kachina Peaks Wilderness, and West Clear Creek Wilderness have fewer miles of road, but still include over 20 miles within one-quarter mile of the wilderness boundary. Clear Creek and Fossil Springs Wilderness Areas are in deeply incised canyons where the sights and sounds of other humans would be very limited.

Kachina Peaks Wilderness is located in high-elevation dense forests where adjacent vehicle use may be difficult to discern. Regardless, the continued use of motor vehicles adjacent the wilderness boundaries may result in impacts to wilderness values by continuing to contribute noise and visual impacts to wilderness users.

Alternative 3 – Direct and Indirect Effects

Prohibition of Cross-Country Motor Vehicle Travel

This alternative would result in an approximate 69 percent decrease in the miles of roads in existing and potential special areas (including special areas, wild and scenic rivers, and wildlife habitat management areas). Approximately 300 miles would be closed, the majority of which fall within proposed wildlife habitat management areas (240 miles). This would result in a decrease in habitat fragmentation as closed roads rehabilitate, which would improve resource quality. A total of approximately 134 miles of road would remain open in special areas, so current impacts from roads (fragmentation, noise, resource damage, soil compaction, etc) would remain, though to a smaller extent than under the no action alternative.

In inventoried roadless areas, approximately 16.64 miles of roads would be closed, leaving 7.8 miles of roads open (a 68 percent decrease). In proposed wilderness, 80 percent of the current forest roads would be closed, leaving approximately 11.28 miles. This would further move inventoried roadless areas and proposed wilderness areas toward obtaining wilderness values and potentially receiving designation as wilderness areas in the future.

The addition of 30 miles of nonsystem (unauthorized) roads and 1.8 miles of previously-unauthorized motorized trail could focus motorized use into those areas, which may result in a higher concentration of noise, dust and other impacts associated with motorized travel. Impacts from these unauthorized roads would be isolated and would not result in adverse affects to wilderness values, inventoried roadless area characteristics, or special area resources as these routes already exist and receive some level of use.

In existing and potential special areas with designated routes, approximately 2,572 total acres would be allocated for camping corridors (see project record for specific special area acreages). The majority of those acres would occur within proposed wildlife habitat management areas (85 percent).

This alternative would result in approximately 724 acres of camping corridors within potential wilderness areas, which would result in localized impacts to wilderness character from loss of vegetation within regularly used motorized dispersed camping areas.

There are no potential wilderness areas, special areas or inventoried roadless area s in game management units 7W and 8 on the Forest, and thus there would be no off-road travel for elk retrieval in those areas under this alternative.

Alternative 4 – Direct and Indirect Effects

Prohibition of Cross-Country Motor Vehicle Travel

This alternative would result in an approximately 62 percent decrease in designated roads within existing and potential special areas, or closure of approximately 269 total road miles (including special areas, wild and scenic rivers, and wildlife habitat management areas). Approximately 165

miles of roads would remain in all existing and proposed special areas, which is 31 miles more than under alternative 3.

Under this alternative, the same amount of road miles would be closed in inventoried roadless areas as under alternative 3.

Impacts from designating these unauthorized roads would be isolated and would not result in adverse affects to wilderness values, inventoried roadless area characteristics, or special area resources. Previously designated OHV areas would remain open and would continue to provide opportunities for motorized recreation (Cinder Hills OHV). Providing a place for motorized recreation would also decrease the likelihood of motorized users trammeling unauthorized areas and reduce the chance of forest user conflicts.

Benefits of this alternative would be similar to those discussed under alternative 3, but to a slightly lesser extent as more roads would remain open and more motorized trails would be designated in special areas.

This alternative would have the same effects as alternative 3 from the designation of motorized camping corridors.

In special areas, approximately 60,656 acres would be designated for off-road vehicle travel for elk retrieval, with the majority within proposed wildlife habitat management areas (56,163 acres). Six of the seven proposed wildlife habitat management areas are within game management unit 5A. Off-road motorized use from motorized big game retrieval may have a negative impact on wildlife within those wildlife habitat management areas, including from noise and ground disturbance. However, effects from off-road travel for motorized big game retrieval would be seasonal and of short duration. There is a low likelihood of off-road travel for elk retrieval in the proposed Cottonwood Basin Fumeroles Geological and Botanical Areas as no elk habitat exists in those areas.

Inventoried roadless areas fall within five game management units: 5BN, 6A, 5BS, 5A, and 6A. Approximately 47,965 acres within inventoried roadless areas would be open to off-road vehicle use for elk retrieval, which is almost 96 percent of the total inventoried roadless area acreage. Effects from off-road travel would be seasonal and of relatively short-duration.

This alternative would result in almost 85 percent of the total potential wilderness areas being designated for off-road vehicle use for motorized big game retrieval, or approximately 81,623 acres. The 13 potential wilderness areas fall within four game management units: 7E, 6A, 5A, 6B, with the majority (eight) within 6A. However, there is a very low likelihood of off-road travel for motorized big game retrieval in 23,900 acres of (the proposed Hackberry Wilderness) as no elk habitat exists in that area.

This alternative would also allow for continued motorized use adjacent to other land uses managed for recreation and preservation such as the Walnut Canyon National Monument. This alternative includes approximately 121 miles of road adjacent to Walnut Canyon, approximately 10 miles of which are unauthorized routes. Although most of the visitor use in Walnut Canyon is located in places isolated from the sights and sounds of vehicle use, these routes may provide access to areas adjacent to the Monument for activities such as shooting, which could result in noise impacts and thus affect visitor experiences in the Monument.

Approximately 37 miles of system motorized trails and the 89 miles of inventoried unauthorized motorized trails would continue to be used. In addition, it is highly likely that under this alternative, many other existing unauthorized motorized trails would continue to be used and new trails would be established over time from continued off-road motorized use. There are no currently known system or unauthorized motorized trails in special areas, inventoried roadless areas, wild and scenic river corridors, or potential wildlife habitat management areas. This alternative would designate almost 1 mile of unauthorized motorized trail in the Abineau Potential Wilderness Area, which would have an impact on wilderness character by reducing opportunities to solitude, primitive recreation opportunities, and potentially increasing the potential for establishment of invasive species in this area.

Lastly, this alternative would continue to allow unrestricted off-road motorized use on approximately 1.4 million acres, which includes all areas of the Forest that are not closed with a closure order. Unrestricted cross-country travel would likely result in the greater impacts on roadless characteristics and may impact wilderness values in potential wilderness areas and existing wilderness areas. For example, much of the viewshed from the hiking trail in Strawberry Crater Wilderness includes areas open to motorized use (including off-road travel) where wilderness characteristics are regularly compromised from the sights and sounds of humans including OHV noise, dust, and tracks.

Unrestricted cross-country use may also impact proposed special areas such as Cottonwood Basin Fumeroles Botanical Special Area by direct impact to plants or increased risk of establishment of invasive species. Continued cross-country travel may also impact surrounding land uses such as the Walnut Canyon National Monument or Wupatki National Monument by creating noise or dust or facilitating activities that result in recreation conflict (e.g., shooting, firewood collection) adjacent to the monument boundaries.

Cumulative Effects of All Alternatives

Projects on the Forest's Schedule of Proposed Action (the agency schedule for land-management activities) for the period up to June 2011 were considered for the cumulative effects analysis as reasonably foreseeable actions. Additionally, although the Four Forest Restoration Initiative is still in the early planning stages, it is a large-scale forest restoration project that has recently published a proposed action. Although there may be temporary roads built associated with forest health treatments, the overall goal is likely to reduce miles of road in project areas by obliterating some nondesignated routes and rehabilitating temporary roads after treatment.

The greatest potential threats to maintaining roadless characteristics, as described in the 2001 Roadless Rule, are road construction, reconstruction, and timber harvesting (USDA Forest Service 2001a). These activities pose disproportionately greater risks of altering and fragmenting natural landscapes at regional and national scales (Roadless Area Conservation Rule, Final Environmental Impact Statement, Vol. 1, p. 1-15 to 1-16). Therefore, consideration of cumulative effects resulting from present and foreseeable future activities was limited to proposals to construct or reconstruct roads or harvest timber within inventoried roadless areas. There are no proposals to harvest timber within inventoried roadless areas in the Schedule of Proposed Actions.

Alternative 1 would result in the greatest direct and indirect impacts to roadless characteristics, and thus this alternative would also contribute to a cumulative impact on these characteristics in

specific areas on the Forest. Current conditions in some inventoried roadless areas include a growing network of unauthorized roads, such as the lands adjacent to the 708 road, which leads down to Fossil Creek. The 708 road is bordered on the east by the Cimarron Hills Inventoried Roadless Area and on the west by the Hackberry Inventoried Roadless Area. The rough terrain does limit vehicular traffic, but over the past several decades, a network of spur trails to campsites has developed in the adjacent inventoried roadless areas. Ongoing projects such as the Fossil Creek Wild and Scenic River Comprehensive Management Plan are expected to include additional restrictions on overnight camping and vehicle use. This wild and scenic river plan may increase the amount of dispersed camping use on the Hackberry and Cimarron Hills inventoried roadless areas (which under Alternative 1, would be open to off-road vehicle use), thus impacting inventoried roadless area characteristics such as solitude, natural diversity and scenic beauty along NFS Road 708.

The East Clear Creek Wildlife Habitat Management Area and Inventoried Roadless Area would be impacted from the lack of restrictions on off-road motorized use under Alternative 1. These impacts may grow as a result of sudden restrictions in motor vehicle access on a large portion of the Apache-Sitgreaves National Forest, which has issued widespread closures as a result of the 2011 Wallow Fire. This would result in cumulative impacts by increasing numbers of motorized users in accessible areas where there are not motorized use restrictions in portions of the East Clear Creek Watershed.

Alternatives 3 and 4 would both result in a reduction in the miles of roads near all special areas, which would combine cumulatively with other similar planning efforts on adjacent forests to reduce contrasts with special area characteristics including solitude and remoteness (see Affected Environment), natural diversity, and special features and values. Removing roads adjacent to specially designated area boundaries, including wilderness, would aid in restoring natural conditions and processes to those areas (Cole and Landres 1996).

These alternatives would contribute to other recent and ongoing efforts to enhance solitude, diversity, and wildlife habitat. Restoration projects such as the Four Forest Restoration Initiative and the several other recent smaller scale forest restoration projects (Hart Prairie, Marshall, Upper Beaver Creek, Clints Well, and others) would all contribute to improving diversity of plant and wildlife species over the long term. The obliteration of nondesignated routes would also contribute to a more natural setting possibly enhancing primitive opportunities. Where adjacent national forests such as the Tonto, Apache-Sitgreaves, and Kaibab National Forests share a boundary with a designated special area or inventoried roadless area, travel management decisions restricting off-road vehicle use would contribute cumulatively to the attainment of these characteristics and values.

Scenic Resources

Introduction

This section of the Motorized Travel Management environmental analysis examines the extent to which alternatives respond to visual resources management direction established in the Coconino forest plan and the Travel Management Rule. The forest plan visual resources direction was established under the implementing regulations of the National Forest Management Act (NFMA).

In the development of the forest plan, the Forest's scenic resources were updated to analyze the current landscape's scenic attractiveness (landscape character inventory) and the public's scenic[8] expectations (landscape visibility inventory). Based upon these inventories, updates were made to adopt the current Scenery Management System, including designation of scenic integrity objectives for all forest land areas. The scenic integrity objectives establish minimum acceptable thresholds for landscape alterations from an otherwise natural-appearing forest landscape. For example, areas with a high scenic integrity objective are expected to retain a natural appearance; areas with a moderate scenic integrity objective may have some alterations, but remain subordinate to the characteristic landscape; areas with a low scenic integrity objective can have alterations that are not natural appearing. However, landform and vegetative alterations must borrow from naturally established form, line, color, or texture so as to blend in with the surrounding landscape character.

As the U.S. population increases and more areas become urbanized, the Forest Service has seen an increase in public concern about the natural scenic qualities of national forests. Based on studies performed by Dimberg, Ulrich, and Simons, the Forest Service's handbook on scenery management concludes that scenic attractiveness "benefits people who are recreating, traveling for business or are otherwise passing through wildland environments" (USDA Forest Service 2000).

The extent of which a natural landscape can be altered before reduction to scenic attractiveness occurs is dependent on how close the observer is in regards to the alteration. The farther the observer is from the alternation the less likely they are to notice the alteration. Viewsheds are divided into three distance zones: foreground (within 0 to ½ mile of the observer), middleground (from ½ mile to about 3 to 5 miles from the observer), and background (farther than the upper limit of middleground). Alterations to the natural landscape are more visible when seen in foreground than they would be when seen in middleground or background.

Travel ways and areas including roads, trails, campgrounds, and viewpoints represent linear or grouped concentrations of public viewing. Portions of landscapes visible from travel routes and areas are important to people for their scenic attractiveness. For scenery management, these are measured as concern levels, based on relative public importance, and are categorized as high, moderate, or low.

Roads and trails create linear alterations in landscapes that can be mitigated through design. Unmitigated, they may present uncharacteristic line qualities in forest landscapes. Landscapes with a dense canopy cover have some capability of masking these linear alterations; sparsely covered landscapes have less capability. The proliferation of unauthorized routes, particularly in sparsely covered landscapes, can adversely affect the scenery resources.

Effects Analysis Methodology

This evaluation applies current Forest Service scenery management methodology in conjunction with existing Coconino forest plan direction. Currently, the scenery resources of Coconino National Forest are managed through the application of the Visual Management System. The Forest Service adopted the Visual Management System in 1974. The culmination of the Visual

[8] The Forest Service handbook direction changed from the Visual Management System to Scenery Management System in 1995, and was revised in 2000. This report will refer to scenery instead of visuals, except in quotations from law, regulation or policy.

Management System was visual quality objectives (VQOs) prescribed in the forest plan for all lands within the Coconino National Forest. The visual quality objective classifications are: preservation, retention, partial retention, modification, to maximum modification. For a full synopsis of each visual quality objective, see National Forest Landscape Management: Volume 2, Chapter 1, The Visual Management System (USDA Forest Service 1974).

Per forest plan guidance "Review the VQO inventory as a part of project planning and make necessary corrections/refinements following field checking (Forest Service 2008, p.60)", the Visual Management System process has been updated as the Scenery Management System, which has been incorporated into forest plans and is outlined in detail in Landscape Aesthetics: A Handbook for Scenery Management (USDA Forest Service 2000). Full adoption of the Scenery Management System is to occur as each national forest revises its forest plan. The Scenery Management System has not been formally integrated into the Coconino forest plan because the current forest plan predates the 2000 Scenery Management System. However, this analysis employs the tools and techniques of Scenery Management System in accordance with national direction (USDA Forest Service 2001b).

The Scenery Management System is the result of a forestwide review of the visual quality objectives and thus meets forest plan guidance stating, "Review the VQO inventory as a part of project planning and make necessary corrections/refinements following field checking (USDA Forest Service 1987, p.60)." To ensure clarity, the following crosswalk between visual quality objectives and scenic integrity objectives is shown in Table 1.

Table 14. Crosswalk of terminology between visual quality objectives and scenic integrity objectives

Visual quality objectives	Scenic integrity objective	The Forest's scenic integrity as people perceive it
Preservation	Very high scenic integrity	Unaltered, complete
Retention	High scenic integrity	Unnoticeably altered
Partial retention	Moderate scenic integrity	Slightly altered
Modification	Low scenic integrity	Moderately altered
Maximum modification	Very low scenic integrity	Heavily altered
Unacceptable modification	Never an objective on National Forest lands	Unacceptably altered

The proposed alternatives have the potential to affect scenic resources. Compliance with the Scenery Management System was based on map review and on-the-ground knowledge of topography and vegetation of the area. This analysis uses scenic integrity objectives to determine if the alternatives meet forest plan standards and guidelines by comparing the degree of alterations from an otherwise natural-appearing forest landscape.

Affected Environment

Figure 9 and figure 10 show the distribution of moderate, high, and very high scenic integrity objectives across the Forest.

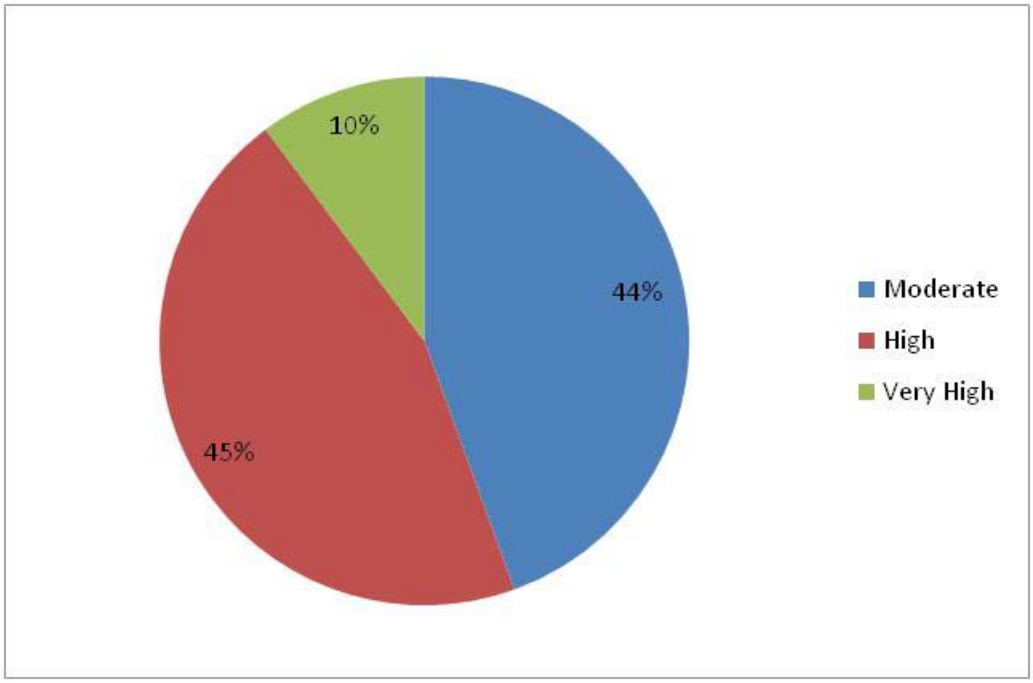

Figure 9. Percent distribution of scenic integrity objectives across the Forest (per May 2011 map, figure 10)

Natural appearing forests offer scenes valued as recreational settings and backdrops to nearby communities. Such settings contribute to the well-being of many individuals in today's complex and fast-paced society. Conservation of the naturally established scenic character of these settings is the primary goal of visual and scenery management on all national forests. Scenic attractiveness is particularly important to those who enjoy the views from Forest roads, trails, and viewpoints. Scenery also contributes indirectly to local quality of life, tourism and economic vitality, and the Forest's scenic heritage. According to the 2005 National Visitor Use Monitoring results for Coconino National Forest, the two dominant activities for the forest are hiking / walking and viewing scenery. Almost two-thirds of the visits have one of them as the primary activity for the visit (USDA Forest Service 2009). The top five activities are shown in figure 11 on page 70.

The Coconino National Forest is a recreation destination for local residents, regional, national and international travelers. The Forest represents a component of the local community's scenic identity and image, contributing to its "sense of place" as well as contributing to the visitor experience associated with tourism. In addition, private landowners with property within or next to the Forest view the surrounding landscape and are likely to consider it important to their quality of life. The approximate 1.8 million-acre Coconino National Forest is one of six national forests in Arizona. It has landscapes ranging from semi-arid desert to alpine tundra. People are drawn to the Coconino for its diversity, including settings that provide: open spaces, remoteness, tranquility, inspiring scenery, and an escape from the desert heat in the summer at higher elevations or along riparian areas, or pockets of warmth in the southern vicinity during the winter. With elevations ranging from 2,600 to over 12,000 feet, the scenery is diverse with views and scenes involving mountains, pine forests, aspen stands, grasslands, lakes, streams, cinder cones and lava flows, rugged canyons, and unique red rock escarpments and formations.

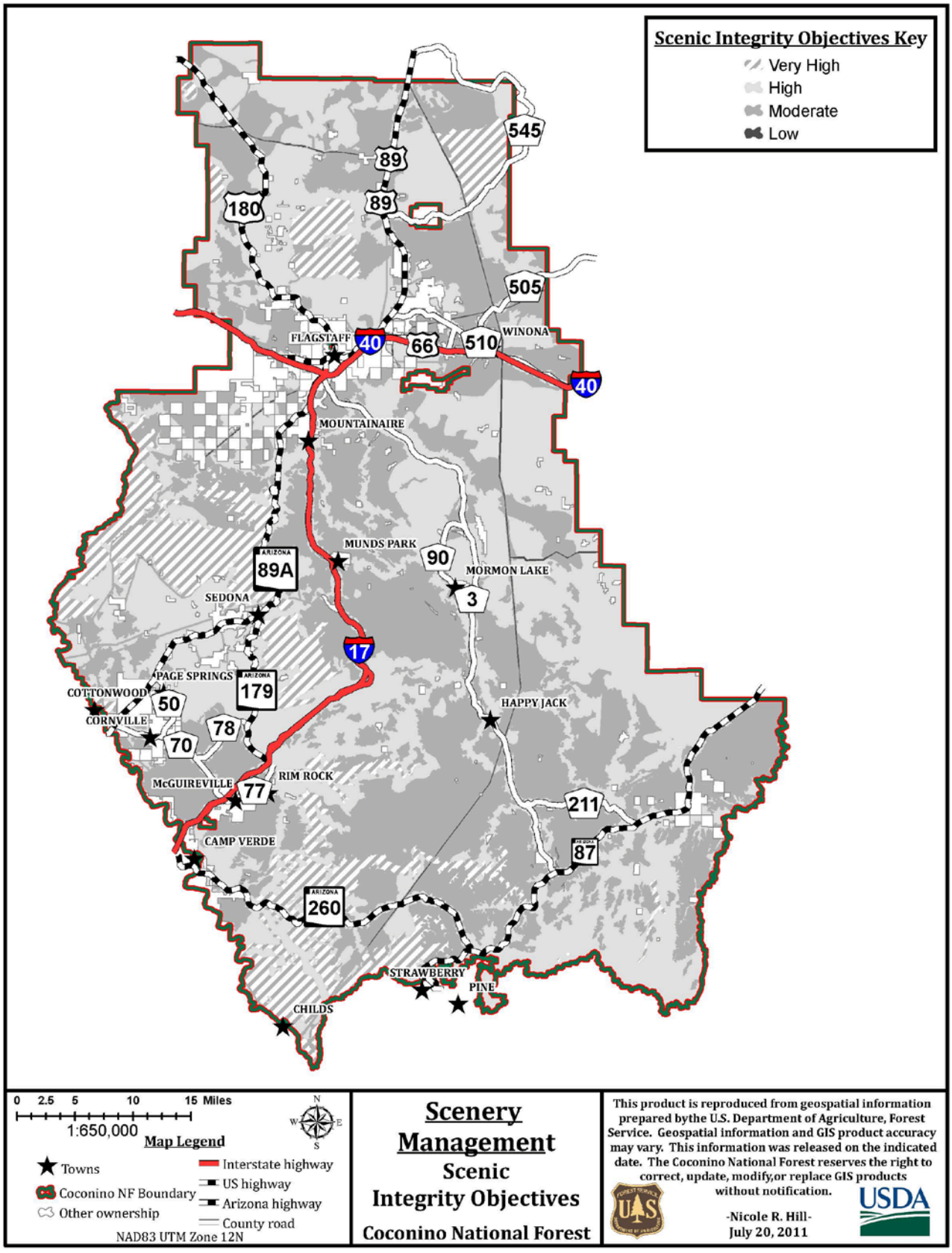

Figure 10. Scenic integrity objective inventory map for the Coconino National Forest (May 2011)

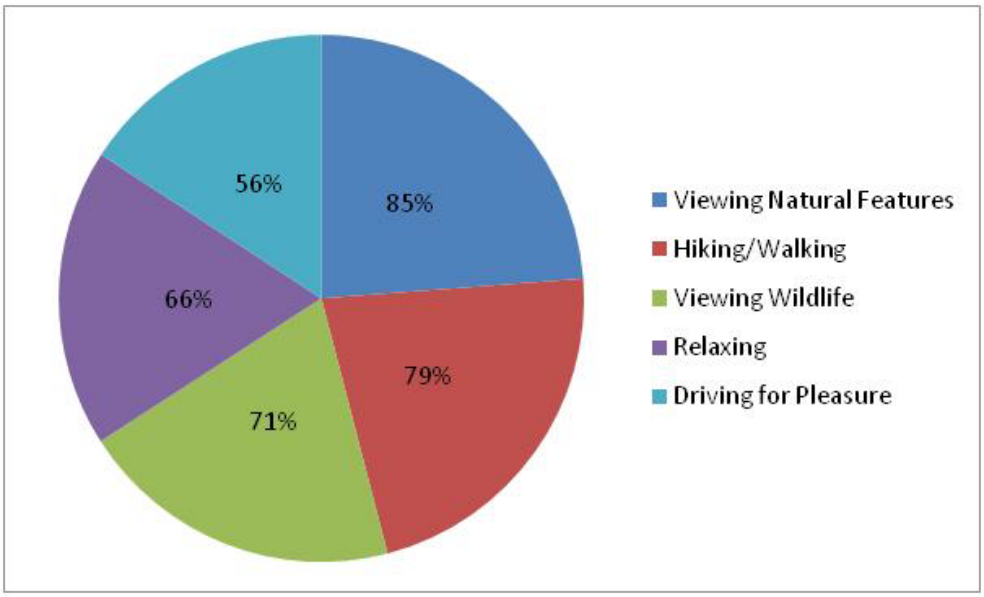

Figure 11. Percent participation in recreation activities on the Coconino National Forest

Visual impacts from unmanaged off-highway vehicle use include unauthorized roads and trails, which often create linear alterations on the landscape and have the potential to be viewed by forest visitors looking from other locations or by forest visitors traveling on the route itself. Unauthorized roads and trails, when viewed from another location, have the potential to create negative visual impacts by introducing uncharacteristic linear features on a nonlinear landscape with color contrasts from exposed soils on the routes and high use areas, and texture changes from trampled or destroyed understory vegetation.

Depending on topography, vegetative screening, and context of the viewer, these features may or may not be noticeable. The duration of view also depends on the context of the viewer. For example, one traveling at high speeds on an interstate highway will likely have lesser duration of view than one traveling at a slow speed on a forest road. One hiking or walking on trails will have a longer duration of view than one riding a bike or horse. And those at stationary viewpoints have the longest view duration. Additionally, the extent of which a natural landscape can be altered before there is a perceivable reduction in visual quality is dependent on how close the observer is in regards to the alteration. The farther the observer is from the alternation, the less likely they are to notice it (depending on scale of alteration).

Forest landscapes have been altered by both human activities and natural processes. Notable impacts from human activities are the result of past logging and associated road building. The majority of the existing transportation system in the landscape characterized by ponderosa pine was developed for timber harvesting. After harvesting-related activities were complete, few of these roads were effectively closed or decommissioned. Early transportation systems outside of the ponderosa pine community are a result of settlement patterns and ranching. Transportation planning in recent years can be linked with tourism and recreation use.

Off-road Motorized Use – Based on current management, between 1,434,592 acres and 1,496,246 acres are open to motorized off-road travel, depending on the time of year. However much of this area is topographically inaccessible to motor vehicle use. The Coconino National

Forest has also specifically designated the 13,711-acre Cinder Hills OHV area for off-road motorized use. Outside of this designated area, off-road motorized use is most common in open, generally flat terrain such as meadows (Mogollon Rim), grasslands (Anderson Mesa), and sparsely vegetation pinyon-juniper or ponderosa pine woodlands (Jacks Canyon, Cornville). Many of these areas include portions of land that are rated high or very high for scenic integrity. Since meadows, grasslands and open pinyon-juniper vegetation types are relatively open landscapes with emphasis on middle-ground and background viewscapes, they are also very susceptible to decreases in visual quality from off-road use.

Motorized Dispersed Camping – Many recreationists enjoy driving vehicles off of Forest roads to participate in dispersed camping. In addition to using the many forest system high-clearance roads, visitors use existing unauthorized routes and create new routes to find areas to camp. These recreation access points are often delineated by a short route off a main road and an open, cleared area with an established fire ring.

Coconino National Forest land managers have noticed a trend for dispersed camping relative to seasonal use. In the warmer summer months, there is increased dispersed camping on the north end of the Forest, as visitors seek the cool weather found in the higher elevations. It is estimated that two out of every three people who camp in the Forest camp in ponderosa pine and mixed-conifer vegetation (See Appendix 1 in Scenic Resources specialist report), which primarily occurs at 7,000 feet and above. Conversely, during cooler times of year (winter and shoulder seasons) dispersed motorized recreation is more popular in the warmer, lower elevations. It is estimated that about 20 percent of forest camping occurs in pinyon-juniper woodland and desert vegetation types (Appendix 1 in Scenic Resources specialist report), which generally occur in lower elevations. Additionally, during hunting seasons, there is a trend for use of large motorized dispersed hunt camps across the Forest, but especially in ponderosa pine forest types (Appendix 1 in Scenic Resources specialist report).

Dispersed camping, especially when involving a motor vehicle, has the effect of removing vegetation alongside roads, potentially resulting in a less natural appearance in the foreground of Forest visitor's view of the forest. In areas that receive high use the effects of dispersed camping can result in loss of vegetation, presence of litter, or campfire rings, hacked trees, or other more permanent visual impacts. In areas with more isolated and infrequent use, loss of vegetation is usually limited although these areas often do have campfire rings present.

Motorized Game Retrieval – Many hunters in Northern Arizona are accustomed to driving vehicles to scout for animals, access favorite hunting areas, and retrieve downed game animals. Hunters use existing and unauthorized routes, and drive cross-country to engage in these activities. According to a joint Forest Service and Arizona Game and Fish Department report on hunting patterns (Burbridge and Neff 1976), "After Labor Day, the fall hunt traffic begins, with many hunters scouting for the fall rifle big game seasons, in addition to a sizeable number of bow hunters afield. The heaviest traffic is in October and November during the turkey, deer and elk firearms hunts. After the end of elk hunt in early December, traffic again becomes very light."

Based on the existing policy of allowing motorized cross-country travel, between 1,434,592 acres and 1,496,246 acres, depending on the time of year, are available for off-road travel for motorized big game retrieval on the Forest. It is estimated that there are an average of approximately 2,922 off-road motor vehicle trips per year across the Forest for retrieval of legally killed elk. The large majority of this occurs in game management units 5BS, 5BN and 6A. Units 5BS and 6A are

mostly forested within ponderosa pine and mixed conifer vegetation types (Appendix 1 in Scenic Resources specialist report). Visual impacts from motorized big game retrieval in these game management units are most likely to occur in open areas such as meadows and grasslands where elk are common and soil compaction from vehicular use would occur. Hunt unit 5BN is made up of transition area ponderosa pine and grassland, grasslands, and high elevation lakes, all of which are susceptible to visual impacts from off-road travel for motorized big game retrieval. Areas that receive more regular off-road travel for motorized big game retrieval and other uses are the most likely to experience a long-term (longer than 1 year) reduction in visual integrity.

Designation of Unauthorized Roads – The designation of unauthorized roads may result in visual impacts depending on the location and visibility of the route from nearby viewpoints. The large majority of unauthorized roads considered for designation under alternatives 3 and 4 include access roads to dispersed camping areas, private lands, or other facilities. In general, these routes already exist on the landscape and visual impacts are pre-existing; thus designation of these routes would result in little additional impact.

Environmental Consequences to Scenic Resources

This section describes the direct, indirect, and cumulative effects of implementing each alternative on the scenic resources in the project area. As stated in the Scenery Management handbook, “Scenic integrity is a measure of the degree to which a landscape is visually perceived to be ‘complete.’ The highest scenic integrity ratings are given to those landscapes that have little or no deviation from the character valued by constituents for its aesthetic appeal. Human alterations can sometimes raise or maintain integrity. More often it is lowered depending on the degree of deviation from the character valued for its aesthetic appeal” (USDA Forest Service 2000).

Deviations from the aesthetic appeal and desired landscape character are disclosed as direct and indirect effects for each alternative.

Direct and Indirect Effects Common to All Alternatives

Existing roads and trails create visual lines on the landscape. It’s these scenic features we consider when evaluating effects to scenery from changes to the transportation system. Uncharacteristic line quality created by motorized cross-country travel and the establishment of unauthorized routes is the greatest impact to the visual resources from the proposed alternatives. Unauthorized routes can create changes to a naturally appearing landscape by introducing noticeable differences to the characteristic form, line, color, or texture of a landscape. The scale of these differences in context with the surrounding landscape provides a context for the severity of effects.

Vegetation types also influence changes to the landscape. Landscapes with a dense canopy cover have the capability of masking some linear alterations to scenery from roads and trails; sparsely vegetated landscapes have less capability to mask linear alterations. On the Coconino National Forest, landscapes made up of grasslands or desert scrub vegetation underlain with red or other easily visible rock are the most susceptible to visual impacts. Ponderosa pine and higher elevation forests are less susceptible to visual impacts from motorized use, but these areas are more vulnerable to visual impacts from motorized use in meadows, cinder hills, and in open, disturbed

areas such as burned lands. An increase in unauthorized routes, particularly in sparsely covered landscapes, can adversely affect the Forest's scenic resources.

Direct and Indirect Effects of Alternative 1

Under Alternative 1, all routes not currently in an area covered by an administrative closure order would remain open and off-road travel would continue to be allowed in almost 83 percent of the Forest. Continuation of motorized cross-country travel has the greatest effects on scenic attractiveness, the scenic importance of a landscape based on human perceptions of the scenic beauty, scenic integrity, and the degree of intactness of landscape character (USDA Forest Service 2000). Without being designed to address scenery concerns, unauthorized routes are more likely to erode, have ruts, and result in scars on the landscape (figure 12). Proliferation of unauthorized routes destroys vegetation, creates unnatural contrasts of bare ground to vegetation, and destroys or damages special landscape features such as wildflowers, grasses, shrubs, rocky outcrops, springs and water containments. The resulting creation of noticeable linear tracks and circular "doughnuts" through the forest do not naturally occur and do not mimic natural openings.

Figure 12. Impacts from off-road motorized use on the Mogollon Rim District in 2011

As such, creation of unauthorized routes conflicts with the desired conditions for scenery management. The characteristic landscape is degraded by repeated motorized cross-country travel, and with extensive occurrences over time, the scenic integrity is lowered, and may not meet forest plan scenic integrity objectives in some portions of the Forest.

Seasonal closures (i.e., Coconino National Forest wet weather policy) currently in effect help to limit the amount of rutting and erosion caused by motor vehicle use during wet seasons. This helps to protect scenic resources and results in better scenic integrity.

Under this alternative, cross-country motorized vehicle travel would continue. Unauthorized routes would continue to be used and new unauthorized routes would be developed. The effects of motorized cross-country travel and unauthorized routes that are created would not naturally

rehabilitate over time. Both the National Visitor Use Monitoring study for the Forest and the Arizona Comprehensive Outdoor Recreation Plan indicate visitation to the forest and motorized travel will continue and actually increase in the state and on the Forest (USDA Forest Service 2009; Arizona State Parks 2008).

To begin to quantify potential impacts, we conducted a GIS query comparing vegetation types, and inventoried scenic integrity objectives. The results are illustrated in figure 13. For this query, we assumed that open vegetation types (those without a tree canopy cover would display more effects to scenery than those with closed vegetation types (those with tree canopy cover). Using the potential natural vegetation types for the Forest, areas of grouped open and closed vegetation types and wetland were analyzed by scenic integrity objective.

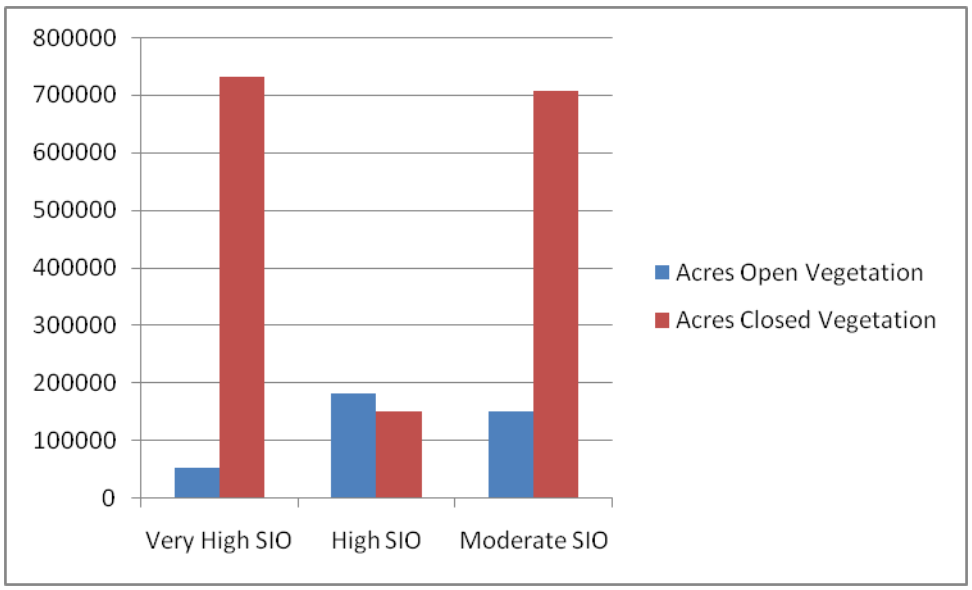

Figure 13. Scenic integrity objective (SIO) acres in grouped open and closed vegetation types (analysis details are in appendix 2 of the Scenic Resources specialist report)

Open vegetation types, as noted above, are most vulnerable for impacts to scenery from vehicular intrusions as the vegetation neither blocks vehicular access nor views of the routes created by repeated use. Motorized cross-country use in open vegetation types is more visible to Forest visitors for greater distances depending upon the slope of the land. The majority of scenic integrity objective acres are in closed vegetation types.

Very high scenic integrity objectives are assigned to designated wilderness; these areas are already closed to motorized and mechanized travel. A few other areas have characteristic landscapes that are “intact” and these have also been assigned with very high scenic integrity objective. Most of these areas have topographic features that minimize motorized cross-country use or are included in closure areas that prohibit motorized travel.

The unauthorized routes created by motorized cross-country travel establish uncharacteristic linear features and denuded soils compared with vegetated areas, which create contrast in color and texture. These effects would not meet very high and high scenic integrity objectives in limited areas in the foreground of open vegetation types up to 3 miles away in some instances. In

the closed areas described above, similar impacts to scenery would be found, but the closed canopies make these impacts visible for a shorter distance. The unauthorized routes that create uncharacteristic linear features and contrast of exposed soils would not meet the very high or high scenic integrity objective in limited areas of the foreground of closed canopy areas up to ¼ mile away.

In open areas of moderate scenic integrity objective, unauthorized routes would not remain visually subordinate to the landscape character being viewed. The uncharacteristic linear features and contrast of exposed soils would appear moderately altered. The unauthorized routes would not meet the moderate scenic integrity objective in limited areas of the foreground of open vegetation areas.

Based on the potential for increasing visual impacts from continued motorized cross-country travel and continuing use and creation of new unauthorized roads, this alternative has the greatest visual impact to the valued landscape character when compared to the other alternatives. It also has the greatest potential for a downward trend in scenic integrity across the Forest.

Motorized Dispersed Camping –Effects of motorized dispersed camping would include small and large group openings were vegetation has been denuded. Contrast in color and texture would be created between the bare soil and surrounding vegetation. This would result in visual impacts to areas of the forest where the natural capacity to regenerate is less than the impact resulting from use (e.g., meadows, grasslands, low vegetation, flat areas adjacent to lakes and streams, and areas with scenic views that are highly desirable camping spots). Highly desirable camping spots such as the meadows near the aspens in the San Francisco Peaks, openings adjacent to lakes such as Roger's Lake and Marshall Lake, and streamside areas along East and West Clear Creek and Fossil Creek often get such heavy use that vegetation does not successfully recolonize. Scenic impacts from dispersed camping areas would continue or grow slightly over time as a result of unrestricted motorized use caused by access dispersed camping areas.

Motorized Big Game Retrieval – Under this alternative, there would be no changes to motorized cross-country travel including motorized cross-country travel for the purpose of motorized big game retrieval.

Direct and Indirect Effects of Alternatives 3 and 4

Prohibition of Off-road Motor Vehicle Travel – Alternatives 3 and 4 would improve the scenic/visual quality of the Coconino National Forest over time because both would limit off-road travel and restrict motorized use to designated roads, trails, and areas. The prohibition of cross-country motorized travel would not be noticeable immediately since natural rehabilitation of trampled vegetation and most unauthorized routes would take between 1 and 3 years in forested sites and longer in less productive vegetation types (Cole and Monz 2004). The scenic impact from unauthorized routes may be noticeable until these areas naturally rehabilitate within 1 to 5 years, although some routes may not return to a natural appearance for over a decade. If unauthorized motorized routes intersect system roads or highways, a short duration view of a low impact, unauthorized route may be noticeable until the route naturally rehabilitates. In the long term, unauthorized motorized vehicle routes and impact areas would naturally rehabilitate.

The effects of this action on scenic resources would result in a more natural-appearing landscape. Overall, the landscape would have higher scenic integrity than currently exists, with less evidence

of human activity over time. The scenic integrity would be improved as impacted unauthorized routes revegetate and take on characteristics associated with higher scenic integrity.

Designation of Camping Corridors – Both alternatives would designate 300-foot-wide corridors along both sides of designated road for 581 miles and along one side of designated road for 32 miles, for the sole purpose of providing motorized access to dispersed camping. This would result in 43,313 acres of motorized dispersed camping corridors on the Forest. Riparian areas, meadows, archaeological sites, areas with sensitive species and other designated nonmotorized use areas have already been removed from consideration for dispersed camping corridor locations. The designation of dispersed camping corridors is expected to concentrate use and thus result in an increase in bare ground from impacts to vegetation in camping corridors (Cole and Monz 2004a).

Motorized dispersed camping corridors are located on approximately 20 percent of proposed designated roads in both alternatives. This designation would increase impacts to the scenic landscape where these corridors are designated. Within 1 year, there are likely to be direct or indirect impacts to scenery in these areas as a result of this alternative. There are many existing campsites within the camping corridors, and additional campsites are expected to be added in the corridors. Expected effects include increased unnatural openings and linear routes to new campsites. All of the designated camps would be within the immediate foreground of open travelways and likely visible to travelers in the camping corridors. Over time, the frequency of camps, combined with the scale of created openings, could result in degraded scenic attractiveness along the dispersed motorized camping corridors (see figure 14).

Figure 14. An undisturbed meadow adjacent to a popular dispersed camping spot under the pines off forest road 213. Many dispersed campsites have small impacts, but in open areas like this, repeated use can cause loss of vegetation and visual impacts.

As noted previously, many recreationists engage in dispersed camping. Many campsites found on the Forest are small in area, and have little disturbance. However, recreation specialists have noted a trend toward large groups of RVs camping together. These group camps can be larger than a football field in size, and repeated use results in large areas of bare soil where the vegetation has been denuded.

The smaller campsites better resemble the desired landscape character that includes openings and patchy vegetation. Creation of large group campsites is less acceptable since a larger area is impacted. Uncontrolled proliferation of campsites and user development of large campsites would cause a downward trend in scenic attractiveness; however, scenic integrity would be maintained since the scale of the impacts is small (about 2 percent of the forest).

Alternately, many dispersed camps outside of the designated camping corridors are expected to rehabilitate over time. Thus, designation of motorized dispersed camping corridors in Alternative 3 and 4 would have an overall and forestwide effect of reducing visual impacts in many areas of the forest and in important areas of the scenic landscape, such as meadows and riparian areas. These alternatives would likely result in improved scenic attractiveness and scenic integrity along routes that would be closed to dispersed camping as unnatural appearing motorized dispersed camps revegetate and blend into the surrounding landscape over time.

Designation of Cinder Hills OHV Area –Because there would be no change to the designation of the Cinder Hills OHV area, there would be no changes to effects to scenery.

Designation of Roads – Alternative 3 would close 4,317 miles of forest roads to public motorized use and would designate 3,097 miles of forest roads as open to motorized use. Alternative 4 would close 3,991 miles of forest roads to public motorized use and would designate 3,423 miles of forest roads as open to motorized use.

Roads closed to public use would still be available for occasional motorized use for administrative and permitted uses. Some closed roads would naturally rehabilitate over time due to lack of use; others would continue to be used and would not change. Closed roads that naturalize would result in landscapes and viewscapes across the Forest with less evidence of human activity over time. This would result in greater consistency with scenic integrity objectives across the Forest, especially those given a high and moderate rating.

A query of the miles of road in open vegetation types compared to closed vegetation types was also made in order to determine a relative quantity of roads in all scenic integrity objectives. Figure 15 and figure 16 illustrate the percent of road in each scenic integrity objective category for alternatives 3 and 4. This query provides a relative comparison of the effects that could be inferred for foreground areas in more visible open vegetation types and less visible foregrounds of closed vegetation types.

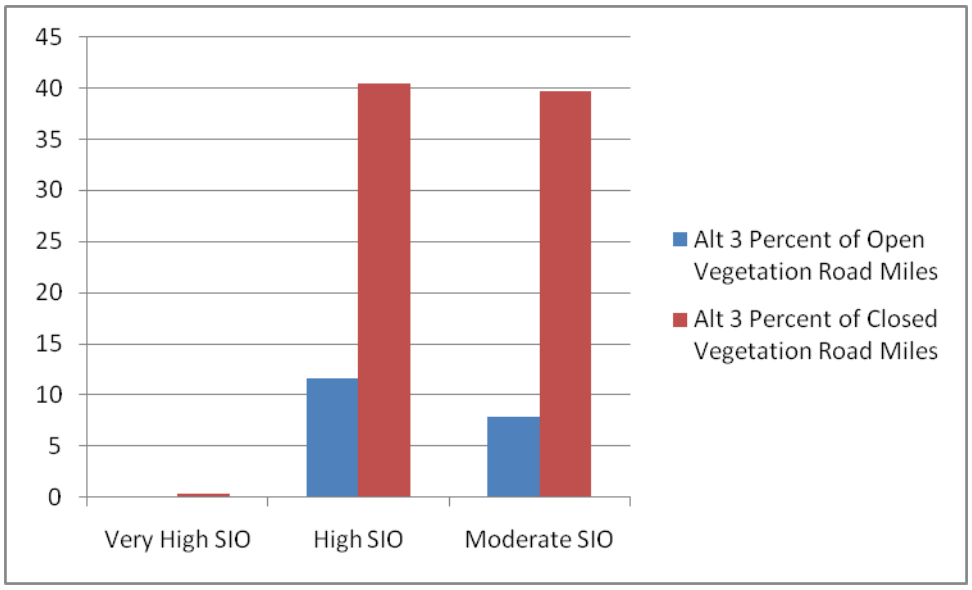

Figure 15. Percent of roads in alternative 3in assigned scenic integrity objectives with open and closed vegetation types

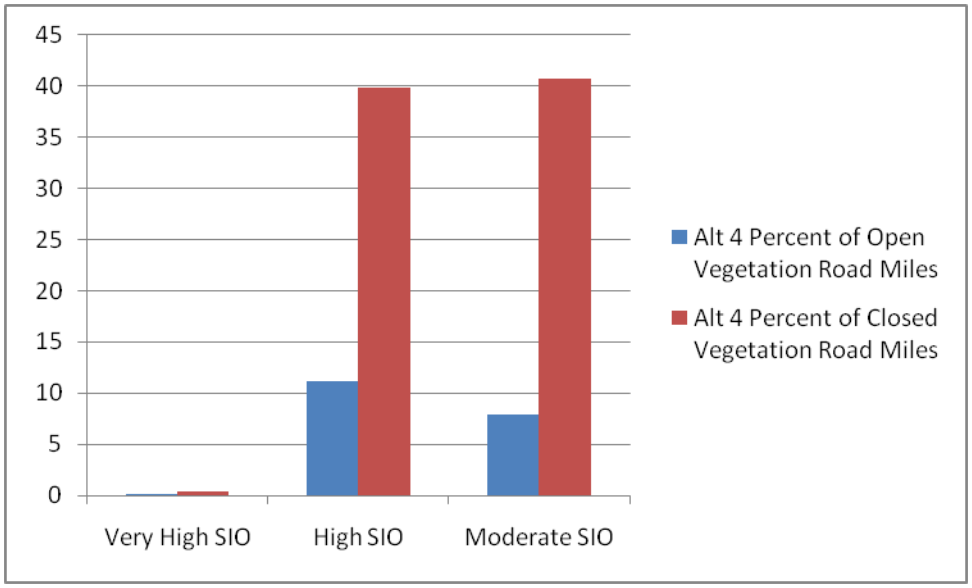

Figure 16. Percent of roads for alternative 4 in assigned scenic integrity objectives with open and closed vegetation types

As shown in the figures above, almost no roads are located in areas designated with a very high scenic integrity objective. Most forest roads in both alternatives are located in closed canopy vegetation types, with less than 20 percent in open vegetation types.

The variation of improvement to scenic attractiveness between the action alternatives would be slight, with alternative 3 showing the most improvement due to the increased potential for landscape restoration at a larger scale with fewer designated open roads proposed. Visitors use motorized vehicles to access the Forest to view scenery or to reach recreation destinations or

trailheads. In some areas, the differences between the two alternatives would be of consequence, specifically where alternative 4 includes designation of roads adjacent to main transportation corridors that alternative 3 does not. Below is a list of some routes that would be visible from main routes and recreation areas that would not be closed under alternative 3, but designated under alternative 4:

- 9008G, which is visible from Kendrick Park and Highway 180
- 133A, which is located in a drainage visible from Casner Park
- 151E, which is partially visible from the Hart Prairie Road (151)
- 300H and 9707F, which are visible from several ridges along the Mogollon Rim surrounding middle Leonard Canyon
- 9806C, which is partially visible from County Road 70 near Cornville
- 9381, which skirts the Fossil Springs Wilderness and is visible from the historic General Cook Trail and portions of State Route 260
- 605, 318 and 9733E; which can be partially seen from State Route 87
- 631, which is partially visible from Interstate 17 near Kelly Canyon
- 9246C, which is partially viewable from the Clear Creek Campground
- 211A, which winds up Yellow Jacket Draw and is partially visible from County Route 211

Though these routes would not necessarily disappear under alternative 3, they would result in local impacts to scenic attractiveness from regular use in alternative 4.

Unauthorized Routes – Both alternatives include designating 30 (alternative 3) to 35 (alternative 4) miles of unauthorized routes that currently exist. Table 15 shows the miles of unauthorized road in each SIO that would be added by alternative. Addition of these existing routes would have little impact since they add about one percent of additional miles to the open road system and are inconsequential at the Forest scale. By bringing these routes under Forest Service maintenance, there is increased potential to incorporate design features to improve compatibility with scenery objectives and visual quality.

Table 15. Miles of unauthorized route added to the open road system by alternative and scenic integrity objective

Scenic Integrity Objective	Alternative 3 Miles of Unauthorized Routes Added	Alternative 4 Miles of Unauthorized Routes Added
Very High	<1	<1
High	20	21
Moderate	10	14
Total	30	35

In the short term, unauthorized routes not added to the motorized system would still be visible from open forest roads or other viewpoints on the Forest. Over time, these routes would be less noticeable as vegetation reestablishes and the unauthorized routes regain natural appearing characteristics.

In summary, both alternatives would be beneficial to the scenic resource since some closed roads and unauthorized routes would naturalize and management of the designated open routes would improve slightly since there are fewer miles of road requiring intensive maintenance (see Transportation section). Scenic attractiveness would be expected to improve due to the restriction of motorized use to designated routes and the removal of motorized use on some routes that are contributing to erosion or appear as unnatural scars or deviations from the desired natural landscape character.

Designation of Motorized Trails – Alternative 3 would retain the existing 37 miles of designated motorized trails, and would add 1.8 miles in Lower Smasher Canyon for 4x4 vehicles. This route is located in an isolated part of the Forest in a winding, rock-strewn canyon, which is not visible from any nearby popular viewing points, routes, or recreation facilities. As a result, the designation of the 1.8 miles Lower Smasher Canyon Trail for motorized use would have no impacts on scenic attractiveness or scenic integrity.

Alternative 4 would retain the existing 37 miles of designated motorized trails and add 52 miles of unauthorized routes to the motorized trail system. The additional miles of motorized trail added would include 1.8 miles in Smasher Canyon, as noted in alternative 3, and the 50-mile Challenger Trail (also known as the Peaks Loop, outside of designated wilderness). Though this trail circumnavigates the lower slopes of the San Francisco Peaks, the large majority of the trail is not visible due to the forested vegetation that surrounds it. The trail is most visible where it meets with nearby nonmotorized trails in the Schultz Creek area. Thus, this alternative would result in a slight, but localized impact on scenic quality.

Motorized Big Game Retrieval – Alternative 3 proposes motorized big game retrieval in game management units 7W and 8 on the Coconino National Forest. Potential short-term effects would occur on 49,478 acres or about 5 percent of the Forest. Effects associated with motorized big game retrieval include trampling of vegetation and creation of temporary linear tracks through the Forest. These effects would likely last no more than one to three growing seasons, or until vegetation recovers enough to eliminate evidence of motorized travel (Cole and Monz 2004a). Most effects from the current condition would be removed (motorized cross-country travel for animal scouting and locations, establishing hunting camps, game retrieval, and other motorized travel). Per Arizona Game and Fish Department data (USDA Forest Service 2011), approximately 74 motorized game retrieval trips are expected and these would be widely scattered across almost 50,000 acres. There are few to no impacts to scenery and notable changes in scenic attractiveness are unlikely.

Alternative 4 proposes motorized game retrieval across much of the Forest for elk. Designated wilderness and areas under motorized closure orders would not be included in motorized game retrieval areas. There is a potential for short-term effects on up to 1,496,246 acres or about 82 percent of the Forest. Effects associated with motorized big game retrieval include trampling of vegetation and creation of temporary linear tracks. These effects would likely last no more than one to two growing seasons or until vegetation recovers enough to eliminate evidence of motorized travel. As in alternative 3, effects from motorized game retrieval would be reduced in comparison to the existing condition. Per Arizona Game and Fish Department data (USDA Forest Service 2011), approximately 2,922 motorized game retrieval trips are expected and these would be widely scattered across almost 1.5 million acres. The greatest impacts would occur on game management units 5BS and 5BN, which are some of the highest permitted elk hunt units and include open ponderosa pine and grassland vegetation. Except for potential scenic impacts from

off-road travel in this area, there are few impacts to scenic attractiveness and notable change in landscape settings is unlikely.

Fuelwood Gathering – Alternatives 3 and 4 would continue to allow retrieval of fuelwood. Current permitting conditions allow for motorized cross-country travel to access and load firewood. No motorized travel is permitted for fuelwood scouting. The most direct route in and out of the area must be used, and entry to the Forest is prohibited in wet conditions when rutting or road damage would occur. Roadside impacts to scenery such as trampling of vegetation would continue. In 2007, 3,303 fuelwood cutting permits were issued. Motorized cross-country travel would have minimal effects on scenic attractiveness since access to load fuelwood would vary by vegetation type and fuelwood desired and would be scattered across the Forest.

Cumulative Effects

The cumulative effects analysis for scenery considers the impact of the alternatives when combined with past, present, and reasonably foreseeable future actions and events. The "viewshed" is the unit of spatial analysis for determining cumulative effects for scenic resources. Viewsheds encompass lands generally seen from a travel route or use point such as a campground. How long effects will last (the temporal scope of analysis) is 20 years. This timeframe was selected because it is the longest anticipated length of time for natural rehabilitation of unauthorized routes (where achievable). In analyzing cumulative effects of motorized travel management, we considered effects from all present and reasonably foreseeable future actions that have potential for changing road density or creation of unnatural openings within the analysis area. These actions affecting scenic resources include utility corridor development and vegetation management; private development; new road construction, reconstruction, decommissioning roads, and adding roads to the Forest transportation system. Impacts from human activities are primarily the result of past logging, road building, range management and development of recreation facilities, and natural disturbances such as fire or tornado activity. Most of the strong scenery contrasts occur either in the background distance zone or out of sight of major highways, trails, or recreation areas.

Alternative 1 – Existing Condition

Since cross-country motorized travel would continue under this alternative, the unpredictable proliferation of unauthorized routes would continue. The proliferation of unmanaged dispersed motorized camping spots could increase over time and denude additional acres of vegetated land, thus creating additional unnatural openings that would contrast with native natural-appearing landscapes when seen from popular travelways or sensitive viewpoints.

These visual impacts would combine with activities such as the development of new powerlines. For example, there is the Sandvig-Young Powerline and East Flagstaff Substation, the potential development of a powerline along NFS Road 125 for the Grapevine Wind Power Project, and additional vegetation management under the 345 kilovolt transmission line that traverses the Forest. The proliferation of unauthorized roads would result in a cumulative effect with continued vegetation management under existing powerlines in the northern part of the Forest, where the Cinder Hills landscape can be viewed from the many high vantages surrounding the Flagstaff area.

The viewshed that includes the open grasslands of Anderson Mesa is mostly viewed from forest roads through this area and would be cumulatively impacted by development of a powerline along NFS Road 125, continued use of unauthorized roads, and increased areas of bare soil in popular camping spots such as along Marshall Lake.

The viewshed within the Forest along the Mogollon Rim are mostly viewed along forest roads and highways. This viewshed is comprised of views of small meadows, which may be impacted by the establishment of unauthorized roads and bare soil from motorized camping. Vegetation management under existing power lines, wildfire, and tornado damage would cumulatively impact this viewshed by altering its natural appearance.

The viewshed of the red rock landscape in and around Sedona is likely to avoid most visual impacts from this alternative because of existing limitations on motorized cross-country travel and overnight camping. Vegetation management under existing powerlines would cumulatively impact this viewshed by altering its natural appearance. Portions of the Forest south of Sedona, including viewsheds from areas surrounding Cornville to Beaver Creek, may experience cumulative scenic impacts from the addition of new subdivisions and commercial development on red and tan colored soils with sparse vegetation.

Wildfires are likely to result in the greatest cumulative impact to scenic resources. Though wildfires may be a natural part of the southwestern forest ecosystem, high-severity large-scale wildfires that remove the majority of vegetative cover from entire viewsheds would have a cumulative downward trend on scenic integrity by removing the characteristic vegetation and exposing unnatural linear features such as roads, trails, powerlines, etc.

Future activities on the Forest may also result in cumulative scenic impacts, or in some circumstances future activities may counteract scenic impacts. Any new road construction, reconstruction, decommissioning and/or adding roads to the Forest transportation system are expected to meet the scenic integrity objectives assigned to the management area in which they occur. Abandoning or decommissioning roads generally results in a more naturally appearing landscape, thus counteracting some impacts from the establishment of new, unauthorized roads. Although the majority of the Forest would continue to have a natural appearance, it is anticipated that the no action alternative along with the past, present, and reasonably foreseeable future actions would result in an increase in National Forest System lands that appear altered.

Alternatives 3 and 4

Both alternatives 3 and 4 would result in a beneficial effect by decreasing unnatural linear disturbances that could impact scenic integrity when visible from high use recreation areas, primary transportation routes, and scenic overlooks. The closure of thousands of miles of roads, unauthorized routes, and prohibition of cross-country travel outside of designated areas and restrictions on motorized big game retrieval would result in improvements to viewsheds across the Forest.

When combined with past, present, and reasonably foreseeable management activities and natural events, improvements in viewsheds due to implementation of travel management would counteract many of the effects on scenery. New utility development, vegetation clearing under powerlines, large-scale vegetation management activities, new road construction, reconstruction, and development of new subdivisions or commercial areas would have short-term or long-term impacts on individual viewsheds and may reduce the scenic attractiveness in localized areas.

Implementation of design features and monitoring with use of adaptive management would help lessen the impact of individual projects.

Wildfires are likely to result in the greatest cumulative impact to scenic resources. Though wildfires may be a natural part of the southwestern forest ecosystem, high-severity large-scale wildfires that remove the majority of vegetative cover from entire viewsheds would have a cumulative downward trend on scenic integrity by removing the characteristic vegetation and exposing unnatural linear features such as roads, trails, and powerlines.

Future activities on National Forest System lands may also result in cumulative scenic impacts, or in some circumstances future activities may counteract scenic impacts. Any new road construction, reconstruction, decommissioning and/or adding roads to the Forest transportation system are expected to meet the scenic integrity objectives assigned to the management area in which they occur. Abandoning or decommissioning roads generally results in a more naturally appearing landscape, thus counteracting some impacts from the establishment of new, unauthorized roads. Although the majority of the Forest would continue to have a natural appearance, it is anticipated that implementation of Alternatives 3 and 4 along with the past, present, and reasonably foreseeable future actions would result in a decrease in Forest lands that appear altered. Though these alternatives would result in localized scenic impacts where motorized dispersed camping corridors are designated, the overall effect would be to reduce impacts to scenic integrity by reducing unnatural visual occurrences throughout the Forest.

On private land or lands administered by other agencies, there is a potential for new development including subdivisions and commercial enterprises to cause changes in natural form, line, shape, color and texture. While the Forest Service cannot dictate or limit such new development, it would have a cumulative effect on scenic resources. When combined with travel management activities, such developments would result in a slight downward trend in scenic attractiveness when combined with alternatives 3 or 4.

Overall, the cumulative effects to the Coconino National Forest landscape would result in maintenance or a slight increase in scenic integrity than currently exists, with less evidence of human activity over time. Cumulatively, forest scenery is expected to meet forest plan scenery objectives.

Socioeconomic Analysis

Introduction

On the Coconino National Forest, motor vehicles are used for a number of recreational activities, as well as for other administrative and commercial activities. This section provides the economic context specific to the proposed action to manage motorized travel in the Forest. The general social and economic conditions and trend analysis has been done as part of the Coconino National Forest's economic and social sustainability assessment for the forest plan revisions, and will be not repeated here. This section describes motorized and nonmotorized uses on the Forest and highlights their changing conditions and trends within the affected region. Also, this section documents the economic contributions of the motorized uses of the affected region. The affected region was defined as the counties adjacent to the Coconino National Forest, which are all of Coconino, Yavapai, and Gila Counties in Arizona.

Methodology for Analysis

The National Visitor Use Monitoring Program provides reliable information about recreational visitors to National Forest System lands managed by the Forest Service at the national, regional, and forest level (see English et al. 2002 for a detailed description of the national visitor use monitoring methodology and analysis process). From January 2000 through September 2003, every national forest collected visitor use information using this methodology. Using a 5-year rotation, every national forest is now collecting information for a second time. This report is based on two existing national visitor use monitoring reports for the Coconino National Forest: 2001 report (survey period January 2000 through December 2000) and 2006 report (survey period October 2004 through September 2005, updated February 2009). The Impact Analysis for Planning (IMPLAN) and Input-Output (I-O) modeling used the 2006 national visitor use monitoring report without the 2009 updates. However, the differences between the original and updated reports are relatively minor and the modeled trends remain valid (see Appendix A in the Social/Economics specialist report for the 2006 national visitor use monitoring data).

In this report, regional economic contributions of motorized recreation were estimated in two different ways and the sources of differences in the estimates were examined. First, the economic contributions of motorized recreation in the Coconino National Forest to the regional economy were estimated using IMPLAN, based on the number of visits and the estimated average spending per travel party. To calculate average expenditures for motorized recreation use of the forest, recreational visits from the 2006 national visitor use monitoring report were apportioned for each activity among local and non-local visitors and day and overnight trips, then converted to a travel party basis based on the trip segment profiles published (Stynes and White 2006). Stynes and White (2006) strongly recommend against using a single spending average figure to represent all visitors to an entire forest or for all visitors engaged in a single activity, since developing a single spending average figure would mask important differences in spending by local and non-local users engaged in day and overnight recreation trips. For this report, five trip type segments were used for local and non-local (overnight) visitors, respectively, and include day trips, overnight trips (on and off forest), and trips for locals and overnight visitors where recreating on the forest is not the primary purpose of the trip. These trip types are based on trip type segments defined by Stynes and White (2005) to help explain differences in spending of distinct subgroups of visitors. Local visitors are defined as living within 50 miles of the recreation site. Non-local or overnight visitors are those that reported being away from home more than 24 hours on their trip. Although spending averages by individual forests have been published (Stynes and White 2006)[9], the forest-level spending averages are not reliable due to small sample sizes and not recommended for economic analyses (Eric White, pers. comm., January 3, 2008).

A 4-year average of the activity spending profiles (Stynes and White 2006) was applied to estimate the spending profiles of the motorized and nonmotorized uses of the Coconino National Forest. Stynes and White classified each national forest as a high, average, or low visitor-spending area to capture spatial variations in visitor spending among different forests. The Coconino National Forest was classified as a high visitor-spending area because the average spending for day and overnight trips to the forest (based on the national visitor use monitoring sample) was above the national average.

[9] According to the 2000 national visitor use monitoring survey, visitors to Coconino National Forest spent an average $125 per party per trip (sample size: 157; standardized $119). The spending average based on the 2005 national visitor use monitoring survey results will be published later this year.

Second, the economic contributions of motorized recreation in the Coconino National Forest were estimated using the 2002 report to the Arizona State Parks, titled, “The Economic Importance of Off-Highway Vehicle Recreation: Economic Data on Off-highway Vehicle Recreation for the State of Arizona and for Each Arizona County” (hereafter referred to as the Silberman Report). For the report, Silberman and his colleagues conducted a random telephone survey followed by mail questionnaires for Arizona residents to estimate the economic contributions of OHV recreation in Arizona (15,000 telephone surveys and 1,269 mail questionnaires from randomly selected Arizona households), and estimated total economic contributions of OHV recreation in the state using IMPLAN. Although the survey results are not specific to the Coconino National Forest, this study provides important primary information on the OHV-related expenditures, which include direct expenditures for motorized vehicles, tow trailers, related equipment, accessories, insurance and maintenance costs, and trip expenditures. The average economic contributions of OHV use were calculated per visit for each county and then those numbers were used to extrapolate total economic contribution of OHV use of the Forest to the affected region.

Input-Output Model

Input-Output (I-O) models estimate the economic linkages of industries within a regional economy in terms of the multipliers that indicate the size of the total effects of "new money" into the economy. For example, when the multiplier is 2, it means every new dollar that comes into the local economy ends up creating $2 worth of economic activities, which can be measured in terms of output, income, and employment. The model follows the flow of money and estimates economic “impacts” within a pre-defined economic area. For example, when visitors to the forest make purchases from businesses in the area (e.g., lunch at a local restaurant), it generates "new money" that can be calculated (direct effects). The effects of "new money" on the local economy, in turn, continue to multiply. The businesses buy more goods and services from other local businesses (indirect effects), and employees of the operations spend more money within the local economy for living expenses and other needs with their increased income (induced effects).When new money for materials and services is spent outside the region (leakage), the total effect (the sum of direct, indirect, and induced effects) will be smaller. If the majority of materials and services derive from within the region, the total effects will be larger. Thus, a multiplier is the ratio between total and direct impacts.

The Social/Economics specialist report contains more information regarding the methodologies used in this analysis, including further details of the I-O model and IMPLAN.

Existing Conditions

Description of the Affected Economic Environment

For the general social and economic conditions and trend analysis of the surrounding areas, see the Coconino National Forest's economic and social sustainability assessment for the Forest Plan revisions. According to the latest County Business Pattern report from the U.S. Census Bureau (2009), there were 121,931 jobs in Coconino, Yavapai, and Gila Counties in 11,392 business establishments. These businesses paid 3,388 million dollars in their payroll in 2009. More information on the overall economic conditions of the three adjacent counties based on the above-mentioned assessment is located in the Social/Economics specialist report.

Motorized and Nonmotorized Uses

According to two national visitor use monitoring reports, recreation on the Coconino National Forest has grown significantly over the years. For calendar year 2000, recreational uses of the Forest were estimated at 1.89 million national forest visits[10] with 2.42 million site visits. Approximately 4.56 million national forest visits to the Coconino National Forest were estimated for fiscal year 2005[11] with about 5.87 million site visits. Table 16 shows participation rates by activity for calendar year 2000 and fiscal year 2005.

In 2000, the top five recreation activities of visitors were viewing wildlife and natural features, camping, general relaxation, and hiking/walking. Each visitor also indicated which activity was the primary occupation for their current recreation visit to the Forest. Survey respondents were asked to select just one of their activities as their main reason for the forest visit; however, some respondents selected more than one, so the total can be more than 100 percent. The top primary activities were camping, hiking/walking, and viewing wildlife or natural features. In 2005, viewing natural features, hiking/walking, viewing wildlife, and relaxing remained as the most popular activities, with the addition of driving for pleasure. The top main activities were hiking/walking, viewing natural features, relaxing, driving for pleasure, and downhill skiing. The most significant growth in participation of an activity was in hiking/walking and driving for pleasure.

For this analysis, the primary activity participation rates (column titled “As main activity” in table 16) from the 2005 national visitor use monitoring data (updated in 2009) were used to estimate motorized and nonmotorized uses of the Forest. Motorized uses include driving for pleasure, motorized trail activity/OHV use, other motorized activity, and snowmobiling. Nonmotorized uses include backpacking, hiking/walking, horseback riding, bicycling, and cross-country skiing. Total activity participations in both motorized and nonmotorized activities increased 28.8 and 25.8 percent, respectively, and the number of visitors who said participating in motorized or nonmotorized activities was their main reason for their recreation visits for the Forest increased 6.5 and 14.9 percent, respectively.

Table 17 and table 18 (p. 88) present the number of visits and travel parties for motorized and nonmotorized uses of the Forest by trip segments. For 1.47 million visitors, participating in nonmotorized activities was their primary reasons for visiting the Forest in 2005, while almost 300,000 visitors participated in motorized activities as the primary reason for their visits. Table 19 (p. 88) presents the estimated average spending per party per trip in a high spending area.

[10] +/- 15.4 percent at the 80 percent confidence interval
[11] +/- 10.2 percent at the 80 percent confidence interval

Table 16. Activity participation and primary activity for the Coconino National Forest (national visitor use monitoring data CY 2000 and FY 2005, updated in 2009)

Activity	Calendar year 2000		Fiscal year 2005		Changes in activity participation (%)	Changes in main activity (%)
	Total activity participation (%)	As main activity (%)	Total activity participation (%)	As main activity (%)		
Hiking / walking	53	23	79.1	38.4	26.1	15.4
Viewing natural features	64*	22*	85.0	24.2	21	2.2
Driving for pleasure	28	2	56.4	7.1	28.4	5.1
Downhill skiing	5	5	4.6	4.4	-0.4	-0.6
Bicycling	4	2	6.7	4.0	2.7	2.0
Visiting historic sites	16	2	32.8	4.2	16.8	2.2
Viewing wildlife	41*	4*	71.1	2.7	30.1	-1.3
Other nonmotorized	10	9	7.5	3.0	-2.5	-6.0
Fishing	10	7	5.9	2.7	-4.1	-4.3
Primitive camping	7	4	4.9	2.3	-2.1	-1.7
Hunting	2	2	2.6	2.2	0.6	0.2
Relaxing	62	20	65.5	8.4	3.5	-11.6
Developed camping	7	5	4.4	1.4	-2.6	-3.6
Picnicking	16	1	15.1	1.8	-0.9	0.8
Motorized trail activity/OHV use**	11	1	12.9	2.4	1.9	1.4
Motorized water activities	2	0	2.4	1.4	0.4	1.4
No activity reported	NA	NA	5.2	5.2	NA	NA
Backpacking	3	1	1.9	0.4	-1.1	-0.6
Nature study	8	0	20.2	0.2	12.2	0.2
Nonmotorized water	0	0	0.7	0.2	0.7	0.2
Gathering forest products	1	0	2.8	0.1	1.8	0.1
Cross-country skiing	1	1	0.2	0.1	-0.8	-0.9
Nature center activities	11	0	22.4	0	11.4	0
Resort use	3	1	0.8	0	-2.2	-1
Horseback riding	2	1	0.9	0	-1.1	-1
Other motorized activity	2	0	0.5	0	-1.5	0
Snowmobiling	0	0	0	0	0	0

* first version of survey form used October through March had these two viewing categories combined as viewing scenery

** these activities were reported separately for the national visitor use monitoring 2005 data.

Table 17. Number of visits by activity types (FY 2005)

Activity	Trip segment (number of visits)					
	Nonlocal day	Nonlocal overnight	Local day	Local overnight	Non-primary	Total
Hiking / walking*	105,319	223,804	829,391	78,990	78,990	1,316,493
Backpacking	-	6,111	520	6,111	260	13,002
Bicycling*	11,182	23,762	88,059	8,387	8,387	139,776
Cross-country skiing	325	1,008	1,755	130	33	3,251
						Nonmotorized uses 1,472,522**
Driving for pleasure	13,457	20,186	159,247	6,729	24,672	224,291
Motorized trail activity / OHV use	8,224	17,196	35,887	10,467	2,991	74,764
						Motorized Uses 299,055**

*These activities share the same trip segment profile.

** No respondent reported horseback riding, other motorized activity and snowmobiling as their primary reasons for visiting the Forest.

Table 18. Number of travel parties by activity types (FY 2005)

Activity	Trip segment (number of travel parties)					
	Nonlocal day	Nonlocal overnight	Local day	Local overnight	Non-primary	Total
Hiking / walking*	50,152	97,306	460,773	35,904	29,255	673,390
Backpacking	-	2,350	400	100	113	2,964
Bicycling*	5,325	10,331	48,922	3,812	3,106	71,496
Cross-country skiing	116	360	763	14	13	1,266
						Nonmotorized uses 749,116**
Driving for pleasure	6,408	7,764	88,470	11,215	10,280	124,137
Motorized trail activity / OHV use	3,916	6,878	17,943	1,196	1,150	31,084
						Motorized Uses 155,221**

*These activities share the same trip segment profile.

**No respondent reported horseback riding, other motorized activity and snowmobiling as their primary reasons for visiting the Forest.

Table 19. Average spending (per party per trip for FY 2005)

Activity	Spending per party per trip				
	Nonlocal day	Nonlocal overnight	Local day	Local overnight	Average
Hiking / walking*	57.86	367.02	26.08	126.93	144.47
Backpacking	-	157.42	26.08**	137.44	147.43
Bicycling*	57.86	367.02	26.08	126.93	144.47
Cross-country skiing	82.34	506.40	46.76	303.84	234.84
Nonmotorized average	**66.02**	**349.47**	**31.25**	**173.79**	**155.13**
Driving for pleasure	63.81	265.61	36.24	159.36	131.26
Motorized trail activity/OHV use	100.70	260.69	57.19	156.42	143.75
Motorized Average	**82.26**	**263.15**	**46.72**	**157.89**	**137.51**

* These activity groups share the same spending profile.

**Average spending of local day backpackers was not available, because backpacking was grouped with primitive camping in the spending report. Average spending of hikers was used as a proxy.

The average spending per party per trip by each activity in table 19 were multiplied by the number of parties engaging in each activity in the Forest to calculate the total spending by each activity group (table 20).

Economic Contribution Assessment

Direct and indirect economic contributions on the affected region are assessed through a county-level I-O analysis. Table 21 shows the estimated spending average of motorized recreation visitors for the Forest by the eight spending categories.

Table 20. Total spending by activity (based on average spending/party/trip in FY 2005)

Activity	Spending (average spending multiplied by number of parties)				
	Nonlocal day	Nonlocal overnight	Local day	Local overnight	Total
Hiking / walking	2,901,801.33	35,713,249.72	12,016,948.10	4,557,339.72	55,189,338.87
Backpacking	-	370,005.30	10,433.93	13,746.54	394,185.76
Bicycling	308,092.49	3,791,777.13	1,275,873.50	483,865.70	5,859,608.82
Cross-country skiing	9,559.09	182,247.21	35,686.50	4,294.18	231,786.98
Nonmotorized average	**3,219,452.91**	**40,057,279.35**	**13,338,942.03**	**5,059,246.14**	**61,674,920.43**
Driving for pleasure	408,915.26	2,062,178.26	3,206,170.80	1,787,153.88	7,464,418.20
Motorized trail activity / OHV use	394,361.24	1,793,096.10	1,026,178.01	187,112.86	3,400,748.22
Motorized average	**803,276.51**	**3,855,274.37**	**4,232,348.81**	**1,974,266.73**	**10,865,166.42**

Table 21. Spending averages for motorized recreation visitors ($ per travel party)

Spending categories	OHV use				Driving			
	Nonlocal		Local		Nonlocal		Local	
	Day	OVN	Day	OVN	DAY	OVN	Day	OVN
Lodging	0.00	33.59	0.00	20.15	0.00	72.76	0.00	43.66
Restaurant / bar	15.24	41.24	8.66	24.74	13.83	77.25	7.85	46.35
Groceries	13.42	51.39	7.62	30.83	5.52	21.34	3.13	12.80
Gas and oil	53.97	91.97	30.65	55.18	37.40	51.86	21.24	31.12
Other transportation	0.00	0.00	0.00	0.00	0.00	4.80	0.00	2.88
Activities	5.06	6.96	2.87	4.18	0.22	5.49	0.12	3.29
Admissions / fees	4.98	9.23	2.83	5.54	2.14	5.81	1.22	3.48
Souvenirs / other	8.03	26.31	4.56	15.78	4.70	26.29	2.67	15.78
Total spending	100.70	260.69	57.19	156.42	63.81	265.61	36.24	159.36

OVN = overnight

To estimate the total spending of the motorized recreation visitors of the Forest, the spending averages were multiplied by the average number of traveling parties in each trip segment (table 22).

The total spending for each spending category (table 22) was applied to IMPLAN model by using appropriate bridge tables to match the national visitor use monitoring spending categories to IMPLAN sectors. Table 23 shows the total economic contributions of motorized recreation uses

of the Coconino National Forest in 2006. Table 24 shows the economic contributions generated per 1,000 recreation visits.

Table 22. Total spending of motorized recreation visitors ($: average spending multiplied by total number of travel parties in FY 2005)

Spending categories	Nonlocal	Local	Total
Lodging	795,942	513,701	1,309,643
Restaurant / bar	1,031,781	1,399,566	2,431,347
Groceries*	607,062	594,516	1,201,578
Gas and oil*	1,486,288	2,844,010	4,330,298
Other transportation	37,305	32,331	69,637
Activities	111,699	104,469	216,167
Admissions / fees	141,843	204,253	346,096
Souvenirs / other*	446,634	513,760	960,394
Total spending	**4,658,554**	**6,206,606**	**10,865,160**

*Expenditures in these categories were margined for IMPLAN analysis, as they represent retail sales.

Table 23. Economic contributions of motorized recreation uses of the Coconino National Forest (FY 2005)

Income and employment		Direct impact	Indirect impact	Induced impact	Total impact
Local	Labor income ($)	1,113,357	228,660	281,054	1,623,071
	Employment	52.1	7	9	68.1
Non-local	Labor income ($)	980,757	202,560	247,381	1,430,698
	Employment	45	6.1	7.9	59.1
Total	**Labor income ($)**	**2,094,114**	**431,220**	**528,435**	**3,053,769**
	Employment	**97**	**13**	**17**	**127**

Table 24. Economic contributions per 1,000 motorized recreation visits (FY 2005)

Income and employment		Direct impact	Indirect impact	Induced impact	Total impact
Local	Labor income ($)	5,244	1,077	1,324	7,644
	Employment	0.25	0.03	0.04	0.32
Non-local	Labor income ($)	16,605	3,430	4,188	24,223
	Employment	0.76	0.10	0.13	1.00
Total	**Labor income ($)**	**21,849**	**4,506**	**5,512**	**31,867**
	Employment	**1.01**	**0.14**	**0.18**	**1.32**

Alternative Calculation of Economic Contributions

Table 25 shows the OHV recreation days and total OHV-related expenditures in three counties based on the Silberman report, which includes expenditures for motorized vehicles, tow trailers, related equipment, accessories, insurance and maintenance costs, and trip related expenditures. The table also shows economic contributions generated in the three counties by OHV uses. These

numbers include all OHV uses on public and private lands, and are not specific to the motorized recreation in the Coconino National Forest.

Table 25. Total OHV uses, expenditures and economic contributions of OHV uses in the affected region (in 2002 dollar as published)

Economic indicator	Coconino County	Gila County	Yavapai County
OHV recreation days	1,974,295	1,262,607	1,195,742
Total OHV expenditures	215.3 million	120.5 million	183 million
Total OHV recreation trips	106.4 million	53.4 million	112.4 million
Vehicles/equipment purchase for OHV use	108.9 million	67.1 million	70.6 million
Labor income generated	51.7 million	22.3 million	43.9 million
Employment generated	2,580	1,322	2,067

Table 26 shows the economic contributions generated per 1,000 visits converted to 2005 dollar. The economic contributions from the Silberman report were adjusted for inflation using the Consumer Price Index for all urban consumers.

Table 26. Economic contributions per 1,000 motorized recreation visits generated by the Coconino National Forest (in 2005 dollar)

Economic indicator	Coconino County	Gila County	Yavapai County	Three-county Average
OHV recreation days	118,387	103,607	166,144	129,379
Total OHV expenditures	58,506	45,913	102,047	68,822
Total OHV recreation trips	59,881	57,693	64,097	60,557
Vehicles/equipment purchase for OHV use	28,429	19,174	39,857	29,153
Labor income generated	1.31	1.05	1.73	1.36
Employment generated	118,387	103,607	166,144	129,379

To calculate the economic contributions generated by the motorized uses of the Forest, the average economic contributions per visit over three counties were multiplied by the total number of motorized recreation visits to the Forest from table 17. Table 27 presents a comparison of two economic contribution estimates in 2005 dollar value.

Table 27. Total economic contributions of motorized recreation visits to the Coconino National Forest

Economic indicator	Estimates based on the 2006 NVUM report (FY 2005)	Estimates based on the 2002 Silberman report (in 2005 dollars)
OHV expenditures	N/A	38,691,531
Total OHV recreation trips	10,865,160	20,581,648
Vehicles/equipment purchase for OHV use	N/A	18,109,883
Labor income generated	3,053,769*	8,718,291
Employment generated	127*	407

*These economic contributions estimates do not include the economic contributions generated by purchase and maintenance of vehicles and equipments.

For this report, the economic contributions of motorized recreation uses of the Forest to the regional economy have been estimated in two different ways. Both methodologies have limitations. The economic contributions based on the 2006 national visitor use monitoring report employed the Forest-level visitation data supplemented with the national average of spending for different recreation activity and trip segments in a high spending area. Trip expenditures for the Coconino National Forest may be substantially different than the averages for a high spending area. Also, the Forest Service national visitor use monitoring data do not include expenditures for durable goods purchases and only include purchases identified for the single trip associated with the interview when motorized uses were the primary purpose of the trip.

Although the Silberman report was based on the statewide survey, it did not have specific visitation data for the motorized recreation in the Coconino National Forest. The expenditure calculations based on the report may have been inflated by applying the average OHV-related expenditures to all motorized recreation, which include other motorized recreation with smaller expenses. Because of the discrepancy in data collection and sampling methods, the results of two studies paint different pictures of the economic contributions of motorized travel. However, these two estimates together provide a reasonable range of economic contributions of the motorized recreation in the Forest. Motorized recreation activities contributed about 0.09 to 0.26 percent of labor income, and about 0.1 to 0.33 percent of total number of jobs to the regional economy of three counties.

Economic Contribution of Nonmotorized Recreation

The primary purpose of this analysis is to assess potential economic impacts of alternative actions to manage motorized travel in the Forest. Economic contribution of nonmotorized recreation uses of the Forest was not analyzed. However, visitors participating in nonmotorized recreation activities are spending more money per visit on average (See table 19). Also, the number of visits for nonmotorized recreation activities was about five times more than for motorized recreation (see table 17). Other national forests found that nonmotorized recreation is a more significant contributor to the economy of surrounding communities (Lindberg and Loomis 2009).

In addition to recognizing that nonmotorized recreation contributes economically many times more than motorized recreation, there are several research studies that have found that motorized recreation can result in the exclusion or displacement of nonmotorized recreationists (Stokowski and LaPointe 2000). Though the inverse relationship between motorized use and nonmotorized recreation has not been adequately quantified to derive economic estimates from changes in motorized use, changes in motorized uses on the Forest can have a direct impact on the economic contribution resulting from nonmotorized uses. In general, we expect the management of motorized uses on the Forest through the designation of a system of motorized routes and areas would reduce the spatial extent of motorized use across the Forest and make the locations of motorized use more predictable. As a result, nonmotorized recreation that depends on quiet and solitude would likely increase across the Forest.

Economic Consequences

Alternative 1

Direct Effects

Under this alternative, the economic contributions of motorized recreation are expected to grow. Total activity participation in motorized activities in the Coconino National Forest grew 27 percent from 2001 to 2005, and the number of visitors who said participating in motorized activities was their main reason for their recreation visits to the Forest grew 6 percent. If this trend continues, we expect the economic contributions of motorized recreation to be larger than now as expenditures for trips and for purchasing and maintaining vehicles and equipment would increase.

Indirect Effects

Implementation of this alternative would result in the continued erosion of nonmotorized recreation settings, and participation in nonmotorized recreation would continue to be affected. The economic contributions from nonmotorized recreation would experience stagnant growth or decrease due to the inverse relationship between motorized use and nonmotorized recreation. Total participation in nonmotorized activities in the Coconino National Forest grew 26 percent from 2001 to 2005, and the number of visitors who said participating in nonmotorized activities was their main reason for their recreation visits to the Forest grew 17 percent.

Cumulative Effects

Restrictions on motorized uses in surrounding areas such as surrounding national forests, Bureau of Land Management lands, and other State and federally owned lands would likely lead to a concentration of unmanaged recreational use (including cross-country travel) on the Coconino National Forest. Coconino National Forest closure orders such as the Mogollon Rim motor vehicle closure order (signed July 30, 2010) would likely be used to limit motorized uses in areas resulting in the greatest impact on resources. This would continue to result in confusion regarding what areas are available for motorized recreational use and would likely result in ongoing or increased impacts to nonmotorized recreational activities that depend on quiet and solitude.

No change to the current management of motorized use on the Coconino National Forest would likely result in increased motorized use on the Forest based on recent trends in the growth of motorized recreation, and from the cumulative restrictions on motorized uses in nearby public lands. Increased motorized use on the Forest would increase the amount of cross-country motorized use for recreational purposes and increase the numbers of unauthorized trails and routes for motorized recreation. Overall, this would result in a combined increase in the amount and spatial extent of motorized recreation on the Coconino National Forest, which would likely increase the economic contribution to the local economy from motorized users. Unmanaged recreation, however, would also likely result in a decline of nonmotorized recreational activities that depend on scenery, quiet, and solitude. The decline in nonmotorized recreation on the Coconino National Forest would likely result in an overall decline of economic contribution from recreation to the local economy.

Alternative 3

Direct Effects

This alternative would limit national forest access to the open road system, and some designated routes may experience more traffic as options for travel routes decrease. The reduced or diminished motorized recreation opportunity could result in fewer Forest visits and shorter trip durations, which could result in reduced economic contributions from motorized recreation. However, if most people adapt to use the designated road and trail system, there may not be significant changes in recreation demand. Furthermore, current motorized recreationists that depend on the Coconino National Forest may choose to continue some motorized recreational opportunities in adjacent areas such as the Tonto National Forest, Bureau of Land Management areas, or private lands, thus maintaining economic contributions from motorized recreation to the local economy. The economic impacts of this alternative could be neutral or negative, but we cannot estimate the extent of the change without knowing the reduced number of visitors and changes in their trip expenditures, specifically resulting from the implementation of this alternative.

Indirect Effects

Decreasing access to the Forest could eventually lead to reduced expenditures for purchasing and maintaining OHV vehicles and equipment if there are no substitute sites for motorized recreation activities. Although the reduction of motorized access to the Forest may not increase nonmotorized recreation activities greatly, decreases in motorized recreation could result in improvements in nonmotorized recreation settings and more diversity to recreation settings in the Forest. Potentially, negative effects on OHV-related industries could mean positive effects on nonmotorized recreation-related businesses.

Cumulative Effects

Motorized recreation was found to contribute about 0.09 to 0.26 percent of labor income, and about 0.1 to 0.33 percent of total number of jobs to the regional economy of the three counties in and around the Forest. This change in economic contribution from motorized recreation may cumulatively combine with ongoing management changes for motorized recreation on nearby public lands and other restrictions on recreation such as from Forest closure orders, including the Schultz Fire closure order and Fossil Creek closure order. These economic impacts would also be additive with increasing unemployment since May of 2007 due to the recent economic downturn and unemployment rates of 7.6, 9.9, and 10.8 percent in Coconino, Yavapai, and Gila counties, respectively (U.S. Bureau of Labor Statistics 2010).

The cumulative effect of decreased motorized access and recreation from alternatives 3 or 4 are likely such a small impact as to be absorbed by larger economic forces or counteracted by the positive economic impacts from increased nonmotorized recreation. For example, the growth in unemployment in the local economy has been largely driven by a drop in housing prices, which has resulted in over 24 times the unemployment that could be caused by the worst-case scenario job loss from any travel management alternative (U.S. Bureau of Labor Statistics 2010).

Furthermore, although the restriction of motorized access and recreation may result in negative economic impacts, a change in management that would slightly reduce motorized use on the Coconino National Forest may have positive economic impacts in a number of other areas, though these are likely not measurable:

- Increased nonmotorized recreation in areas previously used for motorized recreation
- Increase in use of private businesses that cater to motorized recreation experiences less available on the Forest
- Increase in use of other public lands to substitute for motorized recreation experiences less available on the Forest
- Increased nonmarket values to surrounding areas from resource benefits (e.g., clean water, increased wildlife populations) resulting from decreased motorized recreation on the Forest

Alternative 4

Direct, Indirect, and Cumulative Effects

The economic effects of this alternative would be similar to those of alternative 3, but would include 50 additional miles of motorized trail and 326 miles of designated road (almost 11 percent more road than alternative 3). In addition, this alternative would emphasize long distance motorized trail activity by people riding dirt bikes, ATVs, OHVs and other high-clearance vehicles by including the 50-mile single-track Challenger Trail and the Long Route, which includes 187 miles of mostly primitive road. While alternative 4 would add some opportunities for motorized use, and therefore may reduce the decline in motorized recreation expenditures compared with alternative 3, the overall difference between the two alternatives is too small to calculate in this economic analysis.

Cultural Resources

Introduction

Cultural resources are managed under three broad classifications: isolated occurrences, such as an arrowhead or the remains of an abandoned Model-T Ford; archaeological sites, such as a prehistoric pueblo or a pioneer's cabin; and traditional cultural properties, such as the San Francisco Peaks or the Red Rocks country near Sedona. The Coconino National Forest strives to manage all cultural resources to make the best use of their scientific, educational, recreational, and cultural values for both present and future users of the Forest. Many laws, regulations, rules, and policies protect sites and provide guidelines the Forest Service must follow when determining the potential effects of a proposed project or activity on cultural resources. These include formal consultations with tribes having ancestral connections to the Forest, and project reviews by the State Historic Preservation Office, and sometimes the Advisory Council on Historic Preservation.

The Coconino National Forest has recorded almost 10,000 archaeological sites and anywhere from 100 to 300 new sites are added each year. Most of these are found when archaeological surveys are conducted to determine the types and densities of sites that are present in a proposed project area. Cultural resources require specific consideration in order to evaluate the potential impacts to them by the various uses and projects that take place on the National Forest:

- Cultural resources are fragile – they can be easily damaged when bulldozers or other heavy equipment are used on a project, or through the rutting and erosion resulting from unauthorized OHV-created roads.

- They are unique – archaeological sites can be grouped into categories, such as time or likely function, but no two are exactly alike. Human behavior is much too diverse to be easily pigeonholed.
- They are nonrenewable – with special care and protection, we can grow more rare plants or improve habitat to raise more endangered animal species, but we cannot grow another field house constructed in A.D. 900.

Affected Environment

This analysis is looking at changes to motorized use on the Coconino National Forest based on implementation of the Travel Management Rule. It is not an analysis of the entire existing National Forest Road System. The current road system is the result of past projects and land management planning efforts that have gone through road management evaluations, National Environmental Policy Act review, and analysis.

Archaeological Survey Status of Forest Roads – Of the approximately 7,484 miles of road under Forest Service jurisdiction, slightly more than a third (35 to 40 percent) have been archaeologically surveyed to some degree.

Archaeological Site Density and Distribution of Roads –For purposes of evaluating the potential effects of designating various combinations of roads as open or closed to vehicle use, we are defining **site sensitivity** as the potential site density of the area that could theoretically be impacted by road maintenance and use. Five site density classes were defined, which we used to produce an overall site density map for the Forest (figure 32, appendix B). For more information on how site sensitivity and site density classes were developed, please see the full Cultural Resources specialist report.

Table 28 and figure 17 show how the 7,484 miles of roads on the Coconino National Forest (or otherwise under Forest Service jurisdiction) are distributed throughout the Forest. Most roads are located in areas classified as site density 2 (low site density; 4,285 miles), or site density 5 (very high site density; 1,675 miles). In general, very low to low density areas correspond with the high ponderosa pine forest above the Mogollon Rim. However, the ponderosa pine zone on the east side of the San Francisco Peaks, northeast of Flagstaff, is a high site density area. High to very high-density areas occur in the pinyon-juniper zone, particularly in the Verde Valley, along the base of Anderson Mesa, east of Flagstaff, and north of the cinder belt.

Table 28. Archaeological site density classes defined for the Coconino National Forest

Cultural sensitivity level	Color code	Estimated site density
Very low	dark blue	0 sites/square mile
Low	light blue	1 - 10 sites/square mile
Moderate	green	11-20 sites/square mile
High	orange	21-30 sites/square mile
Very high	red	30+ sites/square mile

B: Cultural Resource Density Map

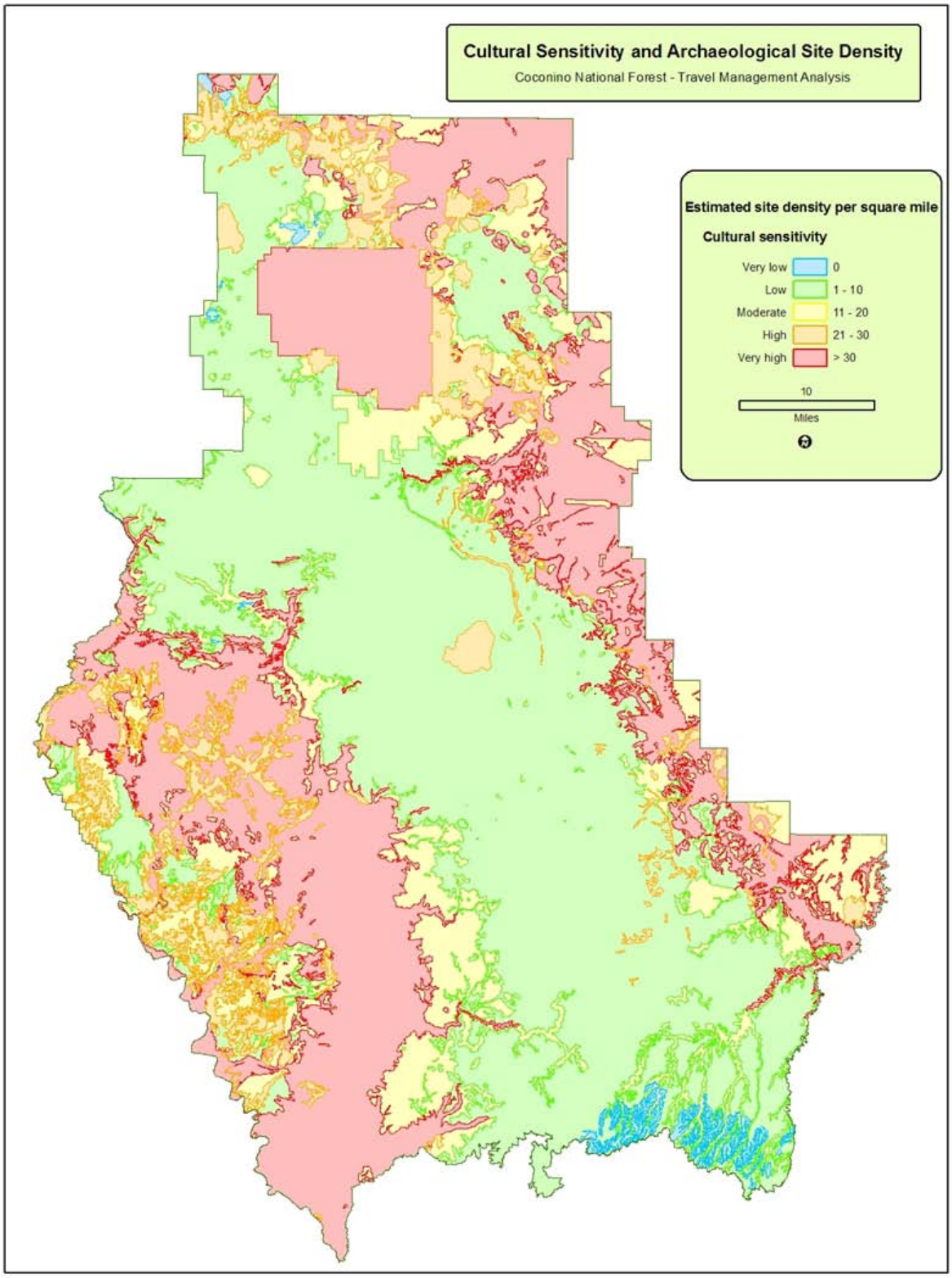

Figure 32. Predicted archaeological site density areas within the Coconino National Forest

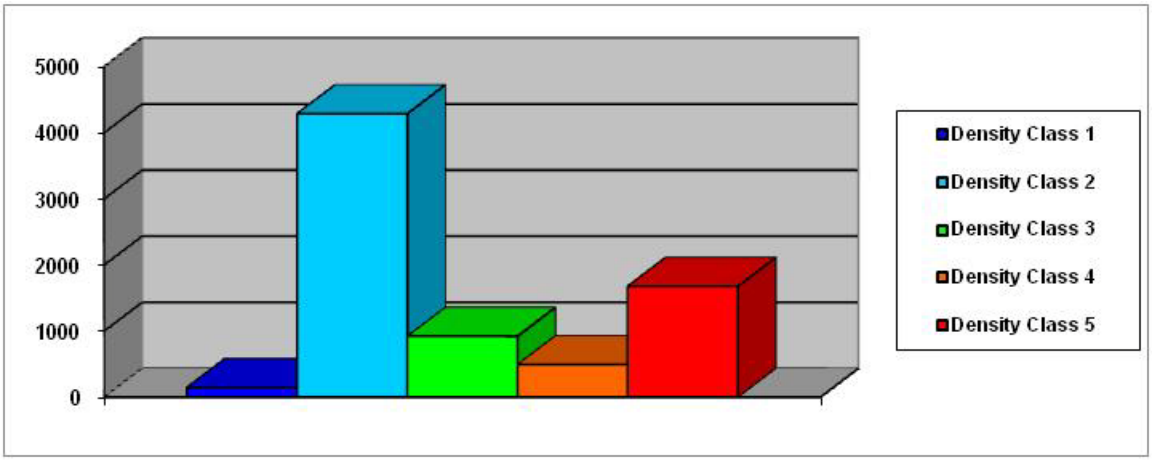

Figure 17. Miles of roads on the Coconino National Forest by site density class

Archaeological Site Condition – Information on the condition of archaeological sites is found in the Archaeological Site Log, where condition information is available for 4,806 sites as of December 30, 2010. When sites are recorded, their condition is noted on a 0 to 5 scale, where 0 indicates an undisturbed site and 5 indicates a site that has been completely destroyed. Table 29 and figure 18 shows site conditions in different parts of the Forest, as represented by the seven former ranger district boundaries, which still form the basis for the designation of sites on the Forest. The table shows that site conditions on the two Verde Valley Districts (D-1: Beaver Creek and D-6: Sedona) are identical, as is the case for the area around the San Francisco Peaks (the D-2: Elden and D-3: Flagstaff Districts). The area around the San Francisco Peaks has the most undisturbed sites, as well as the most highly disturbed sites. The districts in the high pines (D-4: Long Valley, D-5: Mormon Lake, and D-7: Blue Ridge) are dissimilar to one another as well as to the Verde Valley and San Francisco Peaks areas.

Table 29. Percent of sites in each site condition by administrative unit on the Coconino National Forest

	Undisturbed	Condition 1	Condition 2	Condition 3	Condition 4	Condition 5
Beaver Cr.	16%	20%	18%	18%	16%	9%
Sedona	14%	17%	18%	19%	22%	12%
Elden	23%	17%	23%	19%	20%	33%
Flagstaff	13%	18%	20%	18%	17%	24%
Long Valley	2%	5%	5%	7%	7%	4%
Mormon Lake	11%	9%	6%	8%	13%	11%
Blue Ridge	21%	14%	10%	11%	6%	6%

Site conditions range from 0 to 5, where 0 indicates an undisturbed site and 5 indicates a site that has been completely destroyed.

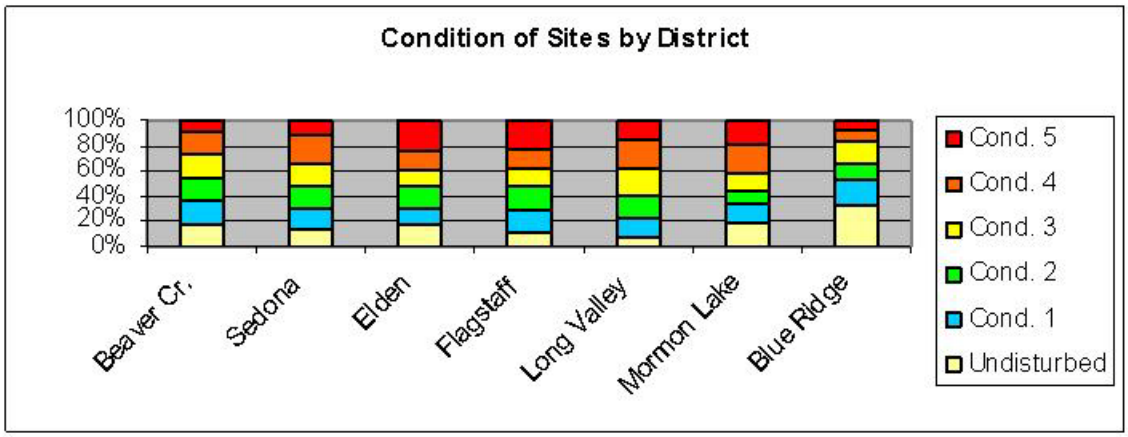

Figure 18. Site conditions on the Coconino National Forest by administrative unit

Table 30 shows the various causes of site damage, with roads being the single-most prevalent cause of site damage (20 percent), followed by vandalism and pot hunting (7 percent). Site condition data, however, has not distinguished between damage due to highways, secondary/graded roads, or off-road vehicle use. Other causes of damage, such as logging, juniper eradication, fire suppression, etc., are significantly less.

Table 30. Number of sites on each administrative unit disturbed by various causes*

Condition	Beaver Creek	Elden	Flagstaff	Long Valley	Mormon Lake	Sedona	Blue Ridge	Total	Percent
Undisturbed	356	520	284	53	225	305	315	2,058	48%
Roads	61	151	218	48	171	121	67	837	20%
Pot hunting & vandalism	41	106	21	7	17	98	30	320	7%
Burned	2	59	74	0	11	2	8	156	4%
Logging	0	24	70	35	14	6	26	175	4%
Recreation	9	29	20	12	13	40	12	135	3%
Power/ phone line	7	65	9	21	6	28	3	139	3%
Juniper eradication	14	65	0	2	4	2	33	120	3%
Grazing	36	9	23	13	11	17	9	118	3%
Construction	5	20	37	2	12	24	6	106	2%
Fire suppression	0	15	45	0	12	7	0	79	2%
Trails	5	12	2	0	0	7	5	31	1%
TOTAL	536	1,075	803	193	496	657	514	4,274	100%

* based on archeological site reviews

Across the Forest, road damage is variable, ranging from a low of 11 percent of sites in the Beaver Creek area to a high of 34 percent in the Mormon Lake area. The Sedona area has a higher proportion of site damage caused by roads (18 percent) than the Beaver Creek area (11 percent), while to the north, more sites have been damaged by roads on the west side of the Peaks

(Flagstaff Ranger District: 27 percent) than on the east side of the Peaks (Elden Ranger District: 14 percent). The percentage of sites damaged by roads in the high pine forest is also variable, ranging from 13 percent in the southeast part of the Forest around Blue Ridge to 34 percent in the Mormon Lake country.

Besides direct impacts to sites caused by roads, there is also an indirect impact from roads due to the access they provide to archaeological sites. Many studies of site vandalism in the Southwest find a direct correlation between looting of sites and their proximity to roads. Land managers throughout the western United States agree that the most important factor contributing to vandalism was accessibility by vehicle: 42 percent consider two-wheel drive vehicle access the most important and 27 percent consider four-wheel drive access the most important (Williams 1978). Often, unauthorized two-track roads have been developed for no other purpose than to provide access to archaeological sites (Lightfoot and Francis 1978; Ahlstrom et al. 1992). Lightfoot noted the amount of illegal artifact collecting on sites was related to its distance and visibility from a road (Lightfoot 1978). Researchers report a range of distances relating proximity to roads to illegal digging. In southwestern Colorado, there was an overwhelming preference for pothunted sites within about ¼ mile of a road capable of two-wheel drive access (Nickens et al. 1981). In the Colorado Planning Unit, artifact collecting seemed most intensive on sites located within 492 feet of a road (Francis 1978). The Perry Mesa vandalism study found most vandalized sites were within 600 feet of a road (Ahlstrom et al. 1992). On the Apache-Sitgreaves National Forest, all looted sites are within 100 feet of a road (Schroeder 2010), and on the Coconino National Forest, 76 percent of looted sites are within 0.25 mile (1,320 feet) of a road and 82 percent are within 0.3 mile (1,600 feet) of a road (Daquila 2008).

Proximity to roads is not the only major factor in determining which sites are looted, in fact one study did not find a direct relationship to looting and proximity to roads. Site type is also an important factor (Ahlstrom et al. 1992). Large pueblos, cave sites, and pit house villages with obvious trash or burial mounds have always been major targets of pot hunters and looters.

To summarize site condition, about 48 percent of all sites on the Forest are undisturbed and 52 percent are disturbed. Of the disturbance, 11 percent is due to natural causes, such as erosion and bioturbation, while 89 percent is due to human causes. Specific causes of damage vary considerably across the Forest (table 30), but roads are the single greatest cause of damage on every part of the Forest, affecting about 20 percent of all recorded sites. Data, however, do not distinguish which types of road or off-road vehicle use is the cause of site damage. Areas that stand out as being different from the norm consist of the south end of the Verde Valley (Beaver Creek Ranger District) where only 11 percent of sites have been impacted by roads, and Long Valley Ranger District, where 28 percent of recorded sites have been disturbed by roads.

Desired Future Conditions

Coconino National Forest Plan: Cultural Resources Direction

The forest plan provides management direction for desired future conditions for the cultural resources of the Coconino National Forest (forest plan, pp. 52-3 to 55) and in subsequent area planning documents. Collectively, they provide the criteria that have been used to evaluate the need for future closures or restrictions, and were among the guidelines used by the Forest's travel management interdisciplinary teams. Specific criteria applicable to cultural resources can be found in the Cultural Resources specialist report.

Environmental Consequences to Cultural Resources

Methodology for Analysis

For the effects discussion, alternative 1 is used as representative of the existing condition; the analysis measures the change in effects to cultural resources when compared to alternative 1. The intent is to portray the effects programmatically and to show the change from the existing condition for each alternative. Effects are evaluated in terms of substantive issues that were identified through external and internal scoping. This analysis evaluates direct and indirect effects from designation on cultural resource sites and traditional cultural properties across the alternatives.

Although this analysis addresses the anticipated environmental effects to cultural resources, it does not address site-specific effects from the perspective of the National Historic Preservation Act (NHPA) of 1966, as amended. For specific information on methods used for compliance with the National Historic Preservation Act, please see the full Cultural Resource specialist report.

The forest plan and subsequent updates provide several criteria that were used as part of the interdisciplinary analysis that resulted in the open and closed road and motorized trail configurations proposed in alternatives 3 and 4. These include consideration for:

- Roads that provide access to cultural sites that have been identified for current or future development as interpretive or recreation use sites or areas
- Roads necessary to meet peoples' needs and values, such as American Indians' traditional gathering of plants and access for various purposes, and access to sites and areas needed for the maintenance of cultural and religious values
- Roads necessary to manage special use sites and areas

As table 30 shows, roads are the main cause of damage to archaeological sites, impacting about 20 percent of sites recorded on the Forest. As a way of comparing the relative effects of the three alternatives, table 31 estimates the potential average number of sites that may be impacted or protected under each alternative. It assumes an area of potential effect to be 45 feet wide—a 15-foot-wide roadway and 15 feet on each side of the road. Road miles for each alternative by site density class were computed by GIS, computed into low and high estimates of the potential number of sites using the Forest Terrestrial Ecosystem Soil site density model ranges (above) and the high and low estimates averaged to facilitate comparison.

Alternative 1 – Direct and Indirect Effects

Alternative 1would not meet the direction or requirements of the Travel Management Rule. However, it would have the following effects (see table 31 and Appendix 2 in Heritage specialist report):

- Of roads open to the public, 93.3 percent are within 0.5 mile of the nearest road.
- All 125 miles of the currently known motorized trail system would remain open. No trails would be closed.
- Between 22 and 44 sites (average 33) would remain affected by the current motorized trail system. No sites would be removed from the area of potential effect.

Table 31. Potential average number of sites impacted or protected by alternative, assuming 45-foot-wide potential impact area

	Alternative 1 - No Action			Alternative 3			Alternative 4		
	Existing Amount	Sites Impacted	Sites Protected	Proposed Amount	Sites Impacted	Sites Protected	Proposed Amount	Sites Impacted	Sites Protected
Roads Open	7,486 mi.	1,074	-	3,097 mi.	440	-	3,426 mi.	477	-
Closed Roads	0	-	0	4,387 mi.		633	4,061 mi.	-	599
Trails Open	125 mi.	33	-	39 mi.	10	-	89 mi.	29	-
Closed Trails	0	0	0	87	-	23	37	-	4
Motorized Camping	1,545,552 acres	44,741	-	43,313 acres	839	-	43,313 acres	839	-
Total Sites	**-**	**45,848**	**0**	**-**	**1,289**	**656**	**-**	**1,345**	**603**

- All 7,486 miles of the current road system would remain open. No roads would be closed.
- Between 650 and 1,497 (average 1,074) sites would continue to be within the area of potential effect related to continued road use, designated motorized travel routes, and dispersed camping. No sites would be removed from the area of potential effect. An unknown number of sites would continue to be potentially affected by continued cross-country travel.
- Off-road travel for big game retrieval and any other activity would continue except in closure areas, which include approximately 1.46 million acres. Unrestricted off-road travel would likely result in minor direct and indirect impacts over time as archeological sites are incidentally driven through or are affected by erosion from areas that receive repeated use.

Under this alternative, it is expected that archeological sites and cultural resource areas would continue to be impacted from direct impacts including use of existing roads on archeological sites and creation of new roads or trails on archeological sites from off-road travel. In addition, this alternative is expected to continue indirect impacts of facilitating access to high-density areas of the Forest for pot-hunting and other previously recorded illegal activities.

This alternative would not help the Forest achieve desired conditions of limiting impacts in National Historic Landmarks and National Historic Districts. Currently there are 7 miles of roads in these areas, of which approximately 0.25 mile are unauthorized routes. These routes and the potential for new unauthorized routes from cross-country motorized use in these areas would move conditions away from the desired conditions stated in the forest plan.

Also under this alternative, approximately 19.7 miles of forest roads, 1.36 miles of which are unauthorized roads, would be within 100 feet of the General Crook Trail. This level of motorized use adjacent to the historic trail would continue to not comply with Forest Plan direction to emphasize foot and horse travel only on this trail. Allowing unrestricted cross-country use in the

area would also limit the effectiveness of management to limit motorized use on the trail as indicated in the forest plan.

Alternative 3 – Direct and Indirect Effects

This alternative would designate 3,097 miles as open and 4,317 miles would be designated as closed. The Cinder Hills OHV Area would remain open to motor vehicles. Designated roads within existing seasonal closure areas would continue to be seasonally closed to motor vehicles.

Issue 1: Prohibit Cross-country Motorized Travel – Motorized off-road travel would be prohibited, except when authorized by permit or where designated it is occurring in designated areas (Cinder Hills), in camping corridors, or in designated motorized big game retrieval areas. A significant, but unknown number of sites would be protected from potential effects and excluded from the area of potential effect by restricting motorized cross-country travel.

Permits could be authorized for specific purposes, such as to gather firewood, to continue activities related to grazing permits, or for traditional cultural practices. Access to the Forest for traditional cultural purposes, such as plant collecting, would continue to be authorized by tribally specific Memoranda of Agreements, Forest policy, and the recently authorized Department of Agriculture Farm Bill.

Issue 2: Reduce the Number of Roads – The current open road mileage is about 7,484 miles and 99 percent of all roads are within 1 mile of another. Alternative 3 would close approximately 4,317 miles of road. This alternative would reduce road density by approximately 20 percent; 78.6 percent of roads open to the public are within 0.5 mile of the nearest road. Since proximity to roads is a significant factor resulting in the looting of sites, reducing the number of roads within 0.5 mile of another by almost 14 percent would help protect an unknown number of sites from possible looting. Between 266 and 614 sites (average 440) would continue to be within the area of potential effect of the designated miles of road but 383 to 883 (average 633) sites would be removed from the area of potential effect (table 32 and Appendix 1 in Heritage specialist report).

Table 32. Percentages of roads open to the public within 4 miles of nearest road by alternative (outside of wilderness areas)

Miles to nearest road open to public	Alternative 1 – Current Situation	Alternative 3	Alternative 4
0 - 0.5 miles	93.3 %	78.6 %	81.5 %
0.5 – 1 mile	5.7 %	17.1 %	14.8 %
1 – 2 miles	0.8 %	3.7 %	3.2 %
2 – 4 miles	0.2 %	0.6 %	0.5 %
> 4 miles	0	0	0
Total	100 %	100%	100%

On the Coconino National Forest, pinyon-juniper vegetation is where the large majority of archeological sites exist. Roads have been identified as the main cause of impacts to sites on the Forest. This alternative would decrease impacts to archeological and cultural resources by closing 66 percent of the currently existing routes in pinyon-juniper vegetation types.

This alternative would help achieve desired conditions of reducing road-related effects to National Historic Landmarks and Districts by closing approximately 35 percent of the roads in those areas (Appendix 4 in Heritage specialist report) and would also remove all unauthorized roads from historic landmarks and districts. This would have the greatest impact to the Ridge Ruin National Historic District by removing portions of five different unauthorized roads located in the district.

Also under this alternative, the miles of forest roads within 100 feet of the General Crook Historic Trail would be reduced by one third. This alternative would eliminate all but 0.07 mile of unauthorized roads 100 feet from the General Crook Historic Trail. This reduction in the level of motorized use adjacent to the historic trail would help achieve Forest Plan direction to emphasize foot and horse travel on this trail.

This alternative would designate 30 miles of unauthorized road for motorized use. None of the 30 miles of the unauthorized routes are expected to result in impacts to cultural sites because these routes would need to be fully surveyed and all potential site impacts would need to be addressed prior to inclusion on the motor vehicle use map (in accordance with the Protocol).

Issue 3: Motorized Trail System – Approximately 37 miles of existing system motorized trails would be kept as part of the system and 1.8 miles of unauthorized motorized trails would be designated (Lower Smasher Canyon Trail). Eighty-nine miles of unauthorized motorized trails would be closed to motorized use. Smasher Canyon Trail is an unauthorized trail in the southwest edge of the Forest that follows the bottom of a wash and ends about 1 mile east of the Verde River. The lower 1.5-mile section would be designated as an approved motorized trail. The upper section would not be designated. Smasher Canyon Trail would require an archaeological survey before it could be made available for public use on the motor vehicle use map; any sites found would need to be avoided or excavated to the extent needed to mitigate impacts from use as a motorized trail.

Although the trail has not been archaeologically surveyed, its designation is expected to have little archaeological impact since no sites were identified during a cursory examination of it by the Red Rock District Archaeologist. Furthermore, it is located in a part of the Forest that has a very low archaeological site density. Between 7 and 13 sites (average 10) would still be within the area of potential effect of the motorized trail system, but 15 to 30 sites (average 23) would be removed from the area of potential effect of the motorized trail system (Appendix 2 in Heritage specialist report).

Issue 4: Dispersed Camping – Roadside parking and camping for the length of a vehicle would be allowed throughout the Forest. This alternative would designate 300-foot-wide corridors along both sides of 581 miles of designated road and along one side of 32 miles of designated road for the sole purpose of motorized access to dispersed camping. This would result in 43,313 acres of motorized dispersed camping corridors on the Forest. Many changes were made to the draft EIS to remove corridors that overlapped with known archeological sites. Selected sites would be monitored to ensure they are not being adversely impacted by camping activities, and if they are, corridors would be modified or deleted to protect sites from further impacts.

Potentially 453 to 1,226 (average 839) sites could be affected by designation of 613 miles of dispersed camping corridors. However, impacts due to dispersed motorized camping are most likely to be in corridors that are in high site density areas. Of the 613 miles of proposed

designated motorized camping corridors, only 103 are in high site density areas as corridors containing high site densities or particularly sensitive or significant sites were deleted from consideration during the corridor evaluation process. Nine corridors with potentially very sensitive sites would not be listed on the motor vehicle use map until they have been inspected by Forest archaeologists and determined whether motorized camping should be allowed in their vicinity, or if modifications should be made to the corridor to ensure their protection. Sixteen additional sites within approved corridors would be monitored to ensure they do not receive additional impacts due to motorized camping. Protective measures would be taken if such impacts are found. Any additional proposed dispersed camping areas would use information from archaeological surveys and State Historic Preservation Office consultations, as required by the Travel Management Rule Protocol, to minimize effects and the number of sites that could be impacted.

Issue 5: Motorized Big Game Retrieval – No motorized big game retrieval would occur except in Arizona Department of Game and Fish Management Units 7W and 8, where the Coconino would authorize off-road travel for retrieval of elk. This is estimated to result in approximately 74 individual off-road vehicle trips for motorized big game retrieval per year in an area of about 49,478 acres. This would be a very large decrease in off-road motorized use from current conditions. Although it is possible that off-road use for motorized big game retrieval could result from the estimated 74 vehicle trips per year, this is almost a 100 percent decrease in impacts from off-road travel under existing conditions.

Prohibiting cross-country use in the area and not allowing off-road travel for motorized big game retrieval in the vicinity of the General Crook Historic Trail and National Historic Landmarks and Districts would help achieve Forest Plan direction to limit motorized use in these areas.

Alternative 4 – Direct and Indirect Effects

This alternative would designate 3,991 miles as closed, and would add approximately 51.8 miles of motorized trail (includes system designation of the Lower Smasher Canyon and Challenger unauthorized motorized trails). The Cinder Hills OHV Area would remain open for cross-country motorized travel. Designated system roads within existing seasonal closure areas would continue to be seasonally closed to motor vehicle use.

Issue 1: Prohibit Cross-country Motorized Travel – This alternative would have the same effects as alternative 3 (see page 102). A significant, but unknown number of sites would be protected from potential effects and excluded from the area of potential effect by restricting motorized cross-country travel.

Issue 2: Reduce the Number of Roads – This alternative would close 3,991 miles of road and designate 36 miles of unauthorized roads. Between 285 and 669 sites (average 477) would continue to be within the area of potential effect of the designated roads. Between 365 and 832 (average 599) sites would be removed from the area of potential effect (table 32 and Appendix 1 in Heritage specialist report). None of the 36 miles of the unauthorized routes are expected to result in impacts to cultural sites because these routes would need to be fully surveyed and all potential site impacts would need to be addressed prior to inclusion on the motor vehicle use map (in accordance with the Protocol).

As stated previously, pinyon-juniper vegetation is where the large majority of archeological sites exist on the Forest. Roads have been identified as the main cause of impacts to sites on the Forest. This alternative would decrease impacts to archeological and cultural resources by closing 53 percent of the currently existing routes in pinyon-juniper vegetation types.

This alternative would move toward desired conditions of reducing road-related effects to National Historic Landmarks and Districts by closing approximately 34 percent of the roads in National Historic Landmarks and Districts (Appendix 4 in Heritage specialist report). This alternative would remove all unauthorized roads from historic landmarks and districts. This would have the greatest impact to the Ridge Ruin National Historic District by removing portions of five different unauthorized roads located in the District. This alternative would designate a portion of road to provide access to the C. Hart Merriam Historic Landmark, which would be closed under alternative 3.

Also under this alternative, the miles of Forest roads within 100 feet of the General Crook Historic Trail would be reduced by one third. This alternative would eliminate all but 0.07 mile of unauthorized roads 100 feet from the General Crook Historic Trail. This reduction in the level of motorized use adjacent to the historic trail would help achieve Forest Plan direction to emphasize foot and horse travel on this trail.

Issue 3: Motorized trail system – This alternative would add 51.8 miles of nonsystem motorized trails. Thirty-seven miles of nonsystem motorized trails would not be designated as open. In addition to Lower Smasher Canyon Trail, the Challenger Trail would be added as a motorized trail. Between 20 and 39 sites (average 29) would still be within the area of potential effect of the motorized trail system but 2 to 6 sites (average 4) would be removed from it (Appendix 2 in Heritage specialist report).

The Challenger Trail is an existing unauthorized route that circles the San Francisco Peaks between about 8,000 and 8,500 feet. Its west end is the Snowbowl Road, just northeast of Little Leroux Spring, and its east end is in Schultz Pass. Each end would connect with the currently designated Fort Valley Trail System. Only scattered segments of the Challenger and Fort Valley Trail System have been archaeologically surveyed; however, 20 historic or prehistoric sites are known to be on or near the trail routes. These include prehistoric field houses, and historic period homesteads, ranches, logging railroad beds, and aborted water diversion ditches (see Appendix 1 in Heritage specialist report). Three specific areas of ceremonial and traditional significance to the Hopi and Navajo are along or near the Challenger Trail, and its entire route is within the San Francisco Peaks traditional cultural property boundary, an area that is sacred to at least 13 tribes.

Before the Challenger Trail could be designated, archaeological surveys would need to be conducted to determine if any damage has occurred to any of the 18 known sites, and if there are any other sites that may be damaged by use of the trail. Formal consultations would need to be made with the 13 tribes known to have significant religious and traditional reverence for the Peaks to determine their specific concerns about a designated motorized trail there, and whether those concerns could be mitigated in some way. Based on the cultural significance of the area, it is highly likely that designation of the Challenger Trail as a motorized system trail would result in a negative impact on the values that are part of the religious and traditional significance of the area.

Issue 4: Dispersed Camping – This alternative would have the same effects as alternative 3 (see page 103).

Issue 5: Motorized Big Game Retrieval – Motorized big game retrieval off of designated routes for legally harvested cow and bull elk would be permitted for 1 mile off all designated routes on the Forest. This is expected to result in an average of approximately 2,922 off-road vehicle trips per year on the Coconino National Forest for elk, based on 2009 Arizona Game and Fish Department hunting statistics. Although it is highly probable that one or more of these trips may result in a vehicle running over scattered artifacts or structural elements of cultural significance, it is expected the effects from one or two passes from a rubber-tired vehicle would be negligible. Additionally, restrictions limiting motorized game retrieval and requiring use of the most direct and least ground-disturbing route would also minimize potential impacts to cultural sites from this activity to negligible levels.

Alternative 4 would leave 326 more miles of road open than would alternative 3 and would thus have the potential to impact more archaeological sites than alternative 3. However, specific effects could be different because of their locations. Under alternative 4, the area of land outside of designated wilderness within ½ mile from a designated route would be decreased by 14.7 percent, which is only slightly more access than under alternative 3.

Cumulative Effects

To understand the contribution of past actions to the cumulative effects of the proposed action and alternatives, this analysis relies on current environmental conditions as a proxy for the impacts of past actions. This is because existing conditions reflect the aggregate impact of all prior human actions and natural events that have affected the environment and might contribute to cumulative effects.

No cumulative effects have been identified for any of the alternatives, since any sites cut by roads have already been affected, regardless of which alternative is considered. Sites that already have roads through them have already been affected by construction, maintenance, and use. Routine maintenance of such sites should be limited to areas that have previously been affected by use and maintenance and any disturbance would take place in areas that have previously been disturbed. Some improvement in condition to sites presently cut by roads, or those that have roads leading to them, can be expected should those roads be closed. However, sites would still be reasonably accessible since expected road density should result in no areas being more than about 0.5 mile from road access.

All alternatives would continue to allow access to tribal governments for traditional religious purposes, regardless of road closures. Areas that are needed for traditional religious purposes, plant collecting, or other special needs may still be accessed by individuals requesting a permit for this purpose. Areas would be provided where fuelwood may be collected, also under permit. Since access for traditional and cultural purposes would not be affected by any of the alternatives, there would be no cumulative effects.

No change would result by designating 30 to 36 miles of unauthorized roads or allowing pull-off parking or camping to take place within one vehicle length of existing roads, since this use has been allowed in the past and would continue to be allowed. Both the unauthorized routes and the acres to be designated as corridors for dispersed camping have previously been available for this activity and efforts have been made to keep popular camping areas available in designated

corridors. Areas where potential conflicts may exist between archaeological sites, traditional uses, and dispersed camping would receive archaeological survey first to determine whether such areas may be designated, and monitoring would be recommended in potentially sensitive areas to determine if designations should be changed. Since there would be no direct or indirect effects to archeological sites from designation of dispersed camping corridors, there would be no cumulative effects.

Contemporary Indian Uses

Affected Environment

The American Indian people of the Southwest have a relationship and respect for the land that extends back into antiquity. To many, their people have been here for centuries, with roots in the various prehistoric traditions that once lived on the land now delineated as the Coconino National Forest. One of the most important places to virtually all tribes in the Southwest is the San Francisco Peaks, but they are particularly important to the Hopi and Navajo. Other examples of this for the Yavapai people include the Red Rock country around Sedona and Montezuma Well, a national monument within the Coconino National Forest. The *Dil zhé'é* (Tonto Apache) also hold Montezuma Well as a significant place in addition to Fossil Creek, an important area for their culture and history.

The Coconino Forest staff routinely consults 13 tribes about proposed projects and management policies. These are the: Pueblo of Acoma, Apache (San Carlos Apache Tribe, Tonto Apache Tribe, White Mountain Apache Tribe, and Yavapai-Apache Nation), Havasupai Tribe, Hualapai Tribe, Hopi Tribe, Navajo Nation, San Juan Southern Paiute Tribe, Pueblo of Zuni, and Yavapai (Yavapai-Prescott Tribe, Ft. McDowell Yavapai Nation, and Yavapai-Apache Nation). Specific consultations are also conducted with various Navajo Chapters that border the forest—Cameron, Coalmine, Dilcon, Gap-Bodaway, Leupp, Tolani Lake, and Tuba City. Besides public involvement activities—such as open houses, meetings, presentations, newspaper articles, information on the forest web page, etc.—special efforts were made to consult with tribal groups living in proximity to the forest and known to use the forest and collect forest products for religious and ceremonial purposes (see chapter 4, "Tribal Consultations"). Among the concerns expressed was the potential for damage and desecration to traditional cultural properties and sacred places as the number of people using motor vehicles for recreation purposes on the forest increases. Similarly, increased off-road use may threaten or destroy seasonal or scarce plant populations. Overcollection of plants used for ceremonial and traditional purposes by nontribal people is another concern resulting from increased visitation, access to plant collecting areas, and off-road vehicular use.

The Coconino National Forest is important to the tribes for many reasons, but the most common uses can be roughly summarized by six general categories:

1. Traditional cultural properties, including natural features such as mountains, springs, shrines, and other places where people go to give prayers and offerings.

2. Collecting forest products such as plants, soil, pigments, and water for ceremonial, medicinal, and other traditional uses.

3. Collecting firewood for ceremonial fires and home heating purposes

4. Collecting pinyon nuts for food and commercial sale.

5. As a source of logs and poles for ceremonial brush structures, kiva beams, and pueblo restorations.

6. Hunting big game and collecting certain small mammals and birds for ceremonial purposes. (Note: the Arizona Game and Fish Department and U.S. Fish and Wildlife Service regulate these activities.)

Environmental Consequences to Contemporary Indian Uses

Alternative 1 – Direct and Indirect Effects

There would be no change in the use of motorized vehicles or access to places and forest resources under alternative 1. No places or sites of cultural and religious significance or traditional uses would be affected with the continued status quo provided by alternative 1.

Alternative 3 – Direct and Indirect Effects

Restricting public motorized use to designated routes and reducing the miles of roads would change the areas that people have historically accessed without restraint. This should allay some concerns regarding the proliferation of motorized activity and its effects on places and plants of religious and cultural significance, particularly the potential for increased access and potential desecration. People needing access to collection sites necessary for ceremonial activities and other traditional uses would have less opportunity to drive to collection sites with this alternative. However, access to forest products would only be partially affected, since many of them (such as plants, poles, and logs) are generally available across much of the forest and would remain accessible from the road system proposed under alternative 3. Under this alternative, American Indians would continue to have access to forest products and places of religious and traditional use under the authority of the memoranda of understanding and free use permits issued for this purpose. Activities authorized by a permit are exempt from the restrictions of the Travel Management Rule and an authorized forest officer can allow cross-country motorized access or via a road closed to the public under the terms of a permit for the collection of such products.

Alternative 4 – Direct and Indirect Effects

Effects that would result from implementation of alternative 4 are similar to those of alternative 3, but with a small increase in open road mileage. The increased road and trail miles would allow more motorized access to areas across the forest, and so would provide a slight increase in access from alternative 3 for people to gather and impact forest products. It is likely that alternative 4 would provide more access to special places than alternative 3, since many of the additional miles of road were proposed specifically for such access. The collection of forest products for traditional or ceremonial purposes would continue under the authority of the free use permits issued to American Indian people for such purposes.

Cumulative Effects

There would be no cumulative effects to contemporary Indian uses on the Coconino National Forest.

Air Quality

Introduction

We received public comments that expressed concern about the potential effects of the proposed alternatives (particularly motorized uses) on air quality. We have determined that this issue is not significant to the decision among travel plan alternatives. The public comments we received expressed concerns about the undesirable effect of encountering emissions from motorized vehicles on Forest roads and trails. The Forest Service acknowledges that odor generated by combustion engines, particularly two-cycle engines, can diminish a nonmotorized user's experience of Forest trails. However, this is a recreation (user satisfaction) issue rather than a general air quality issue. Air quality is not significantly affected by potential motorized use of Forest roads and trails under any of the alternatives.

This air quality analysis examines area weather and meteorology and any potential for recreational travel to cause or contribute to violations of National or State Ambient Air Quality Standards, degradation of air quality by more than any applicable PSD (Prevention of Significant Deterioration) increment, affect class I areas, or cause or contribute to visibility impairment beyond any existing conditions.

Legal Framework

The basic framework for controlling air pollutants in the United States is mandated by the 1970 Clean Air Act, as amended in 1990 and 1999. The Clean Air Act was designed to "protect and enhance" air quality. The primary means by which this is accomplished is by complying with national ambient air quality standards.

Section 160 of the Clean Air Act requires measures "to preserve, protect, and enhance the air quality in national parks, national wilderness areas, national monuments, national seashores, and other areas of special national or regional natural, recreational, scenic, or historic value." Stringent requirements are therefore established for areas designated as "class I" attainment areas. Class I areas include Forest Service and Fish and Wildlife Service designated wilderness areas over 5,000 acres that were in existence before August 1977, and national parks in excess of 6,000 acres as of August 1977. Designation as a class I area allows only very small increments of new pollution above existing air pollution levels. Grand Canyon National Park, Sycamore Canyon Wilderness, Pine Mountain Wilderness, and Mazatzal Wilderness are class I areas with portions in Coconino, Yavapai, and Gila Counties that are considered as part of this analysis (U.S. EPA 2010a).

If a community does not attain the national ambient air quality standards, it is designated as a "nonattainment area" and must demonstrate to the public and the Environmental Protection Agency how it will meet standards in the future. This demonstration is done through the State Implementation Plan (ADEQ 2003). More information regarding the status of the nonattainment designations is available at the Arizona Department of Environmental Quality's website: http://www.azdeq.gov/environ/air/plan/notmeet.html#san.

National Ambient Air Quality Standards

The EPA has established national ambient air quality standards for six criteria pollutants that have been determined to be harmful to public and the environment. The primary standard is intended to protect human health.

Particulate is a term used to describe dispersed airborne solid and liquid particles that will remain suspended in the atmosphere from a few seconds to several months. Particulate matter (PM) less than 2.5 microns in diameter (referred to as $PM_{2.5}$) or less than 10 microns in diameter (PM_{10}) describes particles small enough to enter the human respiratory system. Combustion processes produce ultra fine particles, and are the bulk of $PM_{2.5}$. $PM_{2.5}$ is the principal cause of haze; it seldom settles and is usually removed from the air by rain. PM_{10}, which often consists of pollen and spores with dust, settles in hours.

Visibility Protection and Regional Haze

Within class I areas, visibility is the air quality-related value that is most affected, especially by smoke or significant dust. Particulates that remain suspended in the atmosphere scatter light efficiently and contribute to poor visibility. Very small particles can travel great distances and contribute to regional haze problems. Cumulative particulate load may result from fire use or urban and industrial sources, or it may be from a combination of the two.

Prevention of Significant Deterioration

The Prevention of Significant Deterioration provisions of the Clean Air Act require measures "to preserve, protect, and enhance the air quality in national parks, national wilderness areas, national monuments, national seashores, and other areas of special national or regional natural, recreation, scenic, or historic value." Stringent requirements are therefore established for areas designated as class I areas (42 U.S.C. § 7475 (d)(2)(B)). Designation as a class I area allows only very small increments of new pollution above already existing air pollution levels.

Conformity – The general conformity provisions of the Clean Air Act (Section 176 (c)), prohibit Federal agencies from taking action within a nonattainment area that causes or contributes to a new violation of the standards, increases frequency or severity of an existing violation, or delays the timely attainment of a standard as defined in the area plan. The Coconino National Forest travel management planning process is not subject to the conformity provisions, since it is not located in a nonattainment area.

Area of Analysis

The analysis area for consideration of air quality impacts is the area within a radius of 62 miles (100 kilometers) from the edge of the project area (Coconino National Forest). The EPA's air quality permitting system suggests that sources within a radius of 100 kilometers be considered, especially those located downwind of the source.

Affected Environment

Air quality throughout the project area is considered good to excellent during most of the year due to limited emission sources and vigorous wind dispersal. Air quality in the area is influenced by atmospheric conditions and weather, topography, and local emission sources. Visibility in certain class I areas appears to be degrading with time. However, while the air quality in certain

locations has deteriorated over time, most local residents have seen improvements. These improvements have resulted from joint efforts between State and local air quality agencies in Arizona (ADEQ 2009) to develop state implementation plans. In areas including the Grand Canyon and Sycamore Canyon, overall visibility has improved, but there are still days where atmospheric conditions and local emissions result in poor visibility from haze.

The Coconino National Forest is not located within any nonattainment areas for air quality. The Payson area is the only nonattainment area considered in this analysis as it is within 100 km (about 62 miles) of the project area (U.S. EPA 2010b). The Payson area is not in full attainment for PM_{10} because of emissions from industrial sources (rock crushers, concrete batch plants, and a sawmill), wood smoke, and paved and unpaved roads.

The Regional Haze Rule (40 CFR 51.309(d)(7)) requires states to assess and reduce pollutants that cause haze in order to improve visibility at class I areas, including Grand Canyon National Park and Sycamore Canyon Wilderness.

The Regional Haze State Implementation Plan for the State of Arizona from December 23, 2003 states that "road dust is not a measurable contributor on a regional level to visibility impairment in the 16 Class I areas (ADEQ 2003). Due to this finding, no additional road dust control strategies are needed…" The Plan also states that the State of Arizona will "perform further assessments of road dust impacts on visibility. Based on these assessments, if road dust emissions are determined to be a significant contributor to visibility impairment, the State of Arizona commits to implement emissions management strategies…"

Environmental Consequences to Air Quality

Direct and Indirect Effects of All Alternatives

Designating a system of routes or areas for motorized use on the Coconino National Forest is not expected to result in a substantial decrease or increase of motorized use on the Forest or surrounding areas. Therefore, none of the alternatives is expected to have any measurable effect on air quality caused by dust from motorized vehicle use on paved and unpaved roads.

Studies on establishing restrictions on motorized use have found that motorized use may change within an area, depending upon the nature of those restrictions. For example, a 2008 study from Utah State University estimated that in some instances land use restrictions or management changes on OHV recreation could decrease the number of trips by over 20 percent or increase the number of trips by over 40 percent (Jakus et al. 2008). The study concludes that decreases in OHV use are expected to result from decreased opportunities for satisfactory OHV recreation experiences. They suggest that increased motorized use may result from increased travel time or increases in nonmotorized recreation.

On the Coconino National Forest, we don't expect the proposed action alternatives to have a distinct effect on reducing or increasing motorized use across the Forest. One reason for this is that according to the National Visitor Use Monitoring Survey (2009), only 1.1 percent of users on the Coconino National Forest participate in OHV use as their primary activity. An additional 7.1 percent of visitors come to the Coconino National Forest to drive for pleasure as their primary activity. These activities combined mean less than 10 percent of visitors consider motorized use as their primary activity on the Forest. It is unclear if establishing a designated system of roads, trails, and areas to manage motorized use would decrease or increase this use.

Even if the number of motorized vehicle users who do come to the Forest decreases, it is very likely that these motorized users will seek similar uses on nearby lands such as private, State, or other Federal lands (i.e., Kaibab National Forest, Prescott National Forest, Tonto National Forest, BLM managed lands). Emissions on these adjacent lands also contribute to the same airsheds as do emissions on the Coconino National Forest. Thus, displacement of motorized use as a result of motor vehicle designations on the Coconino National Forest is not expected to result in any increase or decrease in emissions.

Designating a system of roads, trails, and areas under either action alternative is expected to substantially limit cross-country motorized use and decrease motorized use to approximately two-thirds of the existing routes on the Forest. Though we don't expect change in motorized use on a forestwide or regionwide basis, we do expect there would be increased or decreased use in specific areas of the Forest. Use may increase on some designated routes because of a "concentration effect," which is caused by the movement of users from nondesignated routes to designated ones. On routes that are not designated for motorized use, we expect motorized use to decrease.

In areas where designation decreases the amount of motorized routes and areas, there may be a slight decrease in emissions and dust affecting nearby vegetation, wildlife, and recreational users. This decrease would occur within an area of 100 feet from the road edge and would be very small in magnitude.

The limitation of off-road travel in alternatives 3 and 4 would also likely result in a slight decrease in levels of dust affecting nearby vegetation, wildlife, and recreational users. Off-road travel restrictions are likely to reduce the loss of vegetation from driving off-road, resulting in more ground cover and less wind-blown dust. Areas most affected by this decrease in dust would be the lower elevations of the Forest in pinyon-juniper and desert grassland habitats where vegetation is naturally sparse and most vulnerable to disturbance from motor vehicles.

In general, vegetation ground cover may increase in the habitat types where off-road travel becomes restricted, but this slight increase in ground cover would be generally diffused across the landscape and would probably not be noticeable. In areas near private lands or popular recreation areas where off-road travel is common and several unauthorized roads have been established, studies have shown that continued off-road use on bare ground with regular disturbance can cause high levels of dust measuring several tons per acre each year (Goossens and Buck 2008). In areas where this level of off-road use and bare ground occur, air quality impacts are likely to occur within approximately ¼ mile during off-road driving or winds above 20 miles per hour (it differs according to grain size of the soil).

Under the no action alternative, areas such as private lands in Cornville, and dispersed recreation areas such as Jacks Canyon (figure 19) and Stoneman Lake would continue to have a moderate frequency of decreased air quality from dust. This impact would be alleviated by alternatives 3 and 4, which restrict off-road travel and would facilitate a decrease in bare ground and dust.

Figure 19. Dispersed recreation area at Jacks Canyon. Establishment of unauthorized roads at heavy dispersed recreation sites creates large areas of bare ground that could result in dust.

In areas where routes or areas are designated, there could be an increase in motorized use from anywhere between 0 and 40 percent (Jakus et al. 2008). This could result in increased dust and emissions concentrated within about 100 feet of the road prism or area. The magnitude of this increase and how long it lasts is strongly affected by topography, weather, road material, and use of the route. Although research shows there is an association between vehicle emissions and cardiovascular health (Grahame and Schlesinger 2010), this association is based on emissions data from major transportation corridors or air quality measurements within a larger area and therefore is not very relevant to this area.

While there may be decreases or increases of emissions or dust from motor vehicle use in some localized areas where existing routes or areas have not been designated, there would be no discernable difference at the county or airshed level. This is because the designation of routes and areas is not expected to change the amount of motorized use within the Coconino National Forest or surrounding areas. Additionally, any emissions that do occur as a result of motorized use on the Forest are expected to be pushed to the north and east as a result of the area's prevailing southwest winds. This would move emissions and particulate matter away from nearby nonattainment areas such as the Payson area. As a result, none of the alternatives is expected to change air quality measurements causing a violation of county or class I air quality standards. The increases in vehicle emissions that may occur at designated routes and areas are expected to last a short period of time and are not expected to result in measurable impacts to health or visual quality. In conclusion, we don't anticipate there will be measurable direct or indirect effects to air quality.

Cumulative Effects

Because none of the alternatives would cause direct or indirect effects to air quality at the county or airshed level, there would not be any cumulative effects discernable at those scales for which air quality is managed. Localized increases of emissions from a potential concentration of use on designated routes would only result in cumulative air quality impacts to those areas where vegetation clearing or other management activities are occurring in the same area. The cumulative impact of concentrated use and resulting emissions to other activities such as large construction machinery that could cause dust and emissions is expected to be rare because public access is often limited in active construction sites. Similar cumulative effects from prescribed burning activities would also be limited or avoided for the same reason.

Soil and Water

Introduction

The existing condition of the following resources, and terrestrial or riparian ecosystems are analyzed either at a Forestwide scale or by 5th-level hydrologic unit code (HUC) watershed: soils including soil condition and productivity, montane meadows, wetlands, riparian areas, and water quality. Units of measure we used to analyze current sediment delivery into stream courses associated with roads include road type and traffic use, road density, and number of road/stream crossings. Soil, riparian and wetland road locations and conditions, and water quality category will be units of measure used to analyze current conditions of these resources.

Methodologies, Assumptions and Data Limitations

The primary methodologies and modeling systems used in this analysis are included below. For more information on the methodologies, assumptions and data limitations used, please refer to the Soil and Water specialist report, located in the project record.

The Terrestrial Ecosystem Survey: The Terrestrial Ecosystem Survey is used to map, classify and evaluate soils on the Forest. It contains predictions and limitation of soil and vegetation behavior for selected land uses. The Terrestrial Ecosystems Survey ecological units (and soils) are derived from the Forest Ecological Unit Inventory, and the Terrestrial Ecosystems Survey of the Coconino National Forest (USDA Forest Service 1995).

Erosion Hazard and Soil Condition: Erosion hazard interpretations are derived from the Terrestrial Ecosystem Survey as determined by the Universal Soil Loss Equation (USLE) model (USDA Agricultural Research Service 2009). The model averages soil loss Forestwide by Terrestrial Ecosystems Survey map unit and may or may not represent on-site erosion hazard due to soil variability. Soil condition is derived from the Terrestrial Ecosystems Survey and includes recent on-site refinement per the Forest Service's Southwestern Region soil condition protocol (FSH 2509.18, R3 Supplement No 2509.18-99-1, 1999). Soil conditions used reflect averaged interpretations by Terrestrial Ecosystems Survey map unit and may or may not represent on-site conditions due to the wide variability of soils.

Water Erosion Prediction Project (WEPP) Erosion Model: The WEPP model was used in this analysis to estimate and compare sediment delivery resulting from each alternative. It is beyond the scope of erosion modeling to accurately quantify the amount of hillslope soil erosion and sediment delivery into connected drainages and watercourses occurring Forestwide, but the

WEPP FUME model is used to estimate a range of sediment delivery from both undisturbed forest hillslopes and roads by road density. It appropriately uses the unburned variable scenario for outputs.

Affected Environment

Soil Condition and Productivity: Due to the wide range of ecological types on the Forest, existing soils are also quite variable. Five of the 12 recognized soil orders are present on the Forest ranging from Aridisols in the desert lifezones to Inceptisols in the Alpine-Tundra. The majority of the soils classified fall into woodland and forest soil types (Alfisols and Inceptisols) followed by a fairly large amount of Mollisols soils where past and present herbaceous vegetative cover developed organic surfaces. Wetland and montane meadow soils are among the most productive soils on the Forest. These soils and riparian areas have some of the highest levels of impacts associated with motorized travel.

Much of the Coconino National Forest formed in volcanic basalt and cinder parent materials lending itself to clayey-textured soils ranging in depth from shallow (less than 4 inches to bedrock) to moderately deep (20 to 40 inches to bedrock) and deeper soils on flatter slopes that are generally less than about 15 percent gradient. These clayey soils have slow infiltration and permeability and rapid runoff with increasing slope.

Other dominant soils are derived in sedimentary rocks including sandstone and limestone and are generally medium and coarse-textured throughout their profiles. Soil depth ranges from shallow and moderately deep to deep in low-lying positions. Water infiltration and permeability is moderate to rapid and runoff slower than clayey soils described above. Recent developed soils (Entisols) are found in fluvial stream systems and are generally coarse textured and rocky throughout their profile. Water infiltration is rapid and runoff slow.

Table 33 illustrates the estimated historic and current soil condition based on Terrestrial Ecosystems Survey data. The difference between historic and current represents the impacts on the soil caused by human activities and affected by periods of drought.

Table 33. Forestwide soil conditions

Soil condition class	Historic percent	Current percent	Difference between historic and current
Satisfactory	89	62	26%
Unsatisfactory	Low (<5%)	7	7%
Impaired	Low (< 5%)	20	20%
Inherently Unstable	11	11	0%

Satisfactory soil conditions have soil productivity maintained under current use. Unsatisfactory and impaired soil conditions are the result of past management practices and indicate a loss of soil function and soil productivity. Satisfactory soils are not at high risk of loss of soil productivity from motorized use unless repeated travel causes loss of vegetative ground cover (Napper 2008; figure 20).

Figure 20. Unauthorized route created from repeated off-road motorized use adjacent to a meadow in Middle Kehl on the Mogollon Rim

Erosion Hazard: Table 34 illustrates erosion hazard classes on the Forest. Erosion hazard is the probability of soil loss resulting from complete removal of vegetation and litter (Terrestrial Ecosystems Survey Handbook, 4/1986). Severe erosion hazard signifies that loss in soil production potential from erosion is inevitable and irreversible if unchecked. Moderate erosion hazard signifies a loss in soil production potential from erosion is probable and significant if unchecked. Slight erosion hazard indicates loss in soil production potential from erosion is of low probability.

The Forest contains appreciable amounts (about 55 percent) of moderate and severe erosion hazard classes. Concentration of current unmanaged use around communities (such as Cornville, Doney Park, Munds Park, and Rimrock) and destination recreation areas including trails have a very high probability of soil damage if left unmanaged.

Table 34. Erosion hazard on the Coconino National Forest

Erosion hazard	Forest acres	Relative percent of Forest
Slight	846,118	46%
Moderate	583,805	32%
Severe	401,833	22%
Total	1,831,756	100%

Soils with severe erosion hazard intersect about 672 miles of identified forest roads. About half of the soils with severe erosion hazard are inherently unstable soils. These are generally on steep slopes, may have low amounts of vegetative ground cover from natural erosion, and are very fragile and susceptible to accelerated erosion. Disturbance that removes the vegetative ground

cover (such as observed off-road travel and wildfire) on soils with severe erosion hazard has created bare soil susceptible to accelerated erosion.

Surface-erosion problems are worst in highly erodible terrain, particularly landscapes underlain by granite or highly fractured rocks (Megahan and Ketcheson 1996). Unimproved, native roads located on these soils are also primary sediment sources because they generally do not have protective rock or vegetative cover. Existing roads and trails serve as a conduit by capturing and delivering sediment into connected stream courses, and impairing water quality from a suspended sediment standpoint. Soils with moderate erosion are also at risk for accelerated erosion and sediment delivery but to a lesser magnitude than soils with severe erosion hazard.

Montane Meadow Conditions: Many montane meadows (those meadows found in ponderosa pine and mixed-conifer vegetation types) are heavily impacted by recreational motorized use and camping. This type has the greatest susceptibility from off-road use on the Forest based on the flat terrain and lack of obstacles (trees, brush, and boulders) preventing cross-country motorized use (USDA Forest Service 2008a). There are about 24,199 acres of montane meadows for an aerial extent of 1.3 percent on the Forest (Steinke 2007).

About 387 miles (Forest roads analysis, USDA Forest Service 2007a) of forest roads and an unknown number of unauthorized roads intersect these meadows and provide easy access to recreational users (dispersed and off-road camping). A high majority of these meadows have areas of compacted surface soils (caused by motorized use, camping and ungulate grazing) and loss of protective vegetative ground cover resulting in accelerated soil erosion and loss of soil productivity and are classified as impaired soil conditions. Forestwide, montane meadow soil conditions were reported to have 33 percent satisfactory and 67percent impaired conditions (Steinke 2007). Although not well documented, impaired and unsatisfactory montane meadow soil conditions have been observed where dispersed camping occurs, but is generally limited to the area where RVs and vehicular parking occurs and are usually small in acreage extent.

Where it occurs, repeated off-road motorized use can and has removed the protective vegetative ground cover and likely contributes to soil compaction (especially during periods when soils are wet) in montane meadows resulting in rutting, localized minor gully erosion and loss of soil and vegetative productivity on site.

Wetlands Condition: There are about 74 wetlands or 1,140 acres for a 0.1 percent extent on the Forest (Steinke 2007). Forty-three wetlands are currently in proper functioning condition and 31 are functioning at risk according to on-site information collected and reported in the Draft Sustainability Analysis of the Coconino National Forest (Steinke 2007). Most wetlands are accessible by road and/or off-road travel and provide easy opportunity for off-road dispersed camping and motorized use (figure 21).

About 5.6 miles of Forest roads and an unknown number of unauthorized roads are adjacent to or that intersect portions of wetlands (Forest roads analysis, USDA Forest Service 2007a). These roads alter surface hydrology and water flow causing loss of water storage, vegetative productivity and wetland function. Additionally, dispersed camping has been observed in portions of wetland zones or near springs and seeps causing soil disturbance and loss of soil and vegetative productivity and wetland and riparian function.

Figure 21. Ruts from off-road motor vehicle use in a wetland on Anderson Mesa

Riparian Areas Condition: There are 5,103 acres (about 0.3 percent of the Forest) of riparian areas mapped by the Terrestrial Ecosystem Survey. The Survey did not delineate and map riparian areas less than about 90 feet in width due to scale of mapping and therefore, there are many more acres on the Forest not accounted for in the 5,103 acres considered in this analysis.

On National Forest System lands, about 44 miles of roads (any level) currently are within 132 feet of a riparian streamcourse. The 132-foot distance is used following the Coconino forest plan, as amended, for forestwide riparian and nonriparian areas standards and guidelines, which are used as a measure of vegetation width needed to adequately filter sediments that may be delivered from roads into stream systems (forest plan, pp. 71 and 72).

Fifth-level watersheds with the greatest amount of roads within 132 feet of the riparian area are (in descending order): Upper Clear Creek (18 miles), Oak Creek (9 miles), Walnut Creek (7 miles) and Beaver Creek (5 miles) (USDA Forest Service 2010).

There are about 640 miles of riparian areas with adjacent floodplains on National Forest lands and 778 miles including lands of other ownership in the following conditions:

- 44 percent is in proper functioning condition
- 23 percent is functional at risk.
- 6 percent is nonfunctional
- 27 percent is unknown

The Soil and Water specialist report contains more information regarding the location of these conditions on the Forest.

Figure 22. Tire tracks observed on the bank of the Verde River near the community of Camp Verde (note complete lack of riparian vegetation)

Water Quality: Category 1 streams are streams that meet state water quality standards and are in full support of designated beneficial uses. Categories 2, 3, and 4 have waters where monitoring data shows common exceedances in water quality standards for turbidity and suspended sediments.

- There are currently six category 5 impaired (EPA 303(d) listed) waters (5 lakes and 1 stream) on the Forest due to mercury exceedances in fish tissue and *e. coli* exceedances in Oak Creek.
- The 2006/2008 ADEQ 303(d) impaired waters report lists waters including Oak Creek (from headwaters to Spring Creek, about 43.4 miles) as impaired due to exceedances in bacteria *e. coli*, including Spring Creek from Coffee Creek to Oak Creek, 6.4 miles). The likely source of the impairment is leaky septic systems and high levels of recreational swimming in Oak Creek.
- There are 24 miles of category 4 streams (not attaining). Most are located in the Verde River and its tributaries where past and current impairments of the water quality standard for turbidity have occurred.
- There are 240 miles of streams in category 1, 2 or 3 streams on the Forest.

Please see the Soil and Water specialist report for more information regarding stream categories and their descriptions on the Forest.

Existing Road Extent: Maintenance level 4 and 5 roads (paved) are limited in extent and amount to about 75 miles. These roads are grouped into the maintenance level 3 (improved roads) for this analysis.

The majority of roads are maintenance level 2 (native surfaced) roads under Forest jurisdiction and amount to about 7,044 or 94 percent of total miles. Within this category, identified and observed Forest system unauthorized routes may occupy a large percentage on Forest lands and amount to at least 962 miles or about 13 percent of all roads.

The least extensive road types are improved and paved roads. These roads are not proposed for closure. Level 1 and 2 roads (native, unimproved) that are not Forest system roads or are not managed by the Forest Service are minor in extent. These roads are not the same as unauthorized roads, but are roads on lands outside of national forest where there is no Forest Service right-of-way or roads on National Forest System lands where another jurisdiction owns the right-of-way. These roads contribute little to overall sedimentation and loss of soil productivity compared to Forest roads because many of these roads are paved, limited in extent, and limited in use (as in the case of routes to private property).

Out of the 8,407 miles of roads located within the Forest boundary, 923 miles are not Forest system roads. These 923 miles contribute an additional amount (about 11 percent) of total miles and perhaps a proportional amount of sediment (not quantified) is delivered into connected stream courses that may reduce water quality. All of these roads would remain open under all alternatives and contribute the same amount of sediment in all alternatives. These roads are pre-existing and are part of baseline conditions.

Motorized Trails: Establishment of motorized trails and ongoing use has caused the development of bare soil and reduced soil productivity. These effects are not widespread, but localized in area and thus are minor in extent. Current use has resulted in very minor additions of sediment (not quantified) above natural levels to connected stream courses. Engineered trails and roads are designed to prevent water buildup, disperse energy from water flow, and buffer sediment. The development of nonengineered roads and trails (unauthorized routes) has adversely impacted soil productivity and water quality by reducing the extent of undisturbed soil and providing avenues that displace and transport sediment to connected stream courses.

Dispersed Camping: Dispersed camping has been observed throughout the Forest but is most concentrated along the edges of montane meadows, riparian areas, wetlands, and in the ponderosa pine and aspen forests

Types of Road Designations

Nonsystem Roads - These roads are either not Forest Service jurisdiction because they are State, county, municipal, or private roads, or roads that are on Forest Service-managed lands, but are unauthorized roads.

Unauthorized Roads - These are roads on Forest Service-managed lands that are not part of the Forest Service road system. Generally, these include roads that have been created over time from repeated off-road travel or from travel on old logging roads that the Forest Service removed from the system (or never recorded) at some point.

Nondesignated Roads - This means the road is not proposed for designation for motorized use under the Travel Management Rule. Nondesignated roads may or may not be unauthorized, but are generally system roads.

Closed Roads – These are roads that have been given a designation as "closed" in the INFRA database, but may be regularly used by motor vehicles due to the "open unless signed closed" policy on the Forest. These system roads are not "unauthorized," but have been moved to the lowest level of maintenance in the past.

Nonjurisdictional Roads - These roads are owned via an easement by State, county, municipal, or private entities. An example would be an interstate highway that goes through the Forest boundaries. Nonjurisdictional roads are one type of nonsystem road.

(USDA Forest Service 2008a). Recent on-site visits and documentation indicates that soil and vegetation conditions in montane meadows, wetlands and streamside riparian areas are negatively impacted depending on access (Steinke 2007).

GIS analysis shows there are currently about 10,406 acres open to motorized, dispersed camping within 300 feet of perennial streams on the Forest. This includes areas adjacent to perennial streams without camping or other restrictions or closures. Some areas may not be accessible to vehicular traffic due to topography or dense vegetation.

Total Sediment Delivery from Current Road Buffers and Use Forestwide: The total number of road/stream crossings on the Forest in all watersheds is 4,992. There are 1,486 road stream crossings on nonjurisdictional roads within the Forest. Approximately 2,254 road/stream crossings occur on watersheds without perennial streams and therefore, motorized use in these watersheds still contributes to perennial water degradation but to a lesser extent than with watersheds with perennial streams. Motorized traffic at road/stream crossings on lands of other ownership cumulatively contribute and deliver an unquantified amount of sediment into connected stream courses.

Estimated annual sediment delivery in the seven watersheds with perennial streams at road and steam crossings is 55 to 330 tons. Intermittent or ephemeral stream crossings have the potential to deliver sediment downstream into connected perennial water. On National Forest System lands and watersheds with perennial streams, the vast majority of stream crossing sediment delivery occurs on unimproved roads due to the large numbers of stream crossings and bare soil on road surfaces; however, improved gravel roads contribute a portion also.

Environmental Consequences to Soil and Water

The following discussion analyzes the effects of each alternative on the following three categories: off-road vehicle travel, use of existing roads and trails, off-road motorized use for dispersed camping, and motorized big game retrieval (alternatives 3and 4 only). Cumulative effects for all alternatives are discussed at the end of the analysis.

Alternative 1 – Direct and Indirect Effects

Off-road Vehicle Travel

With no action, unrestricted, cross-country travel could continue to adversely affect soil condition, soil productivity, and water quality in all accessible areas of the Forest except for wilderness areas and closure areas.

Repeated tracking by off-road motorized use directly impacts the soil by removing the protective vegetation layer to bare soil, loosening soil aggregates through tire churning, rutting, and soil displacement, which exposes the soil to accelerated erosion that results in loss of soil productivity (figure 23). The impacts are most pronounced during periods when the soil is wet. OHV use indirectly causes accelerated erosion and transport of sediment to connected streams following storm events. Repeated OHV travel on soils with moderate or high erosion hazard is most likely to cause accelerated erosion, runoff and sediment delivery into connected stream courses, posing a risk to long-term soil productivity and downstream water quality. On soils with slight erosion hazard, the direct impact of OHV activity is not expected to result in accelerated soil erosion but

could cause a loss of soil productivity when vegetative ground cover is removed, soil is compacted, or rutting occurs (Greacen and Sands 1980, Braunack and Williams 1993).

Figure 23. Off-road travel in Beaver Creek Watershed where high level of use has removed almost all vegetation

The Forest contains appreciable amounts (about 1,013,000 acres or 55 percent) of moderate and severe erosion hazard classes that are not suitable for motorized travel. It is unlikely that OHV traffic could ever be directed onto erosion-resistant sites at present. OHV motorized use would result in accelerated soil erosion on most areas where use is anything more than incidental, especially in areas with moderate and high erosion hazards. This alternative would allow the most soil erosion impact to occur and would, therefore, be the least desirable from protecting the soil resource.

Soil condition on a fairly large percentage of land (table 33, Affected Environment) is already considered to be unsatisfactory, impaired, or inherently unstable due to past disturbances. This suggests that continued use of cross-country motorized use would create more stress on the soils and the vegetation that protects them. Repeated and anticipated increased cross-country motorized use on these soils would cause even more accelerated erosion and contribute to reduced long-term soil productivity, which is key to sustaining ecosystem diversity.

Off-road motorized use and soil and vegetation disturbance has been observed to be highest in montane meadows compared to all other Forest vegetation types and poses the greatest threat to soil productivity, vegetation, and wildlife (USDA Forest Service 2008). Repeated off-road motorized travel in meadows would continue to cause soil compaction. Although such compaction is not irreversible, it is a long-term adverse effect.

Studies indicate it takes several vehicle passes to remove or destroy protective vegetative ground cover, but it depends on the class of vehicle (Foltz 206). Off-road vehicle travel that occurs on satisfactory soils does not cause widespread damage to the soil resource, but has been observed to

remove protective vegetative cover with repeated travel over limited areas reducing soil and site productivity.

Continuation of the current travel management situation does not meet the intent of the Multiple Use and Sustained Yield Act of 1960, which directs that long-term soil productivity should be maintained. The impacts of motorized cross-country travel occur in an unplanned way without regard to the capability of the land. Long-term soil productivity would be reduced in areas where surface soil is removed though direct motor vehicle impacts. Soil erosion and loss of soil productivity would be the greatest under this alternative and would not be mitigated on most of the area where it occurs. The majority of soils are not suitable for such motor vehicle impacts. Alternative 1 would adversely affect soil condition and productivity much more than all other alternatives because motorized cross-country travel would continue unabated in the majority of the Forest.

Riparian areas and wetlands have been observed to be adversely impacted by cross-country OHV use. High concentrations of motorized camping occur in riparian areas with low to high disturbance. Low concentrations of camping occur in wetlands with medium to high disturbance (USDA Forest Service 2008a). Many impacts occur where there is frequent dispersed camping, but they have also been observed where Forest roads or unauthorized roads connect to riparian areas. Much disturbance comes from motor vehicle-associated recreational activities (Phillips and Tecle 2003).

Continued off-road vehicle use in riparian areas and wetlands would continue to directly destroy riparian vegetation from tires churning up the ground. This would reduce riparian function by causing streambank alteration, soil rutting, compaction and detachment, accelerated erosion, and sediment transport and deposition into connected waters, reducing water quality (USDA Forest Service 2008a, Greacen and Sands 1980, Braunack and Williams 1993). Soil rutting and compaction caused by motorized traffic is not irreversible but may take a long time to recover to near normal soil functions.

Continued driving in stream channels would directly break down streambanks that serve as key fisheries habitat, killing fish eggs and insects living in gravels of the stream, and damaging or destroying the vegetation within and near the stream channel. Under this alternative, motorized travel is expected to continue in these riparian areas and pose risk to riparian function.

Many wetlands have Forest road access and provide easy opportunity for off-road dispersed camping and travel. There are about 5.6 miles (Forest roads analysis, USDA Forest Service 2007a) of Forest roads and an unknown number of unauthorized routes that are adjacent to or that intersect portions of wetlands. Use of these routes alters surface hydrology and water flow causing loss of water storage, vegetative productivity, and wetland function. Under this alternative, off-road motorized travel would continue in these wetland areas and pose risks to wetland function.

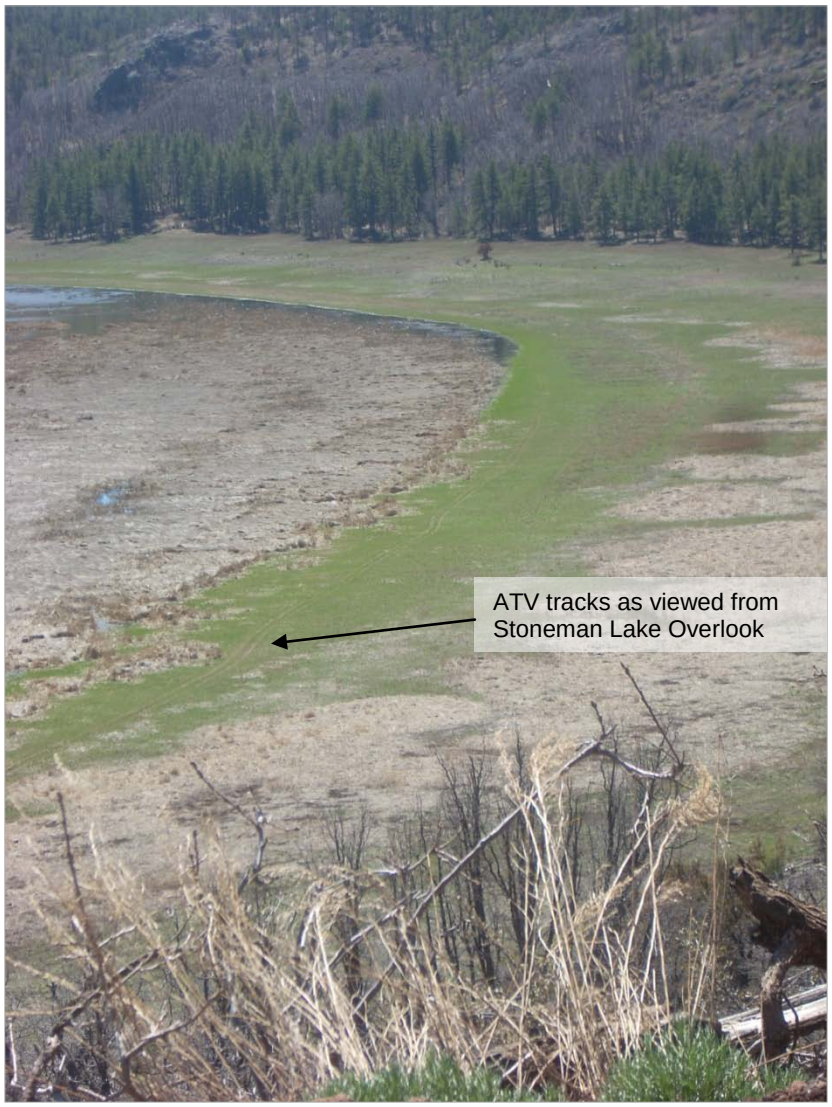

Figure 24. All-terrain vehicle tracks encircling Stoneman Lake, 2011

Use of Existing Roads and Trails

Roads - Roads contribute more sediment to streams than any other land management activity (Gibbons and Salo 1973, Meehan 1991). Roads have three primary effects on water:

- they intercept rainfall directly on the road surface and road cutbanks, and intercept subsurface water moving down the hillslope;
- they concentrate flow, either on the surface or in an adjacent ditch or channel; and
- they divert or reroute water from flow paths that it would otherwise take if the road were not present.

Most of the hydrologic and geomorphic consequences of roads result from one or more of these processes. For example, by intercepting surface and subsurface flow, and concentrating and diverting it into ditches, gullies, and channels (figure 25), road systems effectively increase the

density of streams in the landscape, thereby changing the amount of time required for water to enter a stream channel, altering the timing of peak flows and hydrograph shape (King and Tennyson, 1984). Roads directly affect natural sediment and hydrologic regimes by altering stream flow, sediment loading, sediment transport and deposition, channel morphology, channel stability, substrate composition, stream temperatures, water quality, and riparian conditions in a watershed (Gucinski et al. 2001).

Figure 25. An unauthorized route in the Cornville area has become incised and acts as a channel to concentrate flows from rainfall

With no action, the WEPP model predicts that the presence of these road footprints and estimated low traffic routes would cause a Forestwide combined total of about 3,500 to 21,900 tons of sediment that leaves the road buffer each year. An unknown but substantial amount of this sediment would be carried into connected stream courses affecting water quality. These roads and use would account for the largest amount of sediment leaving the road buffer area compared to improved roads and known nonsystem routes.

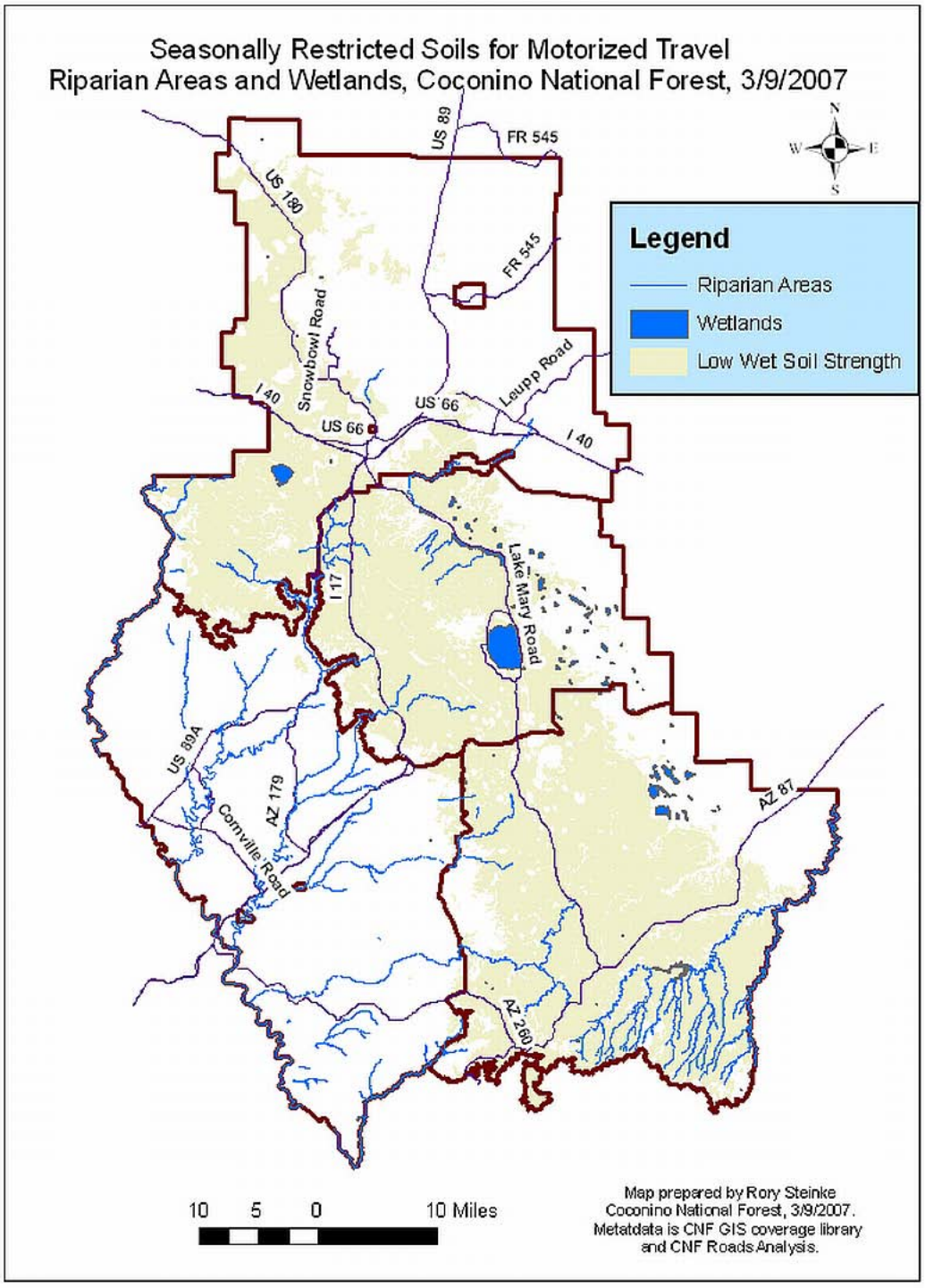

Figure 26. Seasonally restricted soils, wetlands and riparian areas

WEPP modeling shows about 500 to 1,800 tons of sediment would leave the road buffer each year from high traffic routes (which are graveled or paved, thus producing less sediment). An unknown amount of this sediment is carried into connected stream courses affecting water quality. Roads increase the nutrient delivery to streams by removing vegetation, rerouting water flow paths, and increasing sediment delivery (Gucinski et al. 2001).

A large portion of the Forest has soils developed in basalt parent material resulting in clayey textures. Motorized travel on Forest level 1 (closed) and 2 (unsurfaced) roads as well as off-road motorized use during periods when the soil is wet has caused and would continue to cause substantial damage to the soil or roadbed itself. Many level 3 roads (improved) may be suitable for wet weather travel but some may not be. Seasonal restrictions are currently administered by the Forest's wet weather travel restrictions (figure 26 and Forest website[12]) and would continue to be used to direct travel during periods when the soil is wet (regardless of alternative). Generally, this prevents motorized use on many unsurfaced roads during the winter and spring when roads are frozen or saturated. Wet weather travel restrictions are generally not applied during the summer monsoon season and thus motorized use does occur regularly on wet, unsurfaced roads.

Motorized Trails

There would be no change in the motorized trail system, which includes approximately 37 miles of system motorized trails and 89 miles of known unauthorized trails. Soil disturbance associated with motorized trail use is not quantified, and is largely unknown but predicted to be minor in extent and magnitude compared to the impact of the 7,484 known roads on the Forest. However, research by Foltz (2006) and Iverson et al. (1981) indicate OHV use on trails can cause up to a 13-fold increase in erosion from OHV use where trails exist.

Though these motorized trails have limited impacts compared to the 7,484 miles of known roads on the Forest, approximately 89 miles of the 126 miles of motorized trail are unauthorized trails that are likely to result in additional soil compaction, erosion, and sediment delivery to nearby waterways. Unauthorized motorized trails include those that are user-created and in some instances include "fall-line" alignments (figure 27), steep grades, or valley bottom alignments that can result in greater proportions of erosion and sediment production than system trails with engineered alignments and more regular trail maintenance (Olive and Marion 2009).

In many instances, these motorized trails are located in such a way as to intercept natural rainfall flow patterns, resulting in a concentration of water flow resulting in direct or indirect sediment delivery to downstream sources (Foltz 2006). For example, the Challenger Trail is a cross-slope trail that can divert the natural sheet flow of rainfall into channelized flow within the trail corridor. Without engineered trail features to successfully disperse water from the trail, the trail tread results in concentrated flow that delivers sediment-rich waters to downstream areas. Other trails such as the Wing Mountain trail are also used for activities such as hiking, horseback riding, and mountain biking. Activities such as motorized use on this trail increases the erosion from the trail tread, can increase rutting of the trail, and increase channelization. In this situation, continued motorized use would require increased maintenance to prevent soil loss and any possible downstream water quality impacts. The Challenger, Wing Mountain, green gate trail system, and airport trail system are not closely connected to perennial streams (at least several miles away). Therefore, motorized use on these trails would probably not directly deliver large

[12] http://www.fs.fed.us/r3/coconino/conditions/wet-weather.shtml

amounts of sediment into downstream perennial waters and not have a major effect on water quality, yet the use would continue to contribute to negative impacts.

Continued use of the 126 miles of known system and unauthorized motorized trails would continue to contribute to soil loss and sediment delivery to downstream waterways. This alternative would result in approximately four times the impact of alternative 3 and almost 1.5 times the impact of alternative 4 (based on trail miles).

Figure 27. An unauthorized trail with a "fall line" alignment in the Cornville area

Off-road Motorized Use for Dispersed Camping

Off-road motorized use for dispersed camping would continue adjacent to a portion of 7,484 miles of roads. Motorized travel would continue to directly cause localized impacts to soils and to montane meadows and riparian areas but would be restricted to areas fairly minor in Forest extent.

It is estimated about 80 percent of camping occurs in the ponderosa pine and mixed-conifer vegetation types (USDA Forest Service 2008a) where soils have low erosion hazard. Continued camping at these locations would not likely transport large amounts of sediment into connected

stream courses above natural levels. Therefore, the majority of motorized, dispersed camping occurring on the Forest (ponderosa pine, aspen and mixed-conifer types) would not pose substantial risk to water quality or pose a risk to overall soil productivity and ecosystem sustainability. Camping in aspen forests is more concentrated than in ponderosa pine forests but overall, actual impacts are minor in extent and therefore do not and would not continue to cause significant loss of soil productivity.

Although very limited in extent (0.2 percent of Forest), motorized, dispersed camping could have adverse effects to soil and water resources where roads provide access, especially in riparian areas, wetlands, and montane meadows. For example, in areas such as Fossil Creek, the large majority of dispersed motorized camping occurs within or directly adjacent to the creek, resulting in a loss of riparian habitat and increased sedimentation from loss of vegetation in upland areas (Adams et al. 2011). With no action, unrestricted motorized, dispersed camping would continue on up to 10,406 acres located within 300 feet of perennial streams (compared to about 71 acres in alternatives 3 and 4). A high concentration of motorized camping occurs and would probably continue or increase in riparian areas and wetlands with medium to high levels of disturbance (USDA Forest Service 2008a).

The highest concentration of motorized camping and soil and vegetation disturbance occurs in montane meadows compared to other vegetation types on the Forest and is expected to continue and increase under this alternative (USDA Forest Service 2008a). These soils are subject to compaction and rutting when wet.

In montane meadows, riparian areas and wetlands, most impacts occur from associated camping activities. Off-road motorized travel and streamside hiking and swimming are fairly extensive where areas are not fenced or closed. Such activities would continue to adversely impact soil and riparian areas under this alternative. Where repeated off-road travel continues, or even single passes occur on wet soils, soil damage has been observed and would continue under this alternative.

Dispersed camping would have the direct effect of disturbing the vegetative ground cover, exposing bare soil, causing soil compaction and rutting on wet soils and causing accelerated sheet and rill erosion, loss of soil and vegetation productivity (Cole and Monz 2004, USDA Forest Service 2008a), and localized sediment delivery into connected perennial waters.

Probable indirect effects would include elevated levels of sediment and *E. coli* pathogens in connected waters, impairment of water quality in high use areas caused from camping site disturbance that removes vegetative ground cover. Such disturbance can result in accelerated erosion, sediment transport, and runoff into connected perennial waters (Adams et al. 2011).

Alternative 3 – Direct and Indirect Effects

Off-road Vehicle Travel

Under this alternative, continued, unrestricted (specified in grazing permit) off-road motorized travel or motorized use of closed roads would continue where authorized under Federal permit or for administrative use. The effects to soil and water resources would be the same as Alternative 1 and would be regulated according to the terms of the permit.

Motorized, off-road travel would not contribute to degradation of erodible soils or unsatisfactory, impaired, and inherently unstable soil conditions outside of the Cinder Hills OHV area. Soil productivity and functions would improve on vehicle-impacted soils on a large majority of the Forest in both the short term and the long term. Soils currently rutted, compacted (including montane meadows), or low in vegetative ground cover or with visible signs of erosion from vehicular use would begin to recover. Protective, vegetated ground cover would begin to increase rather rapidly and erosion decrease in the short-term while soil infiltration on compacted soils would improve in the long term. Soil rutting may take several years or longer to return to near normal surface topography (USDA Forest Service 2004).

Unrestricted off-road travel would not occur on sensitive soils (wetlands, riparian areas) or on erodible soils. Currently impacted riparian and wetland areas would improve in the short term. Soils currently rutted, compacted or low in vegetative ground cover or with visible signs of erosion from vehicle use would begin to recover, probably faster than upland soils. Protective, vegetated ground cover would rapidly increase and erosion would decrease in the short term while soil infiltration on compacted soils would improve in the long term. This would result in decreased sediment delivery to connected perennial water and improved water quality. Soil rutting may take several years or longer to return to near normal surface topography.

There are about 8 miles of roads that are within 132 feet of a riparian stream course on private lands located within the Forest boundary that would remain open. The Oak Creek watershed has about 6 miles and Beaver Creek and Walnut Creek watersheds have about 1 mile each. These roads contribute to riparian degradation and may reduce water quality downstream. These roads are pre-existing, are part of baseline conditions, and are nonjurisdictional roads not subject to designation under the Travel Management Rule.

Use of Existing Roads and Trails

Roads – WEPP erosion modeling predicts that under this alternative, the presence of native, unimproved open roads and road footprints and estimated low traffic use would cause a Forestwide combined total of about 1,300 to 8,400 tons of sediment that leaves the road buffer each year. An unknown but substantial amount of this sediment would be carried into connected stream courses affecting water quality. These roads and use would account for the largest amount of sediment leaving the road buffer area compared to improved roads and known unauthorized routes.

Designating about 30 miles of unauthorized routes only slightly increases the amount of sediment delivered from Forest buffers by about 0.5 to 2 tons Forestwide. Compared to overall Forest sediment delivery of 3,100 to 18,200 tons, this amount of increase is very minor in extent and magnitude and would not increase risk to downstream water quality.

Further analysis shows that these 30 miles only cross two ephemeral streams and no perennial streams. Compared to the number of stream crossings that occur in major perennial stream watersheds on the Forest (278) these additional two ephemeral stream crossings would not pose additional risk to water quality downstream. These roads already exist and no water quality impairments have been detected in the nearest perennial water downstream. Overall, from a water quality and riparian function standpoint, designation of these 30 miles does not appear to pose additional or current risk to water quality downstream or adjacent riparian function.

Under this alternative, there would be about 407 miles of roads designated for highway-legal vehicles only, most of which are improved routes. WEPP modeling shows about 500 to 1,600 tons of sediment would leave the road buffer each year under high traffic use. An unknown amount of this sediment is carried into connected stream courses affecting water quality. Improved roads are designed to properly drain water and maintained to reduce sediment delivery into stream courses.

Proposed closed roads (native and improved) would still contribute about 1,300 to 8,200 tons of sediment per year but would recover with vegetation over the long term and reduce sediment delivery into connected stream courses (USDA Forest Service 2004).

Nonjurisdictional Forest roads located within the Forest boundary are about 923 miles out of a total of 8,407 miles and contribute an additional amount (about 11 percent) of total miles. This is likely proportional to the amount of sediment (not quantified) delivered into connected stream courses that may reduce water quality. These roads would remain open, are pre-existing, and are part of baseline conditions.

Similar to Alternative 1, the same number of Forest system road/stream crossings would exist but there would be many more closed road miles (4,387) resulting in less traffic disturbance and therefore less sediment delivered into connected streams. Under alternative 3, sediment delivery at stream crossings would be about 25 percent less than alternative 1 and about the same alternative 4.

Since the proposed action would restrict off-road motorized travel and designates (does not construct) routes and areas open to motorized use, there would be limited soil and water ground disturbance associated with implementation. Potential ground disturbance caused from off-road motorized use for permitted exceptions would have identified mitigation measures to reduce adverse impacts to soil and water identified at the time of permit issuance. Travel on Forest roads during periods when the soils are wet would be seasonally restricted (see Alternative 1) when roads are most saturated in the winter and spring and administered according to the forest wet weather travel restrictions.

Motorized Trails – Thirty-seven miles of existing, system motorized trails would be designated in addition to 1.8 miles of the nonsystem motorized Lower Smasher Canyon Trail. Soil disturbance associated with motorized trail use is not quantified, is largely unknown but estimated to be minor in extent and magnitude since the route includes a heavily rock-armored ephemeral channel. However, about 87 miles of unauthorized, nonsystem trails would be closed resulting in slightly less erosion off-site and less sediment delivery into connected stream courses compared to alternative 1. Travel on nondesignated motorized trails would discontinue and result in recovery of vegetation and soil depending on trail location, but overall, would be minor in extent.

Compared to alternative 1 (126 miles open) and alternative 4 (89 miles designated open), soil disturbance associated with trail use in alternative 3 would be less than alternative 1 and 4 and would have minor effects to soil and water resources since trails are not located in riparian areas or perennial streams. Currently used, nondesignated trails would not be used and recovery of vegetation and soil is expected under this alternative.

Currently, Lower Smasher Canyon Trail includes routes that are not system routes; current use by 4-wheel drive vehicles is infrequent and concentrated in the ephemeral channel bottom where soil is already unstable. In addition, these vehicles are designed to minimize soil spinning, travel at

crawling speeds, and have low inflatable tires that compact the soil less (Foltz 1995). On-site inspection shows the majority of the streambank is unalterable rock not subject to degradation or erosion and therefore, jeep traffic does not deliver much additional sediment downstream or destroy much streambank vegetation.

In Lower Smasher Canyon, channel entry and exit points are minimal but vehicle traffic has disturbed the soils and probably contributes minor deposits of sediment downstream. Jeep traffic at these entry and exit points has destroyed hillside and channel vegetation, but is very minor in extent. Designated and armored entry points and implementation of soil and water best management practices (including adequate roadside drainage) could mitigate adverse impacts to soil and water.

Lower Smasher Canyon connects to the Verde River; however, it appears as though impacts associated with rock crawling vehicles in Lower Smasher Canyon do not appreciably contribute sediment downstream and therefore do not measurably contribute to Verde River water quality impairment.

Off-road Motorized Use for Dispersed Camping

Both action alternatives would reduce motorized access to dispersed campsites by an estimated two-thirds, which would reduce impacts from motorized dispersed camping in a majority of the forest but concentrate impacts in designated camping corridors. This is an overall reduction of motorized camping opportunity from 7,484 miles to 613 miles, or 92 percent. Though loss of vegetative ground cover may increase within designated camping corridors, the overall effect would be to reduce the impact of dispersed camping on soils and water quality because impacts increase at a lower rate as dispersed camping is repeated in a particular area in almost all vegetation types (Cole 1995). Additionally, those areas designated for motorized dispersed camping corridors were screened to avoid the most sensitive areas for soil and water and include those areas that already receive moderate to high dispersed camping.

Motorized camping would continue to directly cause very localized impacts to soils and to montane meadows and several riparian areas (at about 12 stream crossings) and up to about 71 acres that are located within 300 feet of perennial streams.

Motorized Big Game Retrieval

Alternative 3 would allow motorized big game retrieval within 1 mile of designated roads in game management units 7W and 8 only. Implementation of motorized big game retrieval in game management units 7W and 8 would have the least amount of impacts by far to stream riparian areas and wetlands compared to all other game management units. There are no wetlands in these two game management units and only about 35 acres of stream riparian areas that could be possibly accessed but actual vehicle accessibility is not known.

Therefore, impacts from motorized big game retrieval on wetlands and stream riparian areas would be negligible to none. Similar to all other game management units, montane and subalpine meadows would still be vulnerable to damage from motorized big game retrieval when wet (figure 28, but this should be minimized with stipulations restricting motorized travel.

Figure 28. Soil damage from vehicle use on wet soils during hunting season in game management unit 11M

Motorized big game retrieval under this alternative would not pose a threat to soil productivity because there would be negligible impact from about 74 vehicular trips. Also, game management units 7W and 8 are generally located on nonsensitive soils, in woodlands and forest vegetation types capable of sustaining infrequent off-road motorized impacts without reducing soil productivity.

Wetlands, riparian areas, and wet soils are the most susceptible to detrimental effects to motorized, cross-country travel but are very limited in extent in the unit. Impacts in the game unit would be limited (very low) in extent and magnitude because there are very few riparian areas and wetlands.

Alternative 4 – Direct and Indirect Effects

Effects for this alternative are similar to those described in alternative 3; however, this alternative would designate 36 miles of unauthorized routes, which is 6 miles more than alternative 3. In addition, there would be 3,423 total miles of open roads of all types that could produce about 3,200 to 18,900 tons of sediment per year across Forest buffers that could potentially be transported into connected streams, posing risk to water quality.

Overall, from a water quality and riparian function standpoint, expected use of these 36 miles does not appear to pose additional or current risk to water quality downstream or adjacent riparian function since trails are not located in riparian areas or perennial streams. Motorized use would occur on an additional six stream crossings (compared to over 1,000 Forestwide) and these streams are either ephemeral or intermittent with use already occurring and no existing water quality impairments downstream.

Implementation of this alternative could produce about 23 percent less sediment than alternative 1 and about the same or slightly more than alternative 3 (about 3 to 4 percent more). Designated, motorized trail use and soil disturbance would be minor in extent and limited with negligible soil disturbance, but more than alternative 3 and less than alternative 1.

With alternative 4, sediment delivery at stream crossings would be 25 percent less than alternative 1 and slightly more than alternative 3.

Table 35 shows the associated acres in each ecosystem of concern per game management unit designated for motorized big game retrieval under this alternative. The average estimated number of game retrievals per game management unit is also included.

Table 36 summarizes the effects of motorized big game retrieval on ecosystems of concern by game management unit. Overall ranking compares each game management unit's relative sensitivity to motorized big game retrieval, with 1 as the highest sensitivity (predicted greatest disturbance to wetlands, stream riparian areas and meadows from motorized big game retrieval), and 9 as the lowest sensitivity (predicted least amount of disturbance to wetlands, stream riparian areas and meadows from motorized big game retrieval).

Table 35. Wetlands, stream riparian areas and montane and subalpine meadows by game management unit on the Forest

	Game management units								
Ecosystems of concern	**5A**	**5BN**	**5BS**	**6A**	**6B**	**7E**	**7W**	**8**	**11M**
Wetlands (acres)	61	1,240	460	697*	89	0	0	0	59
Stream riparian areas (acres)	1,256	103	181	2,787	553	35	0	0	134
Montane/subalpine meadows < 40% slopes (acres)	418	643	2,512	5,368	1,534	2,028	2,582	130	2,759
Avg. estimated game retrievals per year	136	258	795	1,352	137	105	70	4	67

* Although 6A has 697 acres of wetlands, much acreage is from Stehr Lake. Currently, Stehr Lake is not a functioning wetland since decommissioning of the Irving power plant and therefore, there are few wetland acres in 6A.

Table 36. Sensitivity to impacts to soil and water by off-road travel for elk retrieval by game management unit

	Game management unit sensitivity and potential damage from motorized big game retrieval								
Ecosystems of concern	**5A**	**5BN**	**5BS**	**6A**	**6B**	**7E**	**7W**	**8**	**11M**
Wetlands (acres)	low	high	high	low*	low	low	low	low	low
Stream riparian areas (acres)	high	low	low	low	low	low	low	low	low
Montane/subalpine meadows (< 40% slopes) in acres	low	low	high.	high	high	high	high	low	high
Avg. potential game retrievals per year	136	246	795	799	137	105	70	4	67
Overall ranking (1-9)	1	2	3	4	5	7	8	9	6

* Although 6A has 697 acres of wetlands, much acreage is from Stehr lake. Currently, Stehr Lake is not a functioning wetland since decommissioning of the Irving power plant and therefore, there are few wetland acres in 6A.

In summary, game management units 5A, 5BN and 5BS (in descending order) are the most susceptible to wetland, stream riparian area, and meadow damage that could occur from motorized big game retrieval. Game management units 11M, 7E, 7W and 8 are the least susceptible. Game management units 6A and 6 B are intermediate, but low impacts are predicted on wetlands and stream riparian areas from motorized big game retrieval.

The Soil and Water specialist report contains more information about the effects of motorized big game retrieval under this alternative.

Cumulative Effects of all Alternatives

Past, present and reasonably foreseeable actions that are relevant to soil and water resources are described below for all alternatives. The cumulative effects analysis area for water quality includes the Middle Little Colorado and Upper and Middle Verde 4th-level hydrologic unit code watersheds since disturbances that detach soil or cause increases in water runoff in any portion of these watersheds may be transported into connected stream courses and downstream into perennial waters.

Reasonably foreseeable actions that can affect soil and water resources include adjacent national forest travel management decisions, reauthorization of livestock grazing allotments, fuels reduction projects, Forest thinning projects, the 4 Forest Restoration Initiative, watershed improvement projects, and new road construction. These projects may result in short-term soil disturbance including removal of the protective vegetative ground cover and soil compaction that may result in short-term increases in erosion. However, with the implementation of best management practices to mitigate on-site nonpoint source erosion and water quality concerns, risks should be minimized and not pose a threat to soil and water resources. In addition, thinning the forest will reduce fuel loads and the associated risk of high burn severity wildfires that might otherwise result in complete removal of protective vegetative ground cover, increased erosion, loss of soil productivity, sedimentation, and reduced water quality.

The 4 Forest Restoration Initiative to restore ponderosa pine forest includes plans to both construct temporary roads and decommission roads following implementation of forest restoration activities. Though there will likely be short-term increases in erosion from ground disturbing activities, road maintenance, prescribed burning, and use of heavy machinery, this project is expected to result in reduced erosion and improved soil productivity over the long term. Implementation of alternatives 3 or 4 would result in an overall decrease in the amount of sediment delivery within Forest watersheds over the long-term, thus counteracting other activities that result in short-term (less than 1 year) pulses of sediment from other Forest or non-Forest activities.

Overall, these actions are planned to improve soil and water conditions above current conditions. While implementation of Forest decisions along with identified best management practices are designed to improve and mitigate adverse effects to soil and water resources, there is always some level of natural and manmade disturbance that occurs that may have minor and usually short-term negative effects to soil productivity, riparian function or water quality.

Nonjurisdictional roads within the Forest boundary and associated motorized use have negatively impacted soil, riparian and water resources in the past and present and are expected to continue in the future. Nonjurisdictional roads within the Forest boundary located in uplands, riparian areas

and stream crossings contribute sediment to connected stream courses, and reduce riparian habitat.

Non-Forest System roads located within 132 feet of riparian areas contribute to riparian degradation and serve as conduits to deliver sediment to connected stream courses. This is because there is not adequate vegetation width to effectively trap sediment from entering adjacent stream courses and this negatively affects water quality.

Total number of road stream crossings on Forest land on all watersheds is 4,992 and 1,486 on lands of other ownership. Motorized traffic on these lands where there are road/stream crossings cumulatively contribute and deliver an appreciable but unquantified amount of sediment into connected stream courses in all alternatives. Alternative 3 would result in the least amount of cumulative contribution to sediment in downstream areas, thus would be of most importance in the Verde River watershed, which has been documented as having high levels of turbidity, and for several lakes that are above the threshold for mercury levels – part of which is a result of high erosion levels.

On National Forest System lands, there are 24 perennial stream/road crossings and 4,968 nonperennial stream/road crossings (intermittent and ephemeral streams). Most perennial stream crossings occur on Beaver Creek watershed followed by Upper Clear Creek and Oak Creek watersheds. On lands of other ownership, there are 15 perennial stream crossings and 1,471 nonperennial stream crossings (intermittent and ephemeral streams). About 38 percent of perennial stream crossings occur on lands of other ownership. Continued motorized use on these road and stream crossings under all alternatives would contribute a fairly large but unquantified amount of the overall sediment that is delivered into perennial waters resulting in reduced water quality and aquatic habitat. Implementation of either alternative 3 or 4 would reduce and counteract a major portion of the negative effect of sediment delivered into perennial waters compared to alternative 1.

Other present and ongoing activities that contribute to impact soil and water resourced include livestock grazing, hazardous fuel reduction, vegetation management and watershed improvement projects, private land development, development of recreation facilities, and high-impact recreation. In several nearby national forests, including the Kaibab and Apache-Sitgreaves National Forests, similar travel management planning is in progress and likely to decrease the extent of watersheds being traversed with motor vehicles. These activities are outside the jurisdiction of the Coconino National Forest, yet they affect overall impact to soil and water resources.

Collectively, these ongoing activities may have short-term negative impacts on soil and water quality but have been proposed to improve soil condition, soil productivity, and water quality over a number of years. Projects that involve ground-disturbing activities incorporate Forest standards for resource protection and best management practices to mitigate nonpoint source pollution impacts. The largest impact to soil and water quality is from high intensity wildfires, such as the Schultz Fire. Areas on steep slopes or without vegetation are where cumulative effects would occur, resulting in soil loss and unsustainable amounts of erosion. Alternatives 3 and 4 would reduce the amount of designated roads and trails on steep slopes and in recently burned areas. The Challenger Trail in alternative 4, may cumulatively contribute to erosion rates along the trail route, but the soil from motorized use of the trail would be insignificant compared to average rates of postfire erosion from disturbance and slopes.

The closure (nondesignation) of routes in meadows, streamsides, and in riparian zones would provide positive watershed benefits by increasing stream buffers to absorb sediment flow. These benefits are expected to have the overall effect of counteracting activities that result in short-term increases in erosion. Other national forests (Prescott, Kaibab, Apache-Sitgreaves, and Tonto) that are designating motorized routes will have similar effects. Where these Forests include lands that are wholly or partially within in the same watersheds, there will be a cumulative beneficial effect on water and soil.

Implementation of alternative 1 in combination with past, current and expected continued growth in OHV demand and use would collectively pose a higher risk to soil and water quality over time than alternatives 3 or 4. This alternative would result in the greatest input of sedimentation to cumulatively combine with sediment from other Forest and non-Forest activities. As a result, this alternative would have the cumulative effect of decreasing watershed resilience to other activities affecting watershed health (e.g., wildfire).

Alternatives 3 and 4 propose similar actions including restricting cross-country travel and closing several hundred miles of roads that would be primarily beneficial to soils and water resources. The cumulative effect of implementing alternatives 3 and 4 would be to increase watershed resilience to erosion and this would counteract many ongoing negative effects from current and past management that may be present, and would safeguard and improve soil and water resources in the future.

Existing improved roads receive periodic maintenance designed to improve drainage and reduce excessive runoff and sediment into connected drainages. Future runoff and sediment are not expected to increase on existing improved Forest roads. No new roads are currently being planned on the Forest and no new and extensive roads on private lands are known to be planned at this time and therefore would not contribute to future reasonable foreseeable impacts to soil and water resources.

Aquatic Resources

Introduction

The following analysis focuses on the effects of roads on watersheds with threatened, endangered, and sensitive fish species, as well as macroinvertebrates, which are management indicator species. The extent and density of roads by type is derived from the Forest's GIS database and reflects road length and design. It is unknown how many more miles of unauthorized roads exist above the miles currently identified, but is estimated to be very high and expanding every year due to increased motorized vehicular use. For the purposes of this report, extent and density of cross-country routes are assumed to be directly correlated with extent and density of established roads within each watershed.

Affected Environment

Threatened, Endangered, and Sensitive Aquatic Species

Eighteen of the 31 species of native fishes in Arizona are threatened or endangered according to the Federal Endangered Species list (also referred to as "federally listed" or simply "listed"). On the Coconino National Forest, there are populations or historic habitat for nine listed and seven Southwestern Region (Region 3) Sensitive Species of native fish, two of which are also Federal candidate species. Table 37 lists threatened, endangered and sensitive aquatic species that occur

on the Forest and their associated habitat. The Fisheries and Aquatic Biota specialist report (located in the project record) contains detailed descriptions of each species and habitat.

Native fishes of the southwestern United States have declined considerably in extent and abundance in the last century. Primary reasons for declines in native fish include road construction, road use, modification of flow regimes and other intensive land uses that degrade aquatic habitat (Rinne and Neary 2000).

Table 37. Threatened, endangered, or sensitive aquatic species and their habitat that occur on the Coconino National Forest

Species	Aquatic Species Type	Status[1]	Watershed/Occurrence[2]
Colorado pikeminnow	native fish	Experimental Nonessential	Verde River
Razorback sucker	native fish	Endangered	Verde River, Fossil Creek
Gila topminnow	native fish	Endangered	Fossil Creek
Gila Chub	native fish	Endangered	Beaver Creek, Oak Creek
Loach minnow	native fish	Threatened3	Fossil Creek, Verde River[3]
Little Colorado spinedace	native fish	Threatened	Upper Clear Creek
Gila Trout	native fish	Threatened	Upper Verde River (H)
Desert pupfish	native fish	Endangered	Fossil Creek (#)
Spikedace	native fish	Threatened3	Fossil Creek, Verde River[3]
Headwater chub	native fish	Candidate, FS-S	Fossil Creek, West Clear Creek
Roundtail chub	native fish	Candidate, FS-S	Multiple
Sonora sucker	native fish	FS-S	Multiple
Little Colorado sucker	native fish	FS-S	Upper Clear Creek
Bluehead sucker	native fish	FS-S	Upper Clear Creek
Desert sucker	native fish	FS-S	Multiple
Longfin dace	native fish	FS-S	Multiple
A. Mayfly	macroinvertebrate	FS-S	Oak Creek
Page Springsnail	macroinvertebrate	Candidate, FS-S	Oak Creek
Fossil Springsnail	macroinvertebrate	FS-S	Fossil Creek
California Floater	macroinvertebrate	FS-S	Upper Clear Creek

1. Status: FS-S=Forest Service Sensitive Species (Southwestern Region, Regional Forester's List - September 2007)
2. Occurrence: H=Species known to occur historically; # = Species is proposed for introduction into Fossil Creek
3. New critical habitat, and upgraded listing from threatened to endangered proposed by U.S. Fish and Wildlife Service (2010).

Aquatic Management Indicator Species

Macroinvertebrates

As a group, aquatic macroinvertebrates are identified in the Forest Plan (as amended) as management indicator species for high and low elevation late-seral riparian areas. Aquatic macroinvertebrates are organisms that lack a backbone, are visible by the naked eye, and require a watered environment to persist and/or complete their life cycle (Voshell 2002).

This analysis examined 10 streams, five coldwater (above 5000 feet), and five warm water (below 5,000 feet). For more information regarding macroinvertebrates, refer to the Fisheries and Aquatic Biota specialist report.

Examination of both the warm water sites and the coldwater sites found that across the Forest, of the warm water sites, four had an upward trend and one had a downward trend. Downward trends are likely a result of very high road densities, which directly and indirectly alter aquatic habitats (Foreman and Alexander 1998).

Existing Condition

Watersheds

The following 5th-level watersheds are important to aquatic resources on the Coconino National Forest because they all contain stream habitat for federally listed and candidate fish species, Region 3 Sensitive Species, and Forest management indicator species:

1. Beaver Creek
2. Cherry Creek - Upper Verde River
3. Fossil Creek - Lower Verde River
4. Grindstone Wash - Upper Verde River
5. Oak Creek
6. Upper Clear Creek (East Clear Creek)
7. West Clear Creek

These watersheds have been assessed for road densities, number of road-stream crossings and for miles of road within ¼ mile of a drainage (table 38). The Forest Service has correlated road density to properly functioning condition. If a given watershed has more than 2.5 mi/mi^2 (1.55 km/km^2) of road, the watershed may be considered to be impaired and not properly functioning (USDI Fish and Wildlife Service 2005). Trails (including motorized trails) are not considered in road density calculations based on guidance from page 58 of the Forest Plan.

Roads are only one contributor of sediment to stream courses; however, out of all land management activities, roads are the greatest contributors of sediment (Gibbons and Salo 1973; Meehan 1991). No data specific to road sediment contributions exists on the Coconino National Forest, but a road erosion model is used to estimate how much is contributed by roads (Soil and Water specialist report, project record). Sediment impacts on threatened, endangered and sensitive fish species on the Forest include:

- filling of backwaters that provide larval and juvenile fish rearing habitat,
- smothering of invertebrates (including management indicator species), which provide the food base for many threatened, endangered and sensitive fish species,
- interference with fish reproduction by smothering and suffocation of eggs, and
- direct mortality.

Table 38. Existing road densities, stream crossings, miles of road in proximity to streams, and critical habitat designations for select watersheds on the Coconino National Forest

Watershed	Road Miles	Road Density (mi/mi^2)	Miles in Proximity[1]	Stream Crossings[2]	Designated Critical Habitat
Beaver Creek	885	2.04	24.9	689	Gila chub, Red Tank Draw and Walker Creeks
Cherry Creek-Upper Verde River	77	1.60	6.27	72	Razorback sucker, spikedace
Fossil Creek-Lower Verde River	274	1.63	20.78	219	Razorback sucker
Grindstone Wash-Upper Verde River	38	2.25	5.25	22	Razorback sucker, spikedace
Oak Creek	938	2.02	23.73	767	Gila chub, Spring Creek
Upper Clear Creek	733	4.06	148.41	369	Little Colorado spinedace
West Clear Creek	782	2.62	11.35	617	None

1. Miles of road within 0.25 miles of perennial stream
2. Includes both perennial and nonperennial crossings

Environmental Consequences to Aquatic Habitat

The effects of roads on aquatic habitat are believed to be widespread at the landscape scale; correlative evidence suggests that roads are likely to influence the frequency, timing, and magnitude of disturbance to aquatic habitat. Increased fine-sediment composition in stream gravel, a common consequence of road-derived sediments entering streams, has been linked to decreased fry emergence, decreased juvenile densities, loss of winter carrying capacity, and increased predation of fishes, and can reduce benthic organism populations and algal production. Roads can act as barriers to migration, lead to water temperature changes, and alter streamflow patterns. Improper culvert placement where roads and streams cross can limit or eliminate fish passage. Roads greatly increase the frequency of landslides, debris flow, and other mass movement. At the landscape scale, increasing road densities and their attendant effects are correlated with declines in the status of some fish species (Gucincski et al. 2001).

This analysis focuses on the effects of major changes by alternative in each watershed to the following factors: road density, road proximity to streams, number of stream crossings, and estimated sediment produced at these crossings. The analysis uses this information to determine the combined effects to aquatic organisms on the Forest. Table 39 provides a comparison of alternatives by watershed. Additional information can be found in the Fisheries and Aquatic Biota specialist report.

Table 39. Comparison of alternatives by watershed

Watershed	Effects indicators	Alternative 1	Alternative 3	Alternative 4
Beaver Creek	Miles of road	885	364	407
	Density (mi/mi^2)	2.04	0.84	0.94
	Acres open for motorized big game retrieval	224,206	0	224,206
	Road miles within ¼ mile of perennial stream	24.9	7.8	8.1
	Road crossings perennial	8	5	5
	Road crossings nonperennial	681	269	306
	Sediment delivery at stream crossing (tons/year)	14-81	11-64	11-65
Cherry Creek - Upper Verde River	Miles of road	77	33	35
	Density (mi/mi^2)	1.60	0.69	0.71
	Acres open for motorized big game retrieval	19,568	0	19,568
	Road miles within ¼ mile of perennial stream	6.27	1.29	1.33
	Road crossings perennial	0	0	0
	Road crossings nonperennial	72	27	27
	Sediment delivery at stream crossing (tons/year)	1-9	0-6	0-4
Fossil Creek-Lower Verde River	Miles of road	274	104	109
	Density (mi/mi^2)	1.63	0.61	0.65
	Acres open for motorized big game retrieval	83,980	0	83,980
	Road miles within ¼ mile of perennial stream	20.78	5.73	7.30
	Road crossings perennial	2	1	1
	Road crossings nonperennial	217	69	78
	Sediment delivery at stream crossing (tons/year)	4-26	3-19	3-19
Grindstone Wash-Upper Verde River	Miles of road	38	16	17
	Density (mi/mi^2)	2.25	0.94	1.01
	Acres open for motorized big game retrieval	7,870	0	7,870
	Road miles within ¼ mile of perennial Stream	5.25	2.38	2.38
	Road crossings perennial	0	0	0
	Road crossings nonperennial	22	11	12
	Sediment delivery at stream crossing (tons/year)	0-3	0-2	0-2

Table 39. Comparison of alternatives by watershed

Watershed	Effects indicators	Alternative 1	Alternative 3	Alternative 4
Oak Creek	Miles of road	938	403	445
	Density (mi/mi^2)	2.02	0.86	0.96
	Acres open for motorized big game retrieval	171,883	0	171,883
	Roads within ¼ mile of perennial stream	23.73	12.51	12.45
	Road crossings perennial	5	5	5
	Road crossings nonperennial	762	348	373
	Sediment delivery at stream crossing (tons/year)	18-73	13-73	14-75
Upper Clear Creek	Miles of road	733	284	339
	Density (mi/mi^2)	4.06	1.58	1.88
	Acres open for motorized big game retrieval	96,086	0	96,086
	Roads within ¼ mile of perennial stream	148.41	48.83	56.91
	Road crossings perennial	7	4	4
	Road crossings nonperennial	362	81	123
	Sediment delivery at stream crossing (tons/year)	6-45	5-32	6-34
West Clear Creek	Miles of road	782	370	405
	Density (mi/mi^2)	2.62	1.24	1.36
	Acres open for motorized big game retrieval	155,982	0	155,982
	Roads within ¼ mile of perennial stream	11.35	3.52	4.87
	Road crossings perennial	2	0	0
	Road crossings nonperennial	615	247	269
	Sediment delivery at stream crossing (tons/year)	12-73	9-57	9-58

Effects Common to All Alternatives

Road Density – Roads have three primary effects on hydrologic processes: (1) they intercept rainfall directly on the road surface and road cutbanks and affect subsurface water moving down hill slopes; (2) they concentrate flow, either on the surface or in an adjacent ditch or channel; and (3) they divert or reroute water from paths it otherwise would take were the road not present (Wemple et al. 1996, Spellerberg 1998, Jones 2000, Gucinski et al. 2001, Edwards and Evans 2004). The effect of roads on peak streamflow depends strongly on the size of the watershed and the density of roads within that watershed; for example, capture and rerouting of water can remove water from one small stream while causing major channel adjustments in another stream receiving the additional water. In watersheds with low road density, roads constitute a small proportion of the land surface and have relatively insignificant effects on peak flow, while conversely the effects of higher road densities in a watershed magnify these effects.

Road Proximity – Buffer strips between roads and streams tend to reduce sediments reaching aquatic ecosystems. Buffers may be less effective for landslides than for arresting water and sediment from culverts and roadside ditches. Road ditches that drain water and sediment from roads onto nearby hill slopes often develop into swales and ephemeral channels (Forman and Alexander 1998, Edwards and Evans 2004). The formation of these channels increases erosion and transport of fine sediments. When roads are buffered from streams, these channels often end in small alluvial fans and water and sediment do not directly enter the stream. When roads are immediately adjacent to streams, increased amounts of sediment can enter stream channels.

Road Crossings – Roads can act as barriers to migration, lead to water temperature changes, and alter streamflow regimes. Fish passage can be limited or eliminated by improper culvert placement and poorly designed channel crossings of roads. Road-stream crossings also have effects on stream invertebrates.

Culverts have been identified as a major concern in the fragmentation of species populations, or blocking access to important spawning areas. They have been shown to either completely or partially block the passage of different fish species (Warren and Pardew 1998). Culverts can fragment populations resulting in genetic inbreeding and bottlenecks, or more severely, they can prohibit species from reaching refugia habitat or spawning areas, resulting in localized extirpations (Fausch et al. 2006).

Sediment – Roads directly affect natural sediment and hydrologic cycles and patterns by altering streamflow, sediment loading, sediment transport and deposition, channel morphology, channel stability, substrate composition, stream temperature, water quality, and riparian conditions in a watershed. Watersheds with higher densities of roads have been shown to have increased peak flood flows. Road-related mass soil movements can continue for decades after roads have been built. Such habitat alterations can adversely affect all life stages of fish, including migration, spawning, incubation, emergence, and rearing (Forman and Alexander 1998, Gucinski et al. 2001, Edwards and Evans 2004).

The construction, use, and maintenance of roads produce the highest levels of suspended sediment generation in streams (Ziemer et al. 1991). Even though a decision on this travel management project would not result in the removal or obliteration of roads, it is expected to reduce regular use of these roads, which is expected to substantially reduce suspended sediment generation for a large majority of these routes. The reason is that although some of these routes may continue to receive occasional use through permitted use, the lack of regular use would allow some vegetation growth and reduced sediment generation from the breakdown of road surface materials into fine sediments.

Regular motorized use on roads with stream crossings results in generation of fine sediments that are easily washed into streams during precipitation events. Sediment adversely impacts stream fishes directly by changing fish behavior, altering fish physiology, impairing growth, shifting blood chemistry, inducing gill trauma, reducing disease resistance, increasing egg mortality, and direct mortality of juveniles and adults if strong enough (Bisson and Bilby 1982, Anderson 1996, Argent and Flebbe 1999). Sediment indirectly affects fish through behavioral modifications including, increased frequency of the cough reflex, avoidance of suspended sediment, reduction in feeding, and temporary disruption of territoriality. The severity of changes in fish behavior is associated with the timing of disturbance, the level of stress, and the importance of the habitat that the fish may be excluded from (Bisson and Bilby 1982, Anderson 1996, Rice et al. 2001).

Indirect effects on stream fishes from sediment can also occur through modifications to stream habitat. These changes include altered channel morphology, loss of spawning habitat, loss of rearing habitat, changes in food supply, and decreased over-wintering habitat (Lisle 1989, Wood and Armitage 1997, Miller and Benda 2000).

Sediment exceeding natural background levels can fill pools, silt spawning gravels, decrease channel stability, modify channel morphology, and reduce survival of fry (Lisle 1989, Anderson 1996,Argent and Flebbe 1999, Kolka and Smidt 2004). Increased fine-sediment composition in stream gravel has been linked to decreased fry emergence, decreased juvenile densities, loss of winter carrying capacity, and increased predation of fishes. Increased fine sediment can reduce benthic organism populations and algal production. Survival of incubating salmonids from embryos to emergent fry has been negatively related to the proportion of fine sediment in spawning gravels (Anderson 1996, Wood and Armitage 1997, Rowe and Dean 1998, Shaw and Richardson 2001). Increased fine sediment in stream gravel can reduce intra-gravel water exchange, thereby reducing oxygen concentrations, increasing metabolic waste concentrations, and restricting movements of alevins (Lisle 1989, Platts et al. 1989, Anderson 1996). Survival of embryos is directly related to dissolved oxygen concentration, velocity of intra-gravel water, gravel permeability and gravel size. Increases in fine sediment can also reduce winter carrying capacity of streams by loss of concealment cover and by increasing the likelihood of predation (Thurow et al. 1997).

Pools that lose volume from sediment (Jackson and Beschta 1984, Lisle 1982) support fewer fish, and fish that reside in them may suffer higher mortality (Wood and Armitage 1997, Shaw and Richardson 2001, Kolka and Smidt 2004). Pools and other slow water areas are bioenergetically beneficial because fish can forage in such areas with minimal effort (Rosenfeld and Boss 2001). Pools function as resting habitats for adults, rearing habitats for juveniles, and refugia from natural disturbances (Stoneman and Jones 2000, Keim et al. 2002). Where many species are dependent on intermittent/residual pool systems, the loss of pool habitat due to sedimentation has amplified adverse affects on the species dependent on those pools for survival during drier periods.

Chronic sediment input may lead to increased turbidity. Turbidity has been shown to decrease the reaction distance between fish and their prey (Gradall and Swenson 1982, Barrett et al. 1992, Abrahams and Kattenfeld 1997). High turbidity can promote a change in foraging strategies from "lie in wait" to active searching for prey, negatively affecting the ability of fish to feed and limiting growth from increased energy expenditure (Sweka and Hartman 2001a, Sweka and Hartman 2001b).

Effects Common to Alternatives 3 and 4

Unrestricted Motorized Cross-Country Travel – Eliminating the majority of cross-country motorized travel would result in improved soil conditions and decreased erosion in all watersheds on the Forest. Presently disturbed areas would revegetate and existing unauthorized, un-inventoried routes would begin to rehabilitate. This would result in reduced soil loss and associated erosion to streams. Without extensive large-scale analyses, it is impossible to actually quantify the reduction in soil loss; nevertheless, it is logical to assume that restricting motorized cross-country travel would reduce forest soil disturbance and the amount of sediment entering watersheds containing fisheries and other aquatic biota.

Motorized Big Game Retrieval – The small percentage of land and the limited timeframe when effects can occur from motorized big game retrieval under alternative 3 make any effect to fisheries negligible and discountable. Alternative 4 would decrease the amount of off-road travel occurring from existing conditions, but would result in continued impacts from off-road driving in some watersheds where sedimentation or sensitive aquatic habitat may be an issue. This may prevent accomplishing management goals for the recovery of threatened, endangered, or sensitive aquatic species. This is particularly true in the East Clear Creek (Upper Clear Creek) watershed where there is a very high amount of elk hunting (game management unit 5A) and where recovery strategies for threatened and endangered species have focused on closing roads to decrease impacts in areas where off-road use from elk hunting is likely to occur, such as wet meadows or roads that cross over or occur in drainage bottoms (East Clear Creek Recovery Strategy 2001, Dechter 2011).

Dispersed Camping Corridors – The designation of camping corridors under both alternatives would result in no risk to soil productivity or water quality (Soil and Water specialist report, project record). Therefore, the impacts of these corridors are unlikely to have any measurable influence on fisheries or aquatic biota within the analysis area.

Designation of nonsystem roads and trails – A large majority of the nonsystem routes designated for motorized use are routes that have been pioneered to campsites or overlooks by repeated motorized use over flat or rolling terrain. Because of this, these nonsystem roads generally do not result in any additional erosion or sedimentation beyond existing system roads. Nonsystem motorized trails such as the Lower Smasher Canyon and Challenger Trails may result in more erosion or sedimentation than a system road or motorized trail, but this additional amount is likely so small it would not be measureable.

Based on this information, though the alternatives include nonsystem routes to be incorporated into the system through designation, these routes are not expected to result in substantially increased amounts of erosion or sedimentation than system routes. As a result, these routes will be considered in the same context as system routes for the remainder of this analysis.

Cumulative Effects Common to all Alternatives

Reasonable foreseeable actions that can affect fisheries and aquatic biota include actions that occur on lands managed by the Forest Service and other Federal agencies and those that occur in the watersheds on private lands. Foreseeable actions that occur on National Forest System lands include current and future livestock and ungulate grazing through management of livestock grazing allotment permits, fuels reduction projects, forest thinning, watershed improvement projects, and new road construction. However, these actions (not including new road construction) are planned to improve soil and water conditions above current conditions and have mitigation measures and best management practices designed to mitigate any short-term impacts that may occur from project implementation. Actions that take place on private lands are difficult to quantify but include water withdrawals, urbanization, agricultural practices, and introduction and spread of nonnative species. Past, present and reasonably foreseeable actions that are relevant to fisheries and aquatic biota are described below for all alternatives. The cumulative effects analysis area for aquatic resources consists of the seven 5th-code watersheds described on page 139.

The East Clear Creek Watershed Health Project closed 47 miles of open roads, decommissioned 29.8 miles of open roads, and decommissioned 14.2 miles of closed roads. Decommissioning and vegetation healing are ongoing. Alternative 3 follows the East Clear Creek Decision Notice by not designating routes that were closed or decommissioned in this previous decision. In addition, the Clear Creek Land Exchange (December 2007) resulted in a gain of Federal ownership of 23 acres of riparian habitat.

Projects on the Coconino National Forest Schedule of Proposed Action for the period of October 1, 2010 to December 31, 2010, were considered for the cumulative effects analysis as reasonably foreseeable actions (see project record). Additionally, although the Four Forest Restoration Initiative (4FRI) is not on the schedule, it is a large-scale forest restoration project that is actively being planned. Although there may be temporary roads built associated with forest health treatments, the overall goal is likely to reduce miles of road in project areas.

Livestock grazing can contribute to increased sedimentation into aquatic systems and thus affect threatened, endangered and sensitive aquatic species and management indicator macroinvertebrate species. Range analyses for permit reauthorization strive to minimize these effects. Range projects on the schedule of proposed actions that may impact aquatic resources on the Forest include reauthorization of the Buckhorn, Walker Basin, and Apache-Maid allotments as well as continued livestock grazing through existing grazing permits.

Fuels reduction and forest thinning projects can contribute to effects on aquatic species and their habitat. Although the effects of fuels reduction and thinning projects are mitigated to reduce the effects on species and their habitat, they still result in modification of vegetation, which can affect soil exposure and result in increased erosion and sedimentation to aquatic systems. Fuels reduction projects on the schedule of proposed actions include the Clint’s Forest Restoration Project, Munds Park Fuels Reduction, and Hart Prairie Fuels Reduction and Forest Health Project.

Fuels reduction projects have been shown to result in short-term increases in erosion and sedimentation and some studies have concluded that soil erosion can be maintained at or near natural levels using best management practices (LeFevre 2007). In general, increases in erosion or sedimentation from the ground disturbance resulting from these projects lasts from 1 to 5 years, and in many situations, fuels reduction activities tend to decrease the amount of erosion and sedimentation that would occur from wildfire (Gonzales-Caban et al. 2008).

Construction projects that occur within stream floodplains can result in direct trampling of aquatic organisms, and erosion and increased sedimentation into aquatic systems. Although the effects of these projects are mitigated to reduce effects on aquatic species and their habitat, some direct trampling, erosion and sedimentation to aquatic systems may occur and impact aquatic threatened, endangered and sensitive species and macroinvertebrates. Construction projects on the schedule of proposed actions that will likely contribute some sediment to aquatic systems include the Houston Draw Aquatic Organism Passage Project, the Tobias/Flynn Road Access Project, and the West Fork Oak Creek Bridge Replacement Project. The impacts of these projects are expected to be avoided or minimized by application of best management practices and would be short term, if any direct impacts occur.

Recreation management can also have impacts on aquatic resources. The Fossil Creek Wild and Scenic River Comprehensive River Management Plan Project will likely result in the construction

of developed or designation of dispersed camping sites and associated access routes and parking areas. This project will close some roads that are causing resource damage, and will develop and designate trails or other access area. These activities are likely to result in short-term (1 to 5 years) impacts to sedimentation into Fossil Creek and impact its aquatic threatened, endangered, and sensitive species and management indicator macroinvertebrate species. In the long-term (1 to 5 years after implementation), this project is expected to reduce erosion rates and sedimentation to Fossil Creek below current levels.

Unauthorized and unmanaged dispersed recreation, while not continuous across the Forest like grazing or across large areas like fuels reduction and thinning projects, can result in adverse impacts to aquatic species and their habitat. Social trails, social roads, dispersed camping areas, and the use of these by the public can increase sedimentation into aquatic systems. As a result, these activities can impact aquatic threatened, endangered, and sensitive species and management indicator macroinvertebrate species.

The impacts of nonnative species introductions cannot be understated. This includes the introduction of over 100 nonnative fish into the southwest, introduction of invertebrates (particularly crayfish) and other aquatic invasive invertebrate species (e.g., quagga and zebra mussel), and the introduction of aquatic invasive plant species (e.g., Arundo). Documentation of the negative impacts of nonnative fish introductions comprises an extensive body of literature, part of which has been effectively summarized in books (Minkley 1973; Minckley and Deacon 1991; Minckley and Marsh 2009; and references within these publications) and in review articles (Marsh and Pacey 2005, and references therein). Currently, all native fishes in Arizona and 80 percent of native fishes in the Southwest are on either State or Federal protection lists (USDI Fish and Wildlife Service 2010). The primary causal factor for extinction of native fishes in the Southwest is directly related to the introduction of nonnative fish (Miller et al 1989).

Implementation of alternative 3 or alternative 4 would reduce adverse impacts to fisheries and aquatic biota Forestwide by eliminating motorized cross-country travel outside of camping corridors and reducing miles of open roads and use. Closing roads in sensitive resource areas would reduce sedimentation by about 20 to 22 percent over current levels. Alternatives 3 and 4 would reduce overall camping area disturbance very slightly. Proposed motorized big game removal would reduce overall impacts to soil and riparian areas slightly (alternatives 3 and 4) or continue (in some wet years) the low to moderate amount of impacts to riparian areas and meadows as current (alternative 1). These reductions in erosion and sedimentation from designations would partially absorb and prevent sediment pulses from projects or activities that result in short-term erosion and sedimentation. This would occur by decreasing the efficiency of nondesignated routes as channels to deliver sediment to streams and reducing the influence of many routes as sediment sources. These same changes would combine with other activities such as fuel reductions and recreation management projects to result in a cumulative decrease in sedimentation to streams and watersheds within or downstream of the Forest.

Overall, implementation of alternatives 3 and 4 would result in improved soil condition and productivity, improved riparian and wetland conditions Forestwide, less sediment delivery into connected waters, and improved water quality. This, in turn, would reduce the amount of sediment produced from the Forest and the effect it has on fisheries and aquatic biota downstream. Since the overall effect of these proposed actions would be a beneficial effect to fisheries and aquatic biota, the cumulative effects of these actions would counteract activities or

projects that result in erosion and sedimentation thus decreasing impacts on the watersheds within the analysis area.

Environmental Consequences to Threatened and Endangered Aquatic Species

Alternative 1 – Direct, Indirect and Cumulative Effects

Colorado Pikeminnow – The impacts of dams (Horshoe, Bartlett) on the lower Verde River and the introduction of nonnative fish species are the primary reasons for this species' disappearance in the system (USDI Fish and Wildlife Service 2002a). Though this alternative would continue to result in sediment delivery to the Verde River in greater amounts than the other alternatives considered in this analysis, sediment delivery is not a key factor influencing Colorado pikeminnow populations compared to the presence of dams and existence of nonnative fish. As this alternative includes no National Forest System roads that cross the Verde nor would it affect the presence of any existing dams, and therefore has no effect on the Colorado pikeminnow.

Razorback Sucker, Loach Minnow, Spikedace, Gila Chub, Gila Topminnow – This alternative would result in a negative cumulative effect to the razorback sucker, loach minnow, spikedace and Gila chub by continuing to contribute a high level of sediment that would combine with increased sediment from short-term sediment pulses resulting from management actions including fuels reduction projects, development of recreational facilities, road maintenance activities, private land development, and continued impacts from high recreational use along key areas. Should additional temperature stresses, increased periods of drought, or increased sedimentation (from loss of vegetation) result from changes in climate, the present rate of sediment delivery under this alternative could result in a greater cumulative impact on the these species from multiple stressors and/or a cumulative degradation of aquatic habitat (Regier and Meisner 1990).

Little Colorado Spinedace – Little Colorado spinedace is present in the Upper Clear Creek watershed. Of the watersheds with perennial water on the Coconino National Forest, the Upper Clear Creek watershed has the highest road density. The numerous perennial stream crossings that exist under the current road system increase the likelihood of introduction of nonnative species.

The potential introductions of nonnative species from this alternative would combine with the effects of climate change to result in a cumulative negative impact on the Little Colorado spinedace. Climate change will influence the likelihood of new species becoming established and enhance invasive species' competitive and predatory effects on native species and may increase the virulence of some diseases (Rahel and Olden 2008).

Alternative 3 – Direct, Indirect and Cumulative Effects

Colorado Pikeminnow – As discussed under Alternative 1, sediment delivery is not a key factor influencing Colorado pikeminnow populations compared to the presence of dams and existence of nonnative fish. This alternative includes no Forest Service roads that cross the Verde nor would it affect the presence of any existing dams. Therefore, this alternative would have no effect on Colorado pikeminnow.

Razorback Sucker – Management activities that affect water quality (temperature, silt loads), stream flow, stream morphology and access to spawning areas have been correlated with declines in razorback sucker throughout their range (USDI Fish and Wildlife Service 1998). In addition, the spread of nonnative competitors and predators has been shown to reduce the survival of wild populations (USDI Fish and Wildlife Service 2002b).

Under this alternative, designation of nonsystem routes would continue to result in some minor sedimentation, but overall sedimentation to the Verde River and Fossil Creek would be reduced as a result of the removal of motorized use on nonsystem trails such as Upper Smasher Canyon and Horseshoe, and removal of motorized use from dozens of nonsystem and system roads in these watersheds. These benefits would reduce negative effects of sediment and pollution from road or motorized sources on razorback sucker in the Verde River and Fossil Creek. While razorback sucker in the Verde River would still see increased recreation and habitat degradation resulting from urbanization, as well as from nonforest road networks and ongoing grazing, the amount of sediment delivered from roads on the Coconino would greatly decrease, counteracting the amount of sediment being produced from these other activities. Climate change may also increase sediment and result in additional environmental stress to the razorback sucker from increased drought, increased water temperatures, and potential for increased competitiveness of nonnative species (Rahel and Olden 2008). This alternative would decrease stress that results from high sediment levels and thus would provide a buffer to slightly counteract the potential effects of climate change on the razorback sucker.

Loach Minnow, Spikedace, Little Colorado Spinedace, Gila chub, Gila Topminnow – Reductions in sediment at any level would likely result in improved habitat conditions and benefits for the listed species listed above and their associated critical habitats.

By reducing motorized use on Forest watersheds, this alternative would counteract the sediment delivery resulting from cumulative activities including fuels reduction projects, development of recreational facilities, trail development and high impact recreational use in the Fossil Creek corridor, and road maintenance activities on National Forest System roads. This alternative would also result in a decrease in sediment delivered from off-road travel into existing and proposed critical habitat on the Forest.

This alternative would reduce potential introductions of nonnative species that would combine with the effects of climate change to result in a cumulative negative impact on the Little Colorado spinedace (Rahel and Olden 2008). This project would also have the cumulative impact of reducing sediment levels in the Upper Clear Creek watershed because of similar long-term impacts of the Clear Creek land exchange and the East Clear Creek Restoration Project.

The major reduction in motorized use would also decrease the stress from high sediment levels on these species, making their populations more resilient to potential impacts from climate change such as from increased drought and increased water temperatures.

Alternative 4 – Direct, Indirect and Cumulative Effects

Colorado Pikeminnow – The effects of this alternative are the same as those described for this species under alternative 3.

Razorback Sucker – The effects of alternative 4 on razorback sucker would be very similar to those from alternative 3. Alternative 4 proposes slightly greater road densities in some of the

watersheds that drain to the Verde River (an average of 46 percent versus 42 percent for alternative 3). However, the higher road densities proposed by this alternative would still lead to a marked reduction in sediment entering the Verde River and Fossil Creek from the present Forest road system.

Razorback sucker and its critical habitat presently exist in Fossil Creek and the Verde River within game management unit 6A, and in the Verde River within game management unit 6B. Though cross-country travel would be permitted for motorized big game retrieval, it would still be reduced from current levels. This reduction within razorback sucker habitat would benefit the species by reducing access to sites, reducing damage to shoreline and aquatic habitat by vehicles, reducing the potential spread of nonnative aquatic organisms and diseases, and reducing the potential for forest users to handle/collect razorback sucker.

The difference between alternatives 3 and 4 is marginal. Alternative 4 would reduce the level of sediment in both the Verde River and in Fossil Creek, potentially improving habitat for the species in both these systems.

Loach Minnow and Spikedace – This alternative would have similar effects to alternative 3. This alternative would continue sedimentation from approximately half a dozen miles of nonsystem roads to be designated, but would have an overall effect of reducing the density of open roads on the Coconino National Forest in the Fossil Creek watershed by 60 percent.

Loach minnow and spikedace presently occur and/or have critical habitat within game management units 6A and 6B.This alternative would substantially reduce current levels of off-road motorized use since off-road use for game retrieval would be limited to only those who have successfully killed an elk. The reduction in motorized big game retrieval within critical habitat would benefit the species by reducing access to sites, reducing damage to shoreline and aquatic habitat by vehicles, reducing the potential spread of nonnative aquatic organisms and diseases, and reducing the potential for forest users to handle/collect loach minnow and spikedace.

Little Colorado Spinedace – Effects from this alternative would be similar to those described under alternative 3. This alternative would allow off-road vehicular travel for motorized big game retrieval in the Upper Clear Creek watershed. Due to the regulated nature of this activity and the fact it is limited to elk, it is expected that there would still be a large overall decrease from existing off-road vehicular use. Motorized big game retrieval could occur on 95,949 acres in game management unit 5A and 57 acres in game management unit 5B. This continued off-road use would likely reduce but not reverse the downward water quality trend in tributary creeks such as Barbershop Canyon. Thus, motorized big game retrieval would continue to result in sedimentation to Upper Clear Creek watershed and impact aquatic habitat, but at a lower level than existing conditions. These changes would reduce sedimentation into streams inhabited by Little Colorado spinedace, including all critical habitat for the species in East Clear Creek, and would therefore be generally beneficial to the species.

Gila Chub – Effects from this alternative would be similar to those described under alternative 3. Alternative 4 would reduce road density in the Beaver Creek and Oak Creek watersheds by nearly 52 to 54 percent, roads in proximity to perennial streams by 48 to 67 percent, and nonperennial stream-road crossings by 51 to 54 percent. All of these changes would reduce sedimentation into streams inhabited by Gila chub (including all critical habitat for the species on the Forest), and would therefore be beneficial to the species. Alternative 4 would also designate one stream

crossing within Red Tank Draw. However, as the stream is intermittent and sedimentation is not confined nor greatly influenced by the road crossing, direct or indirect impacts to Gila chub resulting from the designation of this stream crossing are extremely unlikely.

Gila chub occur in game management unit 6A; associated effects of motorized big game retrieval in that unit would be the same as those described for other species under this alternative.

Gila Topminnow – Effects from this alternative would be similar to those described under alternative 3. Alternative 4 would reduce the road network in the Fossil Creek-Lower Verde watershed from 274 miles to 109 miles, (only a 5 mile difference from alternative 3), which would reduce road-derived sediments entering the stream. Therefore, alternative 4 would lower the potential for sediment to reduce available habitat for Gila topminnow in Fossil Creek.

Gila topminnows occur in Fossil Creek within game management unit 6A; associated effects of motorized big game retrieval in that unit would be the same as those described for other species under this alternative.

Environmental Consequences to Aquatic Sensitive and Candidate Species

Alternative 1 – Direct, Indirect and Cumulative Effects

Roundtail Chub, Headwater Chub, Little Colorado Sucker, Bluehead Suckers, Longfin Dace, Desert Sucker, Sonora Sucker, Fossil Springsnail, Page Springsnail, and California Floater – This alternative would result in a negative cumulative effect to the species listed above by continuing to contribute a high level of sediment that would combine with increased sediment from short-term sediment pulses resulting from the following ongoing and future activities:

- fuels reduction projects
- wildfires and wildfire suppression
- development of recreational facilities and hiking trails
- road maintenance activities on Forest roads
- private land development
- facilities repair and maintenance in floodplain areas
- livestock grazing
- high recreational use along Fossil Creek, Verde River, and other waterways

Should additional temperature stresses, increased periods of drought, or increased sedimentation (from loss of vegetation) result from changes in climate, the present rate of sediment delivery under this alternative could result in a greater cumulative impact on these species from multiple stressors and/or a cumulative degradation of aquatic habitat (Regier and Meisner 1990). In addition, the potential introductions of nonnative species would combine with the effects of climate change to enhance invasive species' competitive and predatory effects on native species and may increase the virulence of some diseases (Rahel and Olden 2008).

A. Mayfly – This species is thought to occur in the Oak Creek Watershed. It is associated with silt, fine sand, gravel, and woody material. It is not thought that road-derived sediment impairs this species or its habitat and there is no clear understanding as to why this species' range has declined. Therefore, this alternative would have no effect on A. mayfly. Since there would be no

direct or indirect effects to this species for Alternative 1, this alternative would not contribute to cumulative effects for A. mayfly.

Alternative 3 – Direct, Indirect, and Cumulative Effects

Roundtail Chub, Headwater Chub, Little Colorado Sucker, Bluehead Sucker, Longfin Dace, Desert Sucker, Sonora Sucker, Page Springsnail, California Floater – In this alternative, off-road use would be drastically decreased from the existing condition, which would result in a decrease in sediment delivered from off-road travel to habitat on the Verde River, East Clear Creek, and Fossil Creek. In addition, motorized big game retrieval would either be eliminated or substantially reduced on all Forest watersheds. These changes would therefore be generally beneficial to these aquatic species.

This alternative would also not allow any off-road vehicular travel for big game retrieval in the Upper Clear Creek Watershed. However, motorized big game retrieval would be allowed within portions of the Grindstone Wash-Upper Verde and Cherry Creek-Upper Verde watersheds. Off-road use would be drastically decreased from the existing condition, which includes few restrictions on 50,448 acres of the 61,231 acres of the game management units on the Forest. Therefore, this alternative would thus result in a decrease in sediment delivered from off-road travel to sensitive and candidate species habitat.

By reducing road-derived sedimentation and increasing vegetation coverage, this alternative would combine cumulatively with restoration-based efforts such as fuels reduction activities and projects such as the East Clear Creek Restoration Project to reduce sedimentation to nearby waterways in the long term (1 to 5 years after project implementation). This alternative would also counteract continued and increased sediment from short-term sediment pulses resulting from ongoing and future activities described on page 151.

Should additional temperature stresses, increased periods of drought, or increased sedimentation (from loss of vegetation) result from changes in climate, the reduction in sediment delivery under this alternative could increase the resiliency of these species to multiple stressors and/or a cumulative degradation of aquatic habitat (Regier and Meisner 1990). In addition, the potential introductions of nonnative species would be decreased from less motorized access at stream crossings, which would reduce the potential interactive effects of climate change to enhance invasive species' competitive and predatory effects on native species (Rahel and Olden 2008).

A. Mayfly – Road-derived sediment is not thought to impair this species or its habitat and there is no clear understanding as to why this species' range has declined. Therefore, alternative 3 would have no effect on A. mayfly. Since there would be no direct or indirect effects to this species for alternative 3, this alternative would not contribute to cumulative effects for A. mayfly.

Fossil Springsnail – Since half of the watershed for Fossil Creek is on the Tonto National Forest and the extent of the Fossil springsnail is limited to the headwaters of Fossil Creek, this alternative would only decrease a small number of roads relevant to the Fossil springsnail including NFS Roads 154, X-30599, and X-30621. Yet, the decrease of motorized use on these roads may have a large beneficial effect on the springsnail by decreasing one of the main sources of habitat degradation.

This alternative would not allow any off-road vehicular travel for big game retrieval in the Fossil Creek-Verde River watershed. These changes would reduce sedimentation into streams historic or

occupied by Fossil springsnail, and would therefore be generally beneficial to Fossil springsnail and its habitat.

By reducing motorized use on the roads that may contribute sediment to Fossil springsnail habitat, this alternative would counteract the sediment delivery resulting from cumulative activities including trail development and high impact recreational use in the Fossil Creek corridor, and road maintenance activities and motor vehicle use on NFS Road 708. This reduction in motorized use would also help maintain key headwater habitat on which the Fossil springsnail depends, making the population more resilient to potential impacts from climate change such as from increased drought and increased water temperatures.

Alternative 4 – Direct, Indirect, and Cumulative Effects

Roundtail and Headwater Chub – Similar to alternative 3, the average road densities on the Forest under alternative 4 would be drastically reduced. This would have a net beneficial effect on stream systems across the Forest by reducing the amount of road-derived sediments. This would decrease the potential for sediment to impair habitat for roundtail and headwater chub.

Roundtail and headwater chub occur within game management units 5A, 6A and 6B. Alternative 4 would continue to allow motorized big game retrieval within those game management units; however off-road motorized use would still be substantially reduced from current levels. The reduction in motorized big game retrieval within roundtail and headwater chub habitat would benefit the species by reducing access to sites, reducing damage to shoreline and aquatic habitat by vehicles, reducing the potential spread of nonnative aquatic organisms and diseases, and reducing the potential for forest users to handle/collect roundtail and headwater chub.

Cumulative effects from this alternative are similar to those described under alternative 3.

Little Colorado Sucker and Bluehead Sucker – This alternative would have similar effects to those described for alternative 3. Alternative 4 would reduce the open road network in the Upper Clear Creek watershed by 54 percent (61 percent for alternative 3), which would reduce the amount of road derived sediment entering streams and result in a lower probability that Little Colorado sucker and bluehead sucker habitat would be impaired from high sediment loads.

This alternative would allow off-road vehicular travel for big game retrieval in the Upper Clear Creek watershed. Due to the regulated nature of motorized big game retrieval and because it is limited to elk, it is likely there would still be a large overall decrease from existing off-road vehicular use. Under this alternative, motorized big game retrieval could occur on 95,949 acres in game management units 5A and 57 acres in game management unit 5B. This continued off-road use would likely reduce but not reverse the downward water quality trend in tributary creeks such as Barbershop Canyon. Thus, motorized big game retrieval would continue to result in sedimentation to Upper Clear Creek watershed and impact aquatic habitat, but at a lower level than existing conditions. These changes would reduce sedimentation into streams inhabited by these species, and would therefore be generally beneficial.

Cumulative effects from this alternative are similar to those described under alternative 3.

Longfin Dace, Desert Sucker, and Sonora Sucker – This alternative would have similar effects to those described for alternative 3. Alternative 4 would reduce the amount of known roads receiving motorized use by over 51 percent and would prevent motorized cross-country travel on

over 1.4 million acres on the Forest, increasing the amount of vegetation coverage and reducing the amount of road-derived sediments entering streams. These changes would be generally beneficial to longfin dace and desert sucker.

This alternative would substantially reduce current levels of off-road motorized use since off-road use for game retrieval would be limited to only those who have successfully killed an elk. The reduction in motorized big game retrieval within longfin dace, desert sucker and Sonora sucker habitat would benefit the species by reducing access to sites, reducing damage to shoreline and aquatic habitat by vehicles, reducing the potential spread of nonnative aquatic organisms and diseases, and reducing the potential for forest users to handle/collect these species.

Cumulative effects from this alternative are similar to those described under alternative 3.

A. Mayfly – Effects to this species would be the same as those described for alternative 3.

Fossil Springsnail, Page Springsnail and California Floater – Effects to these species would be similar to those described under alternative 3. Alternative 4 would decrease roads open to motorized use by 493 miles (535 miles for alternative 3), and also decrease over 11 miles of roads close to perennial streams.

This alternative would substantially reduce current levels of off-road motorized use since off-road use for game retrieval would be limited to only those who have successfully killed an elk. The reduction in motorized big game retrieval within fossil springsnail, Page springsnail and California floater habitat would benefit the species by reducing access to sites, reducing damage to shoreline and aquatic habitat by vehicles, reducing the potential spread of nonnative aquatic organisms and diseases, and reducing the potential for forest users to handle/collect the species.

Cumulative effects from this alternative are similar to those described under alternative 3.

Environmental Consequences to Aquatic Management Indicator Species

Alternative 1 – Direct, Indirect and Cumulative Effects

This alternative would result in a negative cumulative effect to macroinvertebrates by continuing to contribute a high level of sediment that would combine with increased sediment from short-term sediment pulses resulting from the activities listed on page 151. Should additional temperature stresses, increased periods of drought, or increased sedimentation (from loss of vegetation) result from changes in climate, the present rate of sediment delivery under this alternative could result in a greater cumulative impact on macroinvertebrates from multiple stressors and/or a cumulative degradation of aquatic habitat (Regier and Meisner 1990). In addition, the potential introductions of nonnative species would combine with the effects of climate change to enhance invasive species' competitive and predatory effects on native species (Rahel and Olden 2008).

Alternative 3 – Direct, Indirect, and Cumulative Effects

The effects of alternative 3 on macroinvertebrates would not likely change the Forestwide trend, which is currently stable. By reducing the amount of roads open to public motorized use by 57 percent across the Forest, it would result in reduced sedimentation, less severe peak flows, and a lower potential for road-derived contaminants entering aquatic systems. There is the potential for

the composition of the macroinvertebrate community to shift due to reduced fluctuations in runoff, and decreased amounts of sediment entering streams. However, any shift in the community would likely be towards species that are less tolerant of disturbance (i.e., towards species that have more specialized habitat requirements). This would result in a positive trend for macroinvertebrates.

This alternative would result in a decrease in sediment delivered from off-road travel to macroinvertebrate habitat in the Verde River. In addition, no motorized big game retrieval would be allowed on any of the other Forest watersheds.

Cumulative effects for macroinvertebrates are the same as those discussed for sensitive species under alternative 3.

Alternative 4 – Direct, Indirect and Cumulative Effects

Effects from this alternative are similar to those described for alternative 3 above. This alternative would reduce the amount of roads open to public motorized use by 52 percent.

This alternative would substantially reduce current levels of off-road motorized use since off-road use for game retrieval would be limited to only those who have successfully killed an elk. The reduction in motorized big game retrieval within macroinvertebrate habitat would benefit these species by reducing access to sites, reducing damage to shoreline and aquatic habitat by vehicles, reducing the potential spread of nonnative aquatic organisms and diseases, and reducing the potential for forest users to handle/collect macroinvertebrates.

Wildlife

This section summarizes existing conditions and effects from all alternatives to threatened, endangered, and Forest Service sensitive species (table 40), management indicator species, and migratory bird priority species that may occur or may have habitat within the project area. There are 75 special status animal species on the Coconino National Forest addressed by this analysis.

Methodology for Analysis

Whenever possible, species-specific habitat and locality data were used for analysis. Forest-specific geographic information system (GIS) data were used for riparian and wetland habitat. Additionally, using species-habitat relationships, data were queried by potential natural vegetation type to help with analysis of effects to species' habitats. Within the Forest boundary, potential natural vegetation types were derived from aggregated Forest terrestrial ecosystem survey ecological units and Southwest Regional Gap Analysis Project (SWReGAP; Steinke 2007). Potential natural vegetation types are ecological units based biophysical settings and depict the potential vegetation type that would dominate a site under historic fire regimes and biological processes. The potential natural vegetation types are fully quantified for each species in the Wildlife specialist report.

Table 40. Threatened, endangered, candidate, and sensitive wildlife species on the Coconino National Forest

Scientific name	Common name	Status	District known or expected
Amphibians (4)			
Lithobates chiracahuensis	Chiricahua Leopard Frog	T	MR, RR
Bufo microscaphus microscaphus	Southwestern (Arizona) Toad	S	MR, RR
Lithobates pipiens	Northern Leopard Frog	S	ALL
Lithobates yavapaiensis	Lowland Leopard Frog	S	RR
Birds (12)			
Empidonax traillii extimus	Southwestern Willow Flycatcher	E	MR, RR
Rallus longirostris yumanensis	Yuma Clapper Rail	E	RR
Strix occidentalis lucida	Mexican Spotted Owl	T	ALL
Coccyzus americanus occidentalis	Western Yellow-billed Cuckoo	C	RR
Haliaeetus leucocephalus	Bald Eagle	T (delisted); S (elsewhere on the Forest)	ALL
Accipiter gentilis	Northern Goshawk	S	ALL except RR
Buteogallus anthracinus	Common Black Hawk	S	MR, RR
Falco peregrinus anatum	American Peregrine Falcon	S	ALL
Aechmophorus clarkii	Clark's Grebe	S	ALL
Athene cunicularia hypugaea	Burrowing Owl (western)	S	ALL
Buteo regalis	Ferruginous Hawk	S	ALL
Pipila aberti	Abert's Towhee	S	RR
Insects (3)			
Piruna polingii	Four-spotted Skipperling	S	ALL
Speyeria nokomis nitocris	Nitocris Fritillary	S	ALL
Speyeria nokomis nokomis	Nokomis Fritillary	S	ALL
Mammals (13)			
Mustela nigripes	Black-footed Ferret	E	P, ML, MR
Lutra canadensis sonora	Southwestern River Otter	S	RR
Microtus mexicanus Navaho	Navajo Mexican Vole	S	P, ML, MR
Microtus longicaudus	Long-tailed Vole	S	P, ML, MR
Perognathus amplus cineris	Wupatki Arizona Pocket Mouse	S	P
Sorex nanus	Dwarf Shrew	S	D2
Lasiurus blossevillii	Western Red Bat	S	ALL
Euderma maculatum	Spotted Bat	S	ALL
Idionycteris phyllotis	Allen's Lappet-browed Bat	S	ALL
Corynorhinus townsendii pallescens	Pale Townsend's Big-eared Bat	S	ALL
Eumops perotis californicus	Greater Western Mastiff Bat	S	ALL
Sorex merriami leucogengys	Merriam's shrew	S	ALL
Reithrodontomys montanus	Plains Harvest Mouse	S	P, ML, MR
Reptiles (3)			
Thamnophis eques megalops	Northern Mexican Garter Snake	C	RR, MR
Thamnophis rufipunctatus	Narrow-headed Garter Snake	S	ALL
Heloderma suspectum suspectum	Reticulate Gila Monster	S	RR

Status: E = federally endangered; T = federally threatened; C = federal candidate; S = Forest Service sensitive
District: P = Peaks Ranger District, ML = Mormon Lake Ranger District, MR = Mogollon Rim Ranger District, RR = Red Rock Ranger District

Table 41. Management indicator wildlife species and habitat on the Coconino National Forest

Species	Indicator Habitat
Abert squirrel	Early seral ponderosa pine
Goshawk	Late seral ponderosa pine
Pygmy nuthatch	Late seral ponderosa pine
Turkey	Late seral ponderosa pine
Elk	Early seral ponderosa pine, mixed conifer, and spruce-fir
Hairy woodpecker	Snag component of ponderosa pine, mixed conifer, and spruce-fir
Mexican spotted owl	Late seral mixed conifer and spruce-fir
Red squirrel	Late seral mixed conifer and spruce-fir
Red-naped (yellow-bellied) sapsucker	Late seral and snag component of aspen
Mule deer	Early seral aspen and pinyon-juniper
Juniper (plain) titmouse	Late seral and snag component of pinyon-juniper
Antelope	Early and late seral grasslands
Lincoln's sparrow	Late seral, high elevation riparian (>7,000 feet)
Lucy's warbler	Late seral, low elevation riparian (< 7,000 feet)
Yellow-breasted chat	Late seral, low elevation riparian (< 7,000 feet)
Cinnamon teal	Wetlands/Aquatics

Table 42. Priority migratory birds and habitat associations

Species	Habitat	Potential natural vegetation type
Swainson's thrush* Pine grosbeak* Golden-crowned kinglet*	Spruce-fir	Spruce-fir
Olive-sided flycatcher*	Mixed Conifer	Mixed conifer
Cordilleran flycatcher* Olive warbler** Greater pewee** Grace's warbler** Lewis' woodpecker** Flammulated owl** Purple martin*	Ponderosa Pine	Ponderosa pine
Swainson's hawk* Grasshopper sparrow†	High Elevation Grassland	Montane/subalpine grassland Great Basin grassland
Gray flycatcher* Gray vireo* Black-throated gray warbler* Band-tailed pigeon*	Pinyon – Juniper	Pinyon-juniper woodland Pinyon-juniper evergreen shrub
Black-chinned sparrow* Virginia's warbler*	Chaparral	Interior chapparal
McGillvray's warbler* Red-faced warbler*	High Elevation Riparian	Montane willow Mixed broadleaf
Bell's vireo**	Low Elevation Riparian	Cottonwood willow
Bendire's thrasher** Crissal thrasher** Elf owl** Sage sparrow**	DesertRiparian	Desert communities Semi-desert grassland Cottonwood willow riparian Mixed broadleaf riparian

* Species listed as Partners in Flight priority species

** Species listed in 2008 Birds of Conservation Concern report

† Species listed in both documents

Affected Environment and Environmental Consequences

All Alternatives – Direct and Indirect Effects

Some level of impact is occurring to wildlife wherever motorized travel occurs. Factors such as habitats and species present, density of species, location of travel in relation to important habitats, time of year or even time of day, amount of vehicle travel, and a myriad of other factors could apply in determining what and to what extent impacts are occurring.

Roads and trails directly affect terrestrial species by killing individuals crossing or basking on roads. Over time, this reduces recruitment, particularly with species that have long maturation times (Bury et al. 1977). In one study, the proportion of dead frogs and toads increased with increasing traffic (Fahrig et al. 1995). Bouchard et al. (2009) found that frogs' movement was slower and less linear in areas with more roads and traffic. In addition, frog mortality was higher by 22 percent on roads with a mean traffic count of 58 vehicles per hour (Bouchard et al. 2009). An average of traffic counts on the Mogollon Rim and Red Rock Ranger Districts is 15 vehicles per hour with a high of 48 vehicles per hour along the highest use road (Schnebly Hill in Sedona) for which data was available (USDA Forest Service 2010).

Roads and trails indirectly affect terrestrial species through; 1) loss of habitat due to conversion of native vegetation to a particular road/trail surface (paved, gravel, dirt); 2) fragmentation of habitats due to a road and trail system development; 3) interruption in migratory patterns of wildlife to reach breeding habitat or winter range habitat; and 4) lack of habitat use by wildlife due to disturbance caused by use of the road or trail system.

Direct loss of habitat from roads and trails is generally minor. Currently about 0.006 percent of the Forest has been converted from habitat to roads. These estimates do not include direct habitat loss due to trails and an unknown number of unauthorized roads, which would add more acres to the total and increase the percentages of disturbed habitat. While the totals of direct habitat loss are relatively low, there is an indirect habitat loss that includes the area around roads where wildlife will avoid using habitat. This does not mean the animals never use the areas, only that the majority of animals tend to avoid these zones while the road is in use.

The disturbance effects from motorized use of routes on wildlife, whether roads or trails, are similar. Lack of wildlife use in habitats along roads and trails can be correlated to the level of use a road receives over time. Low use roads may tend to have wildlife using roadside habitats more frequently than roads with high traffic volume (Edge and Marcum 1991). Off-road vehicle travel on undesignated routes (i.e., cross-country) is presently allowed from existing roads (excluding previously closed areas), regardless of road type. Off-road vehicle use affects wildlife directly by harassment, displacement, and the reduction in the security of areas between roads. Wisdom and others (2004) found that recreational activities had a substantial effect on movement rates and flight responses for elk, with ATV use and mountain biking having greater effects on movement rates and flight responses than horseback riding and hiking.

Many studies have been conducted on the effects of noise disturbance on wildlife displacement and avoidance. Noise from developing, using, and maintaining roads affects wildlife within hearing distance. Noise from off-road vehicles can be at volumes and levels that harass desert animals (Bury 1980), even in underground retreats and burrows (Bondello 1976). Studies on the issue of road avoidance as it impacts species are relatively numerous (primarily for big game

species such as elk, deer, and bear). The most common interaction identified in the literature was displacement and avoidance, where animals altered their use of habitats in response to the motorized routes. The effects on wildlife behavior and habitat utilization due to noise from road and trail use may extend as far as several hundred meters from the road or trail. Studies of noise effects document physiological effects to wildlife causing energy loss, which ultimately affect animal survival and reproduction (Wisdom et al. 2004). One study documents that noise immobilized leopard frogs longer, which could leave them more susceptible to being run over while crossing roads and trails (Nash et al. 1970). Noise impacts relevant to this assessment fall into several categories: (1) change in use within the designated open road system, (2) noise related to the use of newly designated roads and trails, and (3) noise associated with camping corridors and the change in use.

The presence of roads and the intensity of motorized use can affect wildlife. When located under an open canopy, a simple linear strip of dirt or gravel can function as a physical or psychological hindrance to the movements of animals (Stamps et al. 1987). Certain facets of the biology and life history of reptiles and amphibians, such as poor dispersal capability and small home ranges (Stebbins and Cohen 1995, deMaynadier and Hunter 2000) make them especially prone to fragmentation of their habitat (Gilpin 1987). Habitat dividers such as roads contribute to slowing or reduction of gene flow between populations. Thus, motorized wheeled cross-country travel and the roads it creates may have a negative impact on these species. Data collected on desert tortoises revealed the presence of only 62 burrows in a high use OHV area, as compared to 171 in an area without use (Bury 1978). Nash et al. (1970) reported that loud noises immobilized sensitive leopard frogs. Another study (Busack and Bury 1974) showed that OHV use adversely affected desert lizard populations through loss of cover and food sources, as well as disturbing social structure. Reptiles and amphibians also tend to be less mobile than other groups of animals, increasing their chances of being killed directly by motorized wheeled vehicles on or off roadways. Research shows a decreasing trend in the number of frogs and toads per kilometer as traffic intensity increases (Fahrig et al. 1995). Continual use of an area, whether high or low intensity, may reduce recruitment of species that are slow to sexual maturity or have naturally low recruitment rates (Bury et al. 1977).

Small mammals are also susceptible to death or injury from collisions with off road vehicles (Taylor 1971, Oxley et al. 1974, Lode 2000, Berry 1980, Bury 1980, Bury et al. 1977). Small lightly trafficked roads, such as those that may be created by OHVs, have also been shown to strongly inhibit the movements of species such as voles (Swihart and Slade 1984, deMaynadier and Hunter 2000). Other significant impacts of OHVs on small mammals include habitat destruction and disturbance (noise, presence of humans, etc.). In the desert, noise from a single OHV may be heard for a 2-4 km (1.2-2.4 mi) radius (Rennison and Wallace 1976), and may be considered a form of harassment (Bury 1980). Kangaroo rats are deafened by even intermittent OHV noise, making them vulnerable to predation (Berry 1980, Lovich and Bainbridge 1999). OHVs can also collapse burrows (Bury et al. 1977, Bury 1980). Destruction and damage of vegetation indirectly affects small mammals by removing vital sources of food and cover. According to Bury et al. (1977), density, diversity and biomass of small mammals are inversely related to the level of OHV use in an area. Impacts to these species may be felt high up the food chain, as they form a prey base for many larger predators.

It is likely that disturbance also has long term and cumulative effects on small mammals. These often include abandonment of disturbed areas for undisturbed ones (Knight and Cole 1991), altering the natural range of a species or pushing species away from higher quality habitat.

Disturbance may also reduce vigor (Knight and Cole 1991). Elevated heart rates and energy expended fleeing disturbances will elevate total energy expenditures or decrease energy acquisition. This may result in increased frequency of sickness, disease and potential death for small mammals (Knight and Cole 1991). Although these responses have been suggested, evidence remains largely circumstantial (Hutchins and Geist 1987).

Bats are vulnerable to disturbance and displacement caused by human activities in caves, mines, on rock faces (Hill and Smith 1984, Nagorsen and Brigham 1993). Cave or mine exploration and rock-climbing are examples of recreation that could reduce population fitness of bats in roost sites (Nagorsen and Brigham 1993, Tuttle 1988). Such activities may be facilitated by road access. Recreation such as camping at night may interfere with bats' ability to effectively use echolocation for communication, navigation, and prey detection; such as interference was observed near running water (Mackey and Barclay 1988). Roads, because of coincident noise, likely reduce the quality of roosting habitat nearby (Harvey 1980). Solvesky (2007) found that Allen's lappet-browed bats selected snags as maternity roosts closer to forest roads.

Studies show that many raptors demonstrate sensitivity to disturbance as well. The presence of people and motorized wheeled vehicles has especially significant impacts during nesting and incubation. Even mild disturbances can cause golden eagles and ferruginous hawks to abandon nests, exposing eggs or young to the elements, starvation or predation (Richardson et al. 1997, Sachet 1988). Fewer young are fledged from disturbed nests, which oftentimes remain unoccupied in subsequent years (White and Thurow 1985). Kahl (1972) cites examples of young osprey frightened into premature flights. Other raptors exhibit similar responses (Sachet 1988, Berry 1980). Humans can also stimulate alterations in raptor behavior outside of the breeding season. Disturbing birds while foraging, or flushing birds from day or night roosts can enhance physical strain in times of prey scarcity and/or severe weather (Holmes et al. 1993, Stalmaster 1987, Stalmaster and Newman 1978, Bueler et al. 1991, Grubb et al. 1992).

habitat fragmentation has long been established as a primary factor in the decline of songbirds. While forest roads and trails are not always wide enough to be considered sources of fragmentation in themselves (Rich and Dobkin 1994, Theobald and Hobbs 1998, Paton 1994), cumulatively, the convoluted network of lesser roads created by motorized wheeled cross-country travel can mimic effects typically associated with habitat fragmentation (Rich and Dobkin 1994). These effects include reduction in habitat quality (Ortega and Capen 1999) and conversion of forest interior habitat to edge habitat. The creation of edges may influence species diversity by reducing habitat for forest interior species like the brown creeper and generating habitat for generalist species (Jones et al. 2000, Boren et al. 1999). Increases in predation and decreases in nest success have also been linked to edges (Paton 1994, Reed et al. 1996). Since so many songbird species are riparian obligates, fragmentation effects in these areas may be especially severe on a landscape perspective (Hamann et al. 1999). In a study conducted on northern spotted owls (Delaney and Grubb 2003), preliminary results on distance and sound thresholds for spotted owls found they are likely to flush from roost/nests when motorcycles are less than 180 m away. These preliminary results are consistent with other raptor disturbance studies (Delaney et al. 1999) that found that spotted owls did flush and demonstrate other behaviors in response to human-based disturbances, but ultimately these disturbances did not impact animal fitness.

Motorized wheeled cross-country travel impacts gamebirds and waterfowl such as turkeys, ducks and quail through vegetation destruction, resulting in a loss of food and cover, as well as damage to bedding and nesting areas. Direct crushing of eggs laid by ground nesting species may occur

as well. The increased mobility allowed by OHVs can also intensify hunting pressures (Holbrook and Vaughan 1985), and accounts from Bury (1980) connect heavy OHV use to declines in quail populations. Ducks are also susceptible to disturbance, and may not nest if agitated during key periods of the breeding cycle (Hamann et al. 1999).

Ungulates such as deer, elk, pronghorn antelope and bighorn sheep suffer physiological effects from motorized wheeled vehicle disturbance. During critical periods such as winter and breeding, these effects can be especially detrimental. Nelson and Leege (1982) report that nearly 40 percent more food is required for survival in the winter; few winter ranges can support such a large forage increase (Canfield et al. 1999). Even healthy animals are physically strained by lack of forage, snow and cold temperatures, and weight loss is common in normal winters on the most productive ranges (Canfield et al. 1999). Recreational disturbances force additional energy expenditure from ungulates by stimulating physiological responses such as increased metabolism and heart rate (Chabot 1991, Geist 1978). Studies have confirmed this occurrence for white-tailed deer (Moen et al. 1982, Moen 1978), bighorn sheep (MacArthur et al. 1979, Stemp 1983, Geist 1985), elk (Chabot 1991, Lieb 1981) and mule deer (Freddy 1977, Weisenberger et al. 1996), as well as other species. Cumulatively, the effects of harassment combined with other winter hardships may result in increased vulnerability to predation, disease or death (Geist 1971, Berwick 1968, Legg 1999).

Disturbance-induced displacement from important habitats serves as a long-term influence on ungulates. Many studies have shown that vehicle traffic on forest roads makes habitats near the road less available for elk use (Rost 1975; Edge 1982; Lyon 1979, 1983; Edge and Marcum 1985a and b, 1991; Marcum and Edge 1991). Lyon (1983) states that for two miles of road per square mile open to vehicular traffic, the impacted area could easily exceed half of available elk habitat. Swan (unpublished data) reports a three-fold reduction in ungulate use in an area with heavy OHV activity. Repeated displacement may also result in a decline in calf survival during elk calving season (Phillips and Alldredge1998). Species like bighorn sheep are already restricted to relatively narrow bands of suitable habitat on steep, rocky slopes; when repeated human activity renders these areas unusable, these animals may have no other high quality habitat readily available for dispersal. Displacement from water sources can be detrimental to ungulates as well as other wildlife species, particularly in the desert southwest where water is limited. Jorgensen (1974) reported that when vehicles were present near a water source, bighorn sheep visits decreased by half. In addition, Canfield et al. (1999) suggest that recreational use may alter the migratory movements of ungulates such as deer and elk.

OHVs also provide hunters entry to areas previously inaccessible by motorized vehicle, as well as increased mobility. These two factors have contributed to acts of poor sportsmanship. Land managers in Montana report that most illegal OHV operations occur during hunting seasons (Montana Fish, Wildlife and Parks 2000). Using decoy elk and deer, northern Arizona law enforcement officials documented numerous examples of roadside hunting, including shooting from vehicles (Bancroft 1990). Researchers in Flagstaff and the White Mountains also observed hunters shooting from vehicles, and concluded that high road densities in turkey habitat is likely a factor in turkey mortality (Jones and Barsch 1993). Pronghorn hunters have reported other hunters herding antelope from OHVs and shooting into the herd from long distances (Canfield et al. 1999). On top of being unethical, these actions can lead to crippling loss of animals due to overharvesting (Posewitz 1994). It may also result in fewer hunting opportunities for other sportsmen.

Irreversible and irretrievable commitments: There would be irreversible or irretrievable impacts to wildlife resources with implementation of either action alternative due to the designation of 30 miles of new roads in alternative 3 and 36 miles of roads in alternative 4; 1.8 miles of new trails to be added to the system in alternative 3, and 36 miles of new roads and 51.8 miles of new trails in alternative 4. Habitat would be permanently unavailable for wildlife use.

Cumulative Effects

Unless noted otherwise, cumulative effects of alternative 4 are the same as those discussed for alternative 3.

Threatened, Endangered, and Candidate Species

For complete information on the potential effects to threatened, endangered, and candidate species relative to travel management planning, please refer to full Wildlife specialist report.

Mexican Spotted Owl and Critical Habitat

Existing Condition

As of November 2010, there were 184 Mexican spotted owl protected activity centers on the Coconino National Forest, with an additional 4 protected activity centers that straddle other national forests. Protected activity centers are established at all Mexican spotted owl known and historical sites and are at least 600 acres in size, encompassing known nests, roosts, and the best available habitat in the area. A GIS data query of the Coconino Mexican spotted owl protected activity center coverage, and authorized and known unauthorized roads and motorized trails showed that there are 420 miles of roads and 15.5 miles of motorized trails within protected activity center boundaries. On average, there are 2.6 miles of road per protected activity center (of those with roads), with a range of 0.1 mile to 10.3 miles. Some protected activity centers, such as those within wilderness, have no roads within their boundaries. Of the 188 protected activity centers, 20 have no roads. The 15.5 miles of motorized trail occurs in nine protected activity centers. There are 52 miles of road within ¼ mile of known nests and 8 known nests in 5 protected activity centers within ¼ mile of motorized trails.

There are 2,678 miles of NFS roads and 62 miles of authorized and unauthorized motorized trails within Mexican spotted owl critical habitat boundaries. Of the primary vegetation types used by owls, camping use is highest in the high elevation forests and meadows and lowest in riparian vegetation types (Recreation specialist report 2011).

Environmental Consequences to Mexican Spotted Owl and Critical Habitat

Alternative 1 – Direct, Indirect, and Cumulative Effects: This alternative would not close any roads or motorized trails and cross-country travel would continue to occur Forestwide, except in areas of existing motorized closures. This alternative would keep the 420 miles of roads, and 10 miles of unauthorized motorized trails currently open within protected activity center boundaries. This alternative has the highest number of protected activity centers with roads and the highest number of protected activity centers with motorized trails. Due to the increasing levels of cross-country OHV travel, this alternative would allow the level of recreational activities within some protected activity centers to increase, exceeding that which was occurring prior to the owl being

listed. This increase does not follow forest plan guidelines or Mexican Spotted Owl Recovery Plan (USDI Fish and Wildlife Service 1995) recommendations.

Motorized travel would continue to directly cause localized disturbance to owls and designated critical habitat. Habitat would be impacted by loss of vegetative ground cover, which would impact owl prey species that rely on plant material for food and cover (i.e., microtine voles, peromyscid mice).

With this alternative, wood and forest product harvesting would continue throughout the Forest and surrounding areas over the next several decades resulting in a cumulative effect to individual owls and critical habitat. Large dead trees (snags) along roads and campsites that pose a hazard would continue to be removed reducing this primary constituent element. Snags and logs would be vulnerable to increased harvest of these structures along roads. Motorized access facilitates firewood harvest and illegal cutting of dead standing trees as well as commercial harvest (Wisdom and Bate 200). Most woodcutting on the Forest occurs in Mexican spotted owl habitat (i.e., ponderosa pine with Gambel oak and mixed-conifer vegetation types). Over time, woodcutting could reduce snags and downed logs, which are important Mexican spotted owl habitat components.

Alternative 3 – Direct, Indirect, and Cumulative Effects: This alternative would not designate unauthorized roads as NFS roads within protected activity centers. Alternative 3 would reduce 323 miles (75 percent) of roads within protected activity centers. Overall, roads would be reduced in all but seven protected activity centers. Alternative 3 would reduce roads within ¼ mile of known nests by 41.6 miles and would eliminate unauthorized motorized trail within ¼ mile of known nests. This reduction in roads and motorized trails would eliminate the potential for noise disturbance from motorized vehicles and associated camping within 65 protected activity centers and reduce the potential for noise disturbance from motorized vehicles and associated camping in 112 protected activity centers.

Alternative 3 would largely benefit Mexican spotted owls by:

- eliminating cross-country travel in a large majority of the Forest except for motorized big game retrieval in game management units 7W and 8;
- greatly reducing the number of miles of open roads and motorized trails and disturbance from off-road use within Mexican spotted owl protected activity centers;
- reducing the number of miles of motorized trails within protected activity centers;
- reducing the number of protected activity centers with motorized trails; and
- eliminating unauthorized motorized trails within close proximity to known nest sites.

This would positively affect owls by reducing access to and activity near occupied sites, reducing disturbance to individuals and their habitat.

Alternative 3 would designate 1,019 acres of camping corridors within protected activity centers, and a portion of the corridors are within ¼ mile of nest and roost locations. Although the effects of camping on spotted owls have not been studied, disruption of nesting, roosting and foraging is a distinct possibility (USDI Fish and Wildlife Service 1995). Designation of motorized camping corridors within protected activity centers may increase disturbance to owls during the breeding season in 47 protected activity centers by increasing access and disturbance, potentially disrupting nesting, roosting and foraging. However designating camping corridors would

concentrate use in areas away from the best available habitat within protected activity centers and provide higher quality habitat within the protected activity centers. On roads that would remain open but are not identified as corridors, camping could increase some due to displaced campers who would no longer be able to access closed roads. Since impacts at any one site are expected to be of short duration and low intensity, new hardened sites probably won't be created in Mexican spotted owl protected activity centers; therefore, habitat and disturbance impacts are expected to be minimal.

Short-term disturbance from prescribed fire treatments, wildfire or wildfire suppression activities, or development of recreational facilities and longer-term loss and degradation of habitat from utility line construction and maintenance, and use and maintenance of nonjurisdictional routes would contribute cumulatively to impacts to the owls in the 47 protected activity centers, with the most effect likely occurring to the 16 owl nests within ¼ mile of designated routes. Overall, however, this alternative would reduce disturbance and habitat degradation from motorized use and access in approximately 177 protected activity centers, which would slightly counteract the long-term impacts of other activities resulting in habitat loss and degradation. Thus, this alternative may result in a cumulative impact to some owls (those within the 47 protected activity centers with designated camping corridors), but the overall population would be slightly more resilient to impacts from other activities and environmental change (e.g., climate change). The owls expected to be impacted from other current projects, including owls adjacent to the waterline road on the San Francisco Mountains, would not be cumulatively impacted by this alternative. Because the road and trail designations for the waterline road and surrounding routes are not expected to have any change or would include designated camping corridors as a result of this project, no cumulative effect is expected to these four owl protected activity centers.

This alternative would reduce the level of recreation activities within protected activity centers, bringing the level of use closer to that which was occurring prior to the Mexican spotted owl being listed.

Reasonably foreseeable actions such as travel management efforts in the adjacent Apache-Sitgreaves, Tonto and Kaibab National Forests will result in a cumulative effect of supporting the increase of primary constituent elements for critical habitat in the Upper Gila Mountain Recovery Unit over the long term (10 or more years).

Alternative 4 – Direct, Indirect, and Cumulative Effects: Alternative 4 reduces miles of roads open for public use in protected activity centers by 277 miles (64 percent), and would designate 0.3 mile of unauthorized roads as NFS roads within protected activity centers. Roads would be reduced in all but 39 protected activity centers. Alternative 4 would reduce roads within ¼ mile of known nests by 34.9 miles and would eliminate motorized trails within ¼ mile of nests.

Alternative 4 would largely benefit Mexican spotted owls in a similar manner to alternative 3, but would include a slightly greater number of routes in Mexican spotted owl protected activity centers or critical habitat. It would also allow for off-road travel for retrieval of downed elk. This would result in a low-level of disturbance to some owls, but would be a large decrease from current conditions.

Thus, this alternative may result in a cumulative impact to some owls (those within the 47 protected activity centers with designated camping corridors), but the overall population would be

slightly more resilient to impacts from other activities and environmental change (e.g., climate change).

Black-footed Ferret and Habitat

Existing Condition

There are presently no known naturally occurring populations or known records of black-footed ferrets on the Coconino National Forest; however there have been no comprehensive surveys for black-footed ferrets on the Forest. Ferrets have been reintroduced as an experimental nonessential population in the Aubrey Valley near Seligman, Arizona, since 1996 (USDI Fish and Wildlife Service 1996). As the historical range of the black-footed ferret is nearly identical to that of certain prairie dog species (including the Gunnison's prairie dog found on the Forest), and black-footed ferrets require prairie dogs to survive, the following discussion includes an analysis of impacts on Coconino National Forest prairie dog colonies as potential black-footed ferret habitat.

Environmental Consequences to Black-footed Ferret and Habitat

Alternative 1 –Direct, Indirect, and Cumulative Effects: If prairie dog colonies were occupied by ferrets, roads and unrestricted cross-country travel could increase potential for direct mortality to ferrets from vehicle collisions. Because there are no known black-footed ferrets on the Forest, the probability of direct effects to black-footed ferrets from the existing road system and unrestricted cross-country travel is low.

A study conducted on attributes of black-tailed prairie dog colonies found although prairie dogs commonly use roads for dispersal, distance to nearest road was neither related to prairie dog density nor to colony area (Reading 1997). Because prairie dogs often occur in areas such as meadows and grasslands, their habitat and colonies have a greater chance of being impacted by cross-country travel and camping. This in turn leads to less available habitat for species such as the ferret that rely on prairie dogs for food.

Under this alternative, 1,091 miles of roads and 7.2 miles of unauthorized motorized trails would remain open within Great Basin, montane/subalpine, and semi-desert potential natural vegetation types and 36.5 miles of road and 0.6 mile of motorized trails that are currently known to pass through prairie dog towns. This would result in the greatest impacts to meadows and grasslands that provide habitat for prairie dogs, and potentially black-footed ferrets.

Cross-country travel, use of existing roads in prairie dog habitat, and development of new power lines or private development in grasslands would result in a cumulative impact to limit prairie dog density in conjunction with activities such as grazing and high impact recreational use. Prescribed burning treatments and grazing may result in short-term impacts to habitat, but these are not likely to result in long-term cumulative impacts and would probably be localized in nature. This alternative would result in the most stress on meadow habitats and thus would have the greatest negative contribution to potential black footed ferret habitat.

Alternative 3 –Direct, Indirect, and Cumulative Effects: Direct effects are unlikely to occur since there are no known locations of black-footed ferrets on the Forest. Within known prairie dog towns, alternative 3 reduces roads by 23.4 miles (64 percent) and eliminates motorized trails. Alternative 3 would provide the greatest improvement to meadow and grassland habitats and the

least amount of potential disturbance to burrow systems thereby improving habitat for prairie dogs and potential habitat for ferrets.

With this alternative, 4,413 acres of camping corridors would be designated within grassland habitats that provide potential habitat for prairie dogs. There would be 2.5 miles of camping corridors designated in prairie dog towns. This could have both direct impacts by displacing prairie dogs and collapsing burrows, and indirect impacts to prairie dogs and ferrets by degrading habitat. This impact may combine with short-term cumulative impacts from mechanical thinning activities, prescribed fire treatments, and wildfire and wildfire suppression and the continued impact from nonjurisdictional roads in meadow habitat to limit or fragment prairie dog populations in a limited area. Camping would be increased on 4,413 acres within grassland habitats and prairie dog towns. On roads that would remain open but are not identified as corridors, camping could increase some due to displaced campers who would no longer be able to access closed roads. Since impacts at any one site are expected to be of short duration and low intensity, new hardened sites probably wouldn't be created; therefore, habitat and disturbance impacts are expected to be minimal.

As a result of this alternative, the habitat as a whole would be more likely to support a greater prairie dog population in meadow systems in the Forest and surrounding areas. Cumulative activities such as travel management planning on the Tonto, Kaibab, and Apache-Sitgreaves National Forests are likely to have a similar individual effect and result in a cumulative effect with each other where undisturbed prairie dog habitat overlaps. This combined with Forest restoration activities could open up more habitat or provide more contiguous swaths of meadow and grassland habitat key to supporting thriving prairie dog colonies.

Alternative 4 – Direct, Indirect, and Cumulative Effects: This alternative would be very similar to the effects of alternative 3, but would designate approximately two additional road miles in prairie dog habitat.

This alternative would authorize off-road travel for motorized big game retrieval of elk in all game management units. This could have potential isolated impacts to grasslands. Although this would reduce off-road motorized use from current conditions because this alternative would limit motorized big game retrieval to elk only, this alternative would continue to allow off-road travel in key potential habitat such as on Anderson Mesa (game management unit 5B) and within isolated montane meadows prevalent in 5A and 6A.

Chiricahua Leopard Frog and Habitat

Existing Condition

Chiricahua leopard frogs were designated as a threatened species under the Endangered Species Act in 2000 and since March 2011, there has been proposed critical habitat for the frog. The Coconino National Forest includes recovery unit 23, Buckskin Hills, which is made up of 232 acres containing six livestock tanks occupied at the time of Chiricahua leopard frog listing in 2000, two previously occupied tanks, and the areas located directly upland of these tanks. The proposed critical habitat has not been finalized, so to address potential impacts to potential Chiricahua leopard frog critical habitat, we analyzed a mile radius around all existing and historic Chiricahua leopard frog sites on the Forest.

Environmental Consequences to Chiricahua Leopard Frog and Habitat

Alternative 1 – Direct, Indirect, and Cumulative Effects: Forest roads pose a greater hazard to slow moving animals, such as amphibians, making them highly vulnerable to mortality as they cross even narrow forest roads (DeMaynadier and Hunter 2000). Unrestricted cross-country travel, use of roads and motorized trails, and camping can increase access to occupied sites, increase disturbance to dispersal habitat and dispersing frogs, cause direct damage to shoreline and aquatic habitat, increase the potential for spreading nonnative aquatic organisms and diseases, and increase the potential for forest users to handle/collect frogs. In addition, motorized use adjacent to stock tanks or other frog habitat can cause sedimentation, which would make stock tanks less resistant to drought (USDI Fish and Wildlife Service 2007).

This alternative would likely not result in direct impacts from motor vehicles impacting Chiricahua leopard frog, but could impact Chiricahua leopard frog habitat by including indirect impacts to their habitat. This alternative would likely result in continued off-road use in and adjacent to drainages such as the area upstream of Doren's Defeat Tank, Walt's tank or Partnership Tank. Thus, this alternative would affect proposed critical habitat by continuing to contribute sedimentation to Chiricahua leopard frog habitat. Though this motorized use could also facilitate runoff, the likelihood of this particular use causing runoff that would alter water chemistry in frog habitat (stock tanks) is unlikely. In addition, this alternative would likely have no direct effect on water quantity or permanence of breeding site.

With this alternative, 183.5 miles of roads within 1 mile of the current and historic Chiricahua leopard frog locations would remain open. Of these miles, over 175 miles of existing roads are accessible by high-clearance vehicles only. There are no known motorized trails within one mile of known Chiricahua leopard frog sites.

This alternative would cumulatively impact Chiricahua leopard frog populations on the Coconino National Forest by maintaining open motorized access to occupied sites, which can impact habitat from sedimentation into stock tanks and increase the potential for nonnative organisms and disease. Though the impact from the motorized use itself is indirect, the limited extent of the species and impacts from livestock grazing, acute drought, and competition from nonnative species could result in a cumulative stressors reducing habitat suitability and resulting in the loss of a local population in the Buckskin Hills metapopulation.

Alternative 3 – Direct, Indirect, and Cumulative Effects: Under alternative 3 there would be 98.2 miles of roads (54 percent of existing roads) closed within 1 mile of all known (historic, recent, and occupied) frog locations. The closure of 98.2 miles of road and prohibition of cross-country travel would benefit frogs by reducing access to sites, reducing erosion and sedimentation into stock tanks, reducing disturbance to dispersal habitat and dispersing frogs, reducing damage to shoreline and aquatic habitat by vehicles, reducing the potential spread of nonnative aquatic organisms and diseases, and reducing the potential for forest users to handle or collect frogs. Since there are no motorized trails within 1 mile of known Chiricahua leopard frog sites, the closure of 87 miles of motorized trails would not affect these frogs.

In this alternative, there would no longer be any motorized-based camping along 98 miles of roads to be closed within 1 mile of Chiricahua leopard frog sites, which would have the same benefits as described for road closure and prohibition of cross-country travel above. However, a total of 898 acres of designated camping corridors are identified within 1 mile of all frog sites; most of which are historical sites not currently inhabited due to other environmental factors such

as the presence of crayfish. Since no camping corridors occur within 1 mile of occupied Chiricahua leopard frog sites, there would be no direct impact to individuals from increased camping within identified corridors.

Alternative 3 would designate 3.2 miles of unauthorized roads as NFS roads within 1 mile of historic Chiricahua leopard frog sites. This would affect frog habitat by increasing access and disturbance to historical habitat, increasing disturbance to dispersal habitat, and increasing the potential spread of nonnative aquatic organisms and diseases.

This alternative would decrease impacts to all primary constituent elements of proposed Chiricahua leopard frog critical habitat, but it would continue to allow the potential for access to tanks, such as the Divide Tank, by designating a motorized dispersed camping corridor nearby. Thus, this alternative would reduce overall threats and impacts to the primary constituent elements of Chiricahua leopard frog proposed critical habitat, but may facilitate access to certain tanks, thus increasing the potential for introduction of predators or invasive species in Chiricahua leopard frog proposed critical habitat.

At a larger scale, similar motorized travel management planning and habitat improvement treatments for Chiricahua leopard frog on the Tonto National Forest are expected to improve habitat and decrease the potential for disturbance and introduction of invasive species to Chiricahua leopard frog populations and habitat in nearby recovery units (units 24 and 25) over the long term (within 5 to 10 years since implementation; USDI Fish and Wildlife Service 2011).

Alternative 4 – Direct, Indirect, and Cumulative Effects: This alternative would have similar effects as alternative 3, but would close approximately 5 fewer miles of roads within all known frog locations.

This alternative would allow off-road motorized big game retrieval for elk in all game management units. Chiricahua leopard frog-occupied habitat only occurs in game management unit 6A.This may result in off-road motorized use in Chiricahua leopard frog occupied habitat; however, the likelihood of this is low since elk hunting occurs primarily in higher elevation forested environs such as in the northern part of game management unit 6A.

Yuma Clapper Rail and Southwestern Willow Flycatcher

Existing Condition

These species have not been regularly detected on Coconino National Forest lands; though potential habitat for these species is located in the Verde and Fossil Creek river riparian habitat.

Environmental Consequences to Yuma Clapper Rail and Southwestern Willow Flycatcher

Alternative 1 – Direct, Indirect, and Cumulative Effects: Unrestricted cross-country travel, use of roads and motorized trails, and camping can affect these species and their habitat by increasing access near riparian zones, increasing sedimentation into streams, causing damage to riparian vegetation by vehicles, and increasing the potential for spreading invasive plants. Use of roads and trails within close proximity to these species could cause aural and visual disturbance. However, direct effects are unlikely to occur since these species are not known to inhabit areas on the Coconino National Forest.

Indirect effects of disturbance to potential habitat from motorized use could combine cumulatively with ongoing high impact recreational use or potential impacts to habitat from development of recreational facilities in conjunction with the Fossil Creek Wild and Scenic River planning efforts. Cumulative effects from this alternative would not result in any direct effects to individuals, but the cumulative effects may have the result of decreasing potential habitat over the long term.

Alternative 3 – Direct, Indirect, and Cumulative Effects: Using potential natural vegetation types for below-rim riparian vegetation, 4.0 miles (83 percent) of roads within cottonwood-willow riparian vegetation would be closed. A more specific query shows that 2.3 miles (88 percent) of roads within 300 feet of the Verde River would be closed. The closure of 4.0 miles of road and prohibition of unauthorized cross-country travel would benefit the rail by reducing access near riparian zones, reducing sedimentation into streams, reducing damage to riparian vegetation by vehicles, and reducing the spread of invasive plants. Because this alternative allows for less cross-country travel for game retrieval than alternative 4, there is slightly more benefit to species and their habitat. Since there are no motorized trails or any of the unauthorized roads to be adopted within low elevation riparian zones, there would be no impacts from those actions on rails.

Motorized dispersed camping would also be decreased within 300 feet of rail and flycatcher habitat along the Verde River, which would have the same benefits as described above for road closure and prohibition of unauthorized cross-country travel. Under both alternatives 3 and 4, no potential camping corridors are identified within 300 feet of rail and flycatcher habitat.

Alternative 3 would have the overall effect of reducing indirect impacts to potential rail and flycatcher habitat by decreasing motorized access. This alternative may result in a cumulatively beneficial effect with similar efforts such as the travel management planning efforts by the adjacent national forests (Tonto and Apache-Sitgreaves) and BLM lands such as the Lake Havasu Field Office; which would all have some cumulative impact of reducing disturbance in key habitats such as low elevation riparian zones. Yet, other activities, such as high impact recreation use along the Verde River and Fossil Creek that result in direct loss of habitat, may overwhelm any potential benefits resulting from implementation of this alternative.

Alternative 4 – Direct and Indirect Effects: This alternative would have similar effects to alternative 3, however, off-road travel for motorized big game retrieval would continue for retrieval of elk. All potential habitat for these species occurs within game management unit 6A. Off-road travel for elk retrieval could occur in riparian habitat affecting these species potential habitat, but elk retrieval in these areas would be limited to only a small number of hunts (special Verde Valley hunts) and thus impacts would be of very low-frequency and would have little or no impact.

Bald Eagle (Sonoran Desert Population)

On February 25, 2010 the U.S. Fish and Wildlife Service concluded that desert eagles are not 'significant' to the overall bald eagle population and thus do not qualify ... for protection under the Endangered Species Act. On Sept. 30, 2010, a Federal Court accepted the finding.

This applies to any and all bald eagles (nesting, wintering, and migratory) in Coconino National Forest. Bald eagles on the Forest are designated as a Forest Service Sensitive species and thus are

considered in this section. For potential effects from each alternative to the Sonoran Desert Population, see the full wildlife specialist report.

California Condor

Since condors do not nest, roost or forage on the Forest, no direct, indirect or cumulative effects on California Condor populations are anticipated from any alternatives.

Western Yellow-billed Cuckoo

Existing Condition

The yellow-billed cuckoo is associated with large tracts of undisturbed riparian deciduous forests especially where mesquite bosques occur in the uplands. Surveys for yellow-billed cuckoos have been conducted throughout the Verde Valley. Since 1999, nearly 50 sites have been surveyed and 18 were found to be occupied by yellow-billed cuckoos (nesting not confirmed at all sites). Cuckoos have been detected along the Verde River, Sycamore Canyon, Oak Creek, Dry Beaver Creek, Red Tank Draw, Wet Beaver Creek, Walker Creek, Beaver Creek, and West Clear Creek. A GIS data query of low elevation riparian zones where mesquites occur in the uplands revealed 61.4 miles of roads occur within 328 feet (100 meters) of cuckoo habitat and 134.4 miles of road within ¼ mile of cuckoo habitat. There is 0.1 mile of motorized trails within ¼ mile of cuckoo habitat.

Alternative 1 – Direct, Indirect, and Cumulative Effects: Unrestricted cross-country travel, use of roads and motorized trails, and camping can affect yellow-billed cuckoos by increasing access near riparian zones, increasing sedimentation into streams, causing damage to riparian vegetation, and increasing the potential for spreading invasive plants. The presence and noise of vehicles within close proximity to nesting sites could cause noise and visual disturbance to nesting cuckoos.

Ongoing management of motorized use based on current direction over the next 20 years would contribute cumulatively to effects from high-impact recreation occurring in the Fossil Creek and Verde River corridors result in disturbance and degradation of riparian habitat. Since motorized access to riparian areas can result in activities that include the removal or fragmentation of riparian vegetation, this alternative would result in the cumulative loss of contiguous large riparian habitat on which cuckoos depend. Though the effect from existing motorized use has a small impact on riparian vegetation year-by-year, the long-term effect would move conditions away from those that support yellow-billed cuckoos.

Alternative 3 – Direct, Indirect, and Cumulative Effects: A total of 40.0 miles (65 percent) of roads would be closed within 328 feet (100 meters) of yellow billed cuckoo habitat. Alternative 3 would designate 0.5 mile of roads within 100 meters of cuckoo habitat. In addition, there would be no motorized off-road travel except for permitted uses and for big game retrieval (game management units 8 and 7W, which includes no cuckoo suitable habitat). The closure of roads and the prohibition of unauthorized cross-country travel would benefit the cuckoo by reducing access near riparian zones, reducing sedimentation into streams, reducing damage to riparian vegetation by vehicles, and reducing activities within line of site of cuckoos, which may cause flushing, premature fledging, or site abandonment. Because this alternative allows for no big game retrieval where there could be access to cuckoo habitat, motorized big game retrieval would have no effect in this alternative. While there are no motorized trails within 328 feet (100 meters)

of cuckoo habitat, there is 0.1 mile of motorized trail within ¼ mile (Lower Smasher Canyon Trail). This could result in very small noise disturbances to cuckoos.

Under alternatives 3 and 4, there would no longer be any motorized-based camping along 40 miles of roads within 328 feet (100 meters) of yellow billed cuckoo habitat, which would have the same benefits as described above for road closure and prohibition of cross-country travel. Under both alternatives, 244.3 and 517 acres of camping corridors are identified within 328 feet (100 meters) and ¼ mile, respectively, of cuckoo habitat. Since most roads within close proximity to special status species were the roads chosen for closure in the action alternatives, impacts to cuckoos from displaced camping are limited. However, there are a few exceptions where people may camp along noncorridor roads near cuckoo sites.

In addition to camping, alternative 3 would designate 0.5 mile of roads within 100 meters of cuckoo habitat, which would have some negative effect to cuckoo habitat. See the Wildlife specialist report for more information on specific cuckoo sites and comparisons of effects.

Though alternative 3 may affect potential foraging cuckoos in some locations, the overall effect would be to decrease disturbance to key areas of riparian habitat moving them toward a more contiguous large riparian areas. This alternative would contribute to this trend with similar travel management planning efforts on the Coconino, Prescott, Tonto, Apache-Sitgreaves National Forests and many areas of BLM lands. Additionally, the 2003 Verde River Wild and Scenic River Management Plan and potential changes to limit impacts of recreation being considered for the Fossil Creek Wild and Scenic River Management Plan would result in combined cumulative effects of decreasing loss of large, contiguous riparian areas on which the cuckoo depend.

Alternative 4 – Direct, Indirect, and Cumulative Effects: The effects of alternative 4 would be very similar to those described in alternative 3. Alternative 4 would designate 2.2 more miles of road than alternative 3, which would continue some negative effect to cuckoo habitat, but still result in a large decrease in impact from existing conditions.

Northern Mexican Garter Snake

Existing Condition

Mexican garter snakes have been sighted along the Verde River and several of its tributaries, most notably Oak Creek near the Bubbling Ponds and Page Springs Fish Hatcheries and in some wetland and upland habitat located on Bubbling Ponds Fish Hatchery grounds. There are approximately 24.4 miles of roads within 132 feet (40 meters) of perennial streams, however, not all of these streams provide potential or suitable habitat. There are no motorized trails within ¼ mile of perennial streams across the forest. Using potential natural vegetation types for mid- and low-elevation riparian zones to more accurately reflect miles of road within Mexican garter snake habitat, we determined there are 8.4 miles of roads in cottonwood/willow and mixed broadleaf riparian.

Environmental Consequences to Northern Mexican Garter Snake

Alternative 1 – Direct, Indirect, and Cumulative Effects: Unrestricted cross-country travel, use of roads and motorized trails, and camping can affect Mexican garter snakes by increasing access to riparian zones, increasing sedimentation into streams, causing damage to riparian vegetation by vehicles, increasing the potential spread of nonnative aquatic organisms and diseases, increasing the potential for forest users to handle and collect garter snakes, and

increasing disturbance to foraging forays into the uplands. There are approximately 24.4 miles of roads within 132 feet (40 meters) of perennial streams. There are no motorized trails within ¼ mile of perennial streams. Using potential natural vegetation types for mid- and low-elevation riparian zones to more accurately reflect miles of road within Mexican garter snake habitat, we determined there are 9.0 miles of roads in cottonwood/willow and mixed broadleaf riparian.

This alternative would continue to result in indirect impacts to the garter snake by reducing cover and reducing habitat integrity from elevated levels of sedimentation. Loss of riparian cover and habitat integrity also results from high-impact recreation in Oak Creek Canyon and Fossil Creek, which would have the effect of cumulatively reducing the extent potential habitat over the long term. High-intensity wildfires, such as the 4,317-acre Brins Mesa Fire in 2006, reduce vegetation cover and result in increased sedimentation within the first 5 to 10 years of post-fire recovery. This can result in a cumulative impact during this period by combining with increased sediment from off-road travel in the Oak Creek watershed, resulting in elevated sediment levels that can decrease habitat quality for years at a time. In addition, continued development of private lands in Oak Creek Canyon and related road access development such as with the current Tobias-Flynn Environmental Assessment can also contribute to loss of riparian habitat and pulses of sedimentation that can last from 1 to 10 years, on average.

Alternative 3 – Direct, Indirect, and Cumulative Effects: A total of 33 miles of roads would be closed within 328 feet (100 meters) of perennial streams under both of alternatives 3 and 4. A total of 161 miles of roads would be closed within ¼ mile of perennial streams under this alternative. Using potential natural vegetation types to more accurately target mid- and low-elevation riparian zones, we determined 6.6 miles of roads would be closed in cottonwood/willow and mixed broadleaf deciduous riparian for alternative 3. In addition, there would be no motorized off-road travel except for permitted uses and big game retrieval (game management units 8 and 7W, which is not within the range of the Mexican garter snake).

The closure of roads and the prohibition of unauthorized cross-country travel would benefit garter snakes by reducing access near riparian zones, reducing sedimentation into streams, reducing damage to riparian vegetation by vehicles, reducing the potential spread of nonnative aquatic organisms and diseases, reducing the potential for forest users to handle and collect garter snakes, and reducing disturbance to foraging forays into the uplands. Under both alternatives 3 and 4, there would no longer be any motorized-based camping along 6.6 miles of roads to be closed in Mexican garter snake habitat (mid- and low-elevation riparian zones), which will have the same benefits as described for road closure and prohibition of cross-country travel, above. Under both alternatives, a total of 31 acres along roads with camping corridors are identified within mid- and low-elevation riparian zones. On roads that are to remain open but are not identified as corridors, camping could increase slightly from displaced campers who would no longer be able to access closed roads; impacts that may occur to Mexican garter snakes would be of low intensity and of short duration. Since most of roads within close proximity to special status species and riparian areas were the roads chosen for closure in the action alternatives, impacts to Mexican garter snakes from displaced camping would be limited.

Alternative 3 would designate 0.3 mile of unauthorized road within Mexican garter snake habitat; this would result in some negative effects to individuals and their habitat.

The overall effects of decreasing access to garter snake habitat would combine cumulatively with efforts in adjacent national forests and BLM lands to manage motorized use on public lands.

Since the garter snake occurs in riparian habitat, which can be strongly impacted by motorized access, it is likely that these efforts with have a combined positive effect toward reducing disturbance in riparian habitat that can support garter snake populations. Other efforts to decrease effects from high-impact recreation such as a proposal to reduce riparian impacts in the Fossil Creek Wild and Scenic River Management Plan and the 2003 Verde River Wild and Scenic River Management Plan would decrease impacts on potential habitat preferred by the Mexican garter snake over the long term.

Alternative 4 – Direct, Indirect, and Cumulative Effects: This alternative would have similar impacts as alternative 3, but would designate approximately 1 additional mile of road in garter snake habitat. This may continue to result in some direct or indirect impacts as discussed above, but would reduce impacts from current conditions.

Motorized big game retrieval could result in some impacts from disturbance to Northern Mexican garter snake potential habitat. The only known northern Mexican garter snake sites occur within game management unit 6A, but there is potential habitat along the Verde River and tributaries in 6B. Alternative 4 would reduce the amount of motorized big game retrieval occurring in Mexican garter snake habitat by limiting retrieval to only elk. This would mean that off-road use for elk retrieval would be very rare as elk primarily occur in upland pine, mixed conifer and meadow habitat types in these game management units. The reduction in motorized big game retrieval by limiting it to elk only in game management units 6A and 6B would benefit Mexican garter snakes by reducing sedimentation into streams, reducing damage to riparian vegetation by vehicles, reducing the potential spread of nonnative aquatic organisms and diseases, and reducing disturbance to garter snakes that undertake foraging forays into the uplands.

The overall effects of decreasing access to garter snake habitat would combine cumulatively with efforts in adjacent national forests and BLM lands to manage motorized use on public lands. Since the garter snake occurs in riparian habitat, which can be strongly impacted by motorized access it is likely that these efforts with have a combined positive effect toward reducing disturbance in riparian habitat that can support garter snake populations. Other efforts to decrease effects from high-impact recreation such as a proposal to reduce riparian impacts in the Fossil Creek Wild and Scenic River Management Plan and the 2003 Verde River Wild and Scenic River Management Plan would decrease impacts on habitat preferred by the Mexican garter snake over the long term.

Forest Service Sensitive Species

Southwestern (Arizona) Toad

Existing Condition

Sullivan (1991) reported Arizona toads from the Verde River just northwest of Child's power plant. Sullivan and Richardson (1993) reported that Arizona toads could potentially occur along the Verde River from West Clear Creek to the East Verde confluences. There are approximately 24.4 miles of roads within 132 feet (40 meters) of perennial streams, however, not all of these streams provide potential or suitable habitat. Using potential natural vegetation types for mid-and low-elevation riparian zones to more accurately reflect miles of road within habitat, we determined there are 9.0 miles of roads in cottonwood/willow and mixed broadleaf riparian. There are no motorized trails within ¼ mile of perennial streams.

Environmental Consequences to Southwestern (Arizona Toad)

Alternative 1 – Direct, Indirect, and Cumulative Effects: Forest roads pose a greater hazard to slow moving animals such as amphibians, making them highly vulnerable as they cross even narrow forest roads (DeMaynadier and Hunter 2000). Unrestricted cross-country travel, use of roads and motorized trails, and camping can affect the southwestern toad by increasing access near riparian zones, increasing sedimentation into streams, causing damage to riparian vegetation, increasing the potential for spreading nonnative aquatic organisms and diseases, and increasing the potential for forest users to handle/collect toads.

This alternative would result in indirect affects to Arizona toad habitat by providing access that can impact riparian vegetation and lead to spreading of nonnative species. These affects could result in long-term cumulative negative impacts to the toad resulting from access to toad habitat from nonjurisdictional roads, impacts from cattle grazing, and ongoing high-impact recreational activities in canyons with perennial water and along the Verde. These impacts from the no action alternative would continue to contribute to impacts that would affect toad habitat.

Alternative 3 – Direct, Indirect, and Cumulative Effects: Under this alternative and alternative 4 there would be 6.6 miles (73 percent) of roads closed in low- and mid-elevation riparian zones. The closure of roads and the prohibition of unauthorized cross-country travel would benefit toads by reducing access near riparian zones, reducing sedimentation into streams, reducing damage to riparian vegetation by vehicles, reducing the potential spread of nonnative aquatic organisms and diseases, and reducing the potential for forest users to handle and collect toads. This alternative would allow for motorized big game retrieval in game management units 7W and 8, which includes no known habitat for the Arizona toad, and thus would have no effect on the species.

Since there are no motorized trails within ¼ mile of a perennial stream, closure of 87 miles of trail would not affect the toad.

Under alternative 3, there would no longer be any motorized-based camping along 6.6 miles of roads to be closed within toad habitat (mid- and low-elevation riparian zones), which would have the same benefits as described for road closure and prohibition of unauthorized cross-country travel, above. This is 0.2 more mile of road closure than alternative 4. Under both alternatives, a total of 31 acres along roads with camping corridors are identified within toad habitat. Since most of roads within close proximity to special status species were the roads chosen for closure in the alternatives 3 and 4, impacts to toads from displaced camping is not likely to occur. Also under both alternatives there would be 0.3 mile of unauthorized roads converted to system roads within toad habitat. This would result in slight negative effects to toads and their habitat.

Restricting open motorized access on over 70 percent of the roads in potential toad habitat and stopping unlimited cross-country travel would result in an overall benefit to maintaining and increasing viable toad habitat. This effect would combine cumulatively with travel management efforts on adjacent forests and BLM lands to reduce impacts to low-elevation riparian habitat. Other ongoing efforts such as the 2003 Verde River Wild and Scenic River Management plan and the Fossil Creek Wild and Scenic River Management Plan would decrease impacts from ongoing high-impact recreational use near water sources. Cumulatively, these activities would result in an increase in extent and/or integrity of low elevation riparian habitat.

Alternative 4 – Direct, Indirect, and Cumulative Effects: Effects of this alternative are similar to those described under alternative 3.

The only known northern Arizona toad sites are from the Verde River and its tributaries, which are located in game management units 6A and 6B. Alternative 4 would reduce the amount of motorized big game retrieval occurring in Arizona toad habitat by limiting retrieval to elk only, which would benefit Arizona toads by reducing sedimentation into streams, reducing damage to riparian vegetation by vehicles, and reducing the potential spread of nonnative aquatic organisms and diseases. For elk harvested adjacent to occupied sites, some disturbance to toads and some impacts to habitat could occur from motorized big game retrieval. However, it is unlikely that hunters would need to drive into aquatic habitat to retrieve elk, and existing federal regulations (36 CFR 261.15H) prohibit damaging or unreasonably disturbing the land, wildlife, or vegetative resources when traveling off road. Additionally, this alternative specifies that hunters are required to use the most direct and least ground disturbing route to access the elk, that only one vehicle trip is allowed, that motorized vehicles are not allowed to cross riparian areas, streams and rivers except at hardened crossings or crossings with existing culverts, and that motorized big game retrieval would not be allowed when conditions are such that damage to natural resources would occur. All of these factors minimize the magnitude and likelihood of negative effects to Arizona toads.

Northern Leopard Frog

Existing Condition

The range of the northern leopard frog is now limited to permanent waters around Stoneman Lake and Apache Maid Mountain. A GIS data query shows a total of 1,780 miles of roads within one mile of these known northern leopard frog locations. There are 24.6 miles of motorized trail within 1 mile of northern leopard frog sites.

Environmental Consequences to Northern Leopard Frog

Alternative 1 – Direct, Indirect, and Cumulative Effects: Unrestricted cross-country travel is a common use in the Stoneman Lake area. In addition to potential impacts on northern leopard frogs and their habitat from unrestricted cross-country use, use of roads and motorized trails, and camping can affect the southwestern toad by increasing access to occupied sites, increasing disturbance to dispersal habitat and dispersing frogs, causing damage to shoreline and aquatic habitat, increasing the potential for spreading nonnative aquatic organisms and diseases, and increasing the potential for forest users to handle and collect frogs.

This alternative would continue to result in direct and indirect impacts to northern leopard frogs, which may combine with ongoing activities that have similar effects. Cumulative direct effects from short-term disturbance to northern leopard frogs would be limited due to the wet weather restrictions in place; however, activities resulting in short-term direct impacts such as vegetation management activities from forest restoration or utility maintenance or high-impact recreational activities adjacent to water would continue to impact frog populations. Access to aquatic habitat facilitated by this alternative would cumulatively combine with other Forest activities, use of nonjurisdictional roads, and habitat loss and degradation on private lands would continue to result in impacts to key aquatic habitat.

Alternative 3 – Direct, Indirect, and Cumulative Effects: Under this alternative there would be 1,025 miles (58 percent) of roads closed within on1e mile of northern leopard frog sites. In addition, there would be no motorized off-road travel except for permitted uses and motorized big game retrieval (game management units 8 and 7W, which are not within the range of the northern

leopard frog). The closure of roads and the prohibition of unauthorized cross-country travel would benefit frogs by reducing access to sites, reducing disturbance to dispersal habitat and dispersing frogs, reducing damage to shoreline and aquatic habitat by vehicles, reducing the potential spread of nonnative aquatic organisms and diseases, and reducing the potential for forest users to handle/collect frogs. Under this alternative, a total of 19.9 miles of motorized trail within one mile of northern leopard frog sites would be closed.

Under this alternative, there would no longer be any motorized-based camping along 1,025 miles of roads to be closed within one mile of northern leopard frog sites, which would have the same benefits as described for road closure and prohibition of unauthorized cross-country travel, above. Under both action alternatives, a total of 16,594 acres along roads with camping corridors are identified within one mile of northern leopard frog sites. In order to reduce effects to frog habitat, road corridors near certain meadows were restricted to the tree side of the road only.

Camping along roads that are to remain open but are not identified as corridors could increase slightly from displaced campers who would no longer be able to access closed roads. However, because these increases are only expected during the three high use weekends, impacts would be of short duration. Since most of roads within close proximity to special status species were the roads chosen for closure in the action alternatives, there is a lowered potential for impacts to northern leopard frogs from displaced camping to occur. Alternative 3 would also designate 3.2 miles of unauthorized roads as system roads within one mile of frog habitat, which would have some negative effects.

Although this alternative may increase the intensity of disturbance in limited areas (such as along popular roads like the Stoneman Lake Road, figure 29), the overall effect of this alternative would be to reduce the extent of disturbance to areas with northern leopard frog habitat. This would have similar effects to travel management planning efforts in adjacent forests and BLM lands. As a result, there will be a cumulative reduction in the amount of disturbance to northern leopard frog habitat over a large portion of its range in Arizona.

Figure 29. Photo taken June 18, 2011 of existing dispersed camping area adjacent to NFS road 213 (Stoneman Lake Road)

Efforts to reduce effects of high-impact recreation along water sources, such as the decommissioning of the Kinnikinnick Lake Campground, is expected to improve potential habitat, but it is unknown whether the lake would be reinhabited by northern leopard frogs. Grazing permit reauthorization of the Apache Maid Range Allotment could also result in cumulative increases in potential habitat by minimizing impacts from grazing through fencing and other design specifications.

Alternative 4 – Direct, Indirect, and Cumulative Effects: Effects of this alternative are similar to those described for alternative 3, however under this alternative, 90 more miles of roads and 10.4 miles of motorized trail would remain open within 1 mile of northern leopard frog sites. There would also no longer be any motorized-based camping along 935 miles of roads to be closed within one mile of northern leopard frog sites.

Alternative 4 would also designate 3.5 miles of unauthorized roads as system roads and 10.4 miles of unauthorized motorized trails as system trails within 1 mile of frog habitat, which would have some minor negative effects.

Alternative 4 would reduce the amount of motorized big game retrieval occurring in northern leopard frog habitat by limiting retrieval to elk only. Northern leopard frog occupy habitat in lands that occur in game management unit 6A. Though this alternative would allow up to 1,350 vehicle trips for motorized big game retrieval per year (USDA Forest Service 2011), the reduction in motorized big game retrieval by limiting it to elk only would benefit northern leopard frog by reducing sedimentation into streams, reducing damage to riparian vegetation by vehicles, and reducing the potential spread of nonnative aquatic organisms and diseases. Effects from elk harvesting adjacent to occupied sites are the same as those described for the Southwestern (Arizona toad) under alternative 4.

Lowland Leopard Frog

Existing Condition

Currently, lowland leopard frogs are known to occur in Spring Creek but only on the private land parcel, Josephine Tunnel (private land), Page Springs Fish Hatchery (state land), possibly in Oak Creek Canyon (only tadpoles observed), Soda Springs (private land), and in Fossil Creek. Unsurveyed, but suitable locations below the rim are numerous and include perennial streams (Walker Creek, Red Tank Draw), various springs (Russell, Holly), and numerous earthen livestock tanks below the rim. There are approximately 130 miles of roads within 1 mile of current and historic lowland leopard frog locations. There are no motorized trails within 1 mile of known lowland leopard frog sites.

Environmental Consequences to Lowland Leopard Frog

Alternative 1 – Direct, Indirect, and Cumulative Effects: Unrestricted cross-country travel, use of roads and motorized trails, and camping can affect lowland leopard frogs by increasing access near riparian zones, increasing sedimentation into streams, causing damage to riparian vegetation, increasing the potential for spreading nonnative aquatic organisms and diseases, and increasing the potential for forest users to handle/collect frogs.

This alternative would continue to contribute direct and indirect impacts from roads in lowland frog habitat and disturbance to habitat from motorized access to riparian areas and sedimentation

from upstream loss of vegetative cover. These effects would result in a continued cumulative loss and fragmentation of riparian habitat in addition to the loss and fragmentation caused by high-impact recreational uses along the Verde River, Oak Creek and Fossil Creek. This alternative would also contribute to sediment from upstream loss of vegetative cover from unrestricted cross-country use and travel on unmaintained roads, which would combine cumulatively with activities such as continued development of private lands and access including the Tobias-Flynn Access Road project, which would result in pulses of sediment to Oak Creek Canyon lasting from one to five years.

Alternative 3 – Direct, Indirect, and Cumulative Effects: Under this alternative there would be 78 miles (60 percent) of roads closed within one mile of lowland leopard frog sites. In addition, there would be no motorized off-road travel except for permitted uses and for big game retrieval (game management unit 8 and 7W, which are not within the range of the lowland leopard frog). These actions would benefit frogs by reducing access near riparian zones, reducing sedimentation into streams, reducing damage to riparian vegetation by vehicles, reducing the potential spread of nonnative aquatic organisms and diseases, reducing the potential for forest users to handle/collect frogs, and reducing disturbance to dispersal habitat and dispersing frogs. Because this alternative allows for no off-road travel for game retrieval in lowland leopard frog habitat, there is more benefit to species and their habitat than alternative 4. Since there are no motorized trails within 1 mile of a lowland leopard frog sites under this alternative, closure of 87 miles of trail would not affect the frog. The designation of 0.05 mile of unauthorized roads would occur within 1 mile of lowland leopard frog sites.

Under this alternative, there would no longer be any motorized-based camping along 19 miles of roads to be closed within one mile of lowland leopard frog sites, which would have the same benefits as described for road closure and prohibition of unauthorized cross-country travel, above. Under both action alternatives, a total of 486 acres along roads with camping corridors are identified within one mile of lowland leopard frog sites. Since most of roads within close proximity to special status species were the roads chosen for closure in the action alternatives, impacts to lowland leopard frogs from displaced camping is not likely to occur.

Although this alternative doesn't eliminate potential effects to the lowland leopard frog, motorized access to lowland leopard frog habitat is decreased by approximately 60 percent. This would result in a cumulative impact of decreasing the frequency and intensity of impacts over a large extent of lowland leopard frog habitat when combined with the beneficial impacts of other Travel Management planning efforts on nearby national Forests and BLM lands. Also, efforts to curb high-recreational impacts along Fossil Creek and the Verde River through the establishment and implementation of wild and scenic river management plans would result in a long-term cumulative benefit to this species habitat.

Alternative 4 – Direct, Indirect, and Cumulative Effects: Effects from this alternative would be similar to those for Alternative 3, although under this alternative, there would be 2 more miles of roads would remain open within one mile of lowland leopard frog sites. Since there are no motorized trails within a mile of a lowland leopard frog sites under this alternative, closure of 37 miles of trail and the addition of four miles of motorized trails would not affect the frog. In addition, 0.05 mile of unauthorized roads would be designated as forest system roads within 1 mile of lowland leopard frog sites.

The only currently known lowland leopard frogs are from the Fossil Creek drainage, but there have been recent detections of frogs in Oak Creek and the Verde River. Tributaries to these rivers provide potential habitat. All of these locations are located in game management units 6A and 6B. Alternative 4 would reduce the amount of motorized big game retrieval occurring in lowland leopard frog by limiting retrieval to elk only, which would benefit lowland leopard frog by reducing sedimentation into streams, reducing damage to riparian vegetation by vehicles, and reducing the potential spread of nonnative aquatic organisms and diseases. Effects from elk harvesting adjacent to occupied sites are the same as those described for the Southwestern (Arizona toad) under alternative 4.

Bald Eagle (Not Federally Listed Population)

Existing Condition

Nesting Habitat - There is one bald eagle breeding area, Lower Lake Mary, outside of the listed area; therefore, these eagles are addressed as a sensitive species. Almost 6 miles of roads are open within 2,500 feet of nests, and there are no motorized trails within 2,500 feet. Breeding bald eagles at this breeding area are protected by a seasonal closure that restricts all entry during the breeding season and is monitored by nest watchers some years (AZGFD Nest Watch program).

Wintering Habitat - Bald eagles on the Forest are primarily winter visitors (refer to the Wildlife specialist report for more information on wintering bald eagles). Currently, 38 eagle roosts have been spatially identified in GIS. They consist of 11 confirmed roosts, plus 27 additional potential roosts. All known roosts are within ponderosa pine habitat. There are 14.2 miles of roads, and no motorized trails within 500 feet of these roosts. There are 4,150.2 miles of roads and 71.1 miles of motorized trails in the ponderosa pine potential natural vegetation type, a portion of which provides suitable roosting habitat for eagles.

Environmental Consequences to Bald Eagles

Alternative 1 – Direct, Indirect, and Cumulative Effects:

Nesting and Wintering Habitat – Use of roads and motorized trails, unrestricted cross-country travel, motorized big game retrieval and camping would continue in the vicinity of the Lower Lake Mary Breeding Area and winter roosts. These activities can affect the bald eagle by increasing access to breeding and roosting areas, causing damage to vegetation, and increasing activities within line of site of bald eagles which may cause flushing, premature fledging, and nest or roost abandonment. Use of roads and trails during the breeding season and within close proximity to nesting sites, or during the winter within close proximity to night roosts or key foraging areas, could cause aural and visual disturbance to nesting bald eagles. Because snow and wet conditions make much of the Forest difficult to access during the months when wintering eagles are on the Forest, disturbance impacts from motorized travel are likely to be relatively small.

Cumulative impacts from this alternative would be greatest to nesting eagles at the Lower Lake Mary Breeding Area. Continued motorized use in close proximity to the nesting site would result in regular, frequent disturbance during the nesting season. Other activities including prescribed fire, wildfire, and wildfire suppression activities could combine to result in levels of disturbance to cause loss of fledglings or increased levels of nest abandonment.

Alternative 3 – Direct, Indirect, and Cumulative Effects:

Nesting Habitat – Alternative 3 would close 3.8 miles (65.5 percent) of roads within 2,500 feet of the Lake Mary nests. This would reduce noise and disturbance to these eagles. No unauthorized motorized trails currently exist within 2,500 feet. No roads or motorized trails would be added to the system within 2,500 feet.

Under this alternative, 3.3 acres of camping corridors are identified within 1,000 to 2,500 feet of bald eagle nests in the Lake Mary breeding area. Implementation of a seasonal closure that restricts all entry during the breeding season in years when the nest is active would minimize potential disturbance impacts.

Alternative 3 would not allow motorized big game retrieval to occur within the vicinity of the Lake Mary Breeding Area.

Wintering Habitat – Within 500 feet of known and confirmed bald eagle roosts, 8.0 of the existing 14.2 miles of roads would be closed (56.3 percent). There are no existing motorized trails and no unauthorized roads or motorized trails would be added to the system within 500 feet of roosts. Additional unknown roosts are likely in ponderosa pine habitat that provides suitable roosting habitat. Alternative 3 would close 2,520 miles (60.7 percent) of roads to public use and 46.7 miles (65.7 percent) of motorized trails within the ponderosa pine potential natural vegetation type. Within the potential natural vegetation type, 6.4 miles of road and 0 miles of motorized trails would be added to the system. This alternative generally contributes positively to the forest plan standard and guideline to avoid road development near roosts, and the Arizona Conservation Assessment and Strategy (Driscoll et al. 2006) guideline to avoid disturbance within 500 feet of roosts from October 15 to April 15.

This alternative designates 123.2 acres of camping corridors within 500 feet or known or potential roosting areas, and 29,581 acres (4 percent) in the ponderosa pine potential natural vegetation type. This could result in some disturbance to roosting eagles in a small amount of roosting habitat. Most camping occurs outside of the season when wintering bald eagles are present, but fall and early winter hunting camps could have impacts to night roosting eagles. However, since unrestricted cross-country travel would be prohibited, and 56.3 percent of roads within 500 feet of roosts and 60.7 percent of roads within the ponderosa pine potential natural vegetation type would be closed, the overall impacts would be positive for roosting eagles.

Alternative 3 would allow off-road travel for motorized big game retrieval in the portions of game management unit s 7W and 8 that occur on the Forest, or 39,031 acres of ponderosa pine habitat, which is 5.2 percent of the ponderosa pine habitat currently open to motorized big game retrieval. No confirmed roosts are known, but wintering eagles are occasionally observed in this area (Bald Eagle Midwinter Survey data, Coconino National Forest Supervisor's Office). Although motorized big game retrieval would occur in these game management units, it would be prohibited in the vicinity of the Lower Lake Mary Breeding Area, known roosts, and most of the ponderosa pine potential natural vegetation type that could provide additional roosting habitat. This reduces the likelihood of disturbance to bald eagles compared to no action.

Although this alternative may increase the frequency or intensity of disturbance within a limited area near bald eagle roosts and one nest, the overall effect would be to decrease the potential impact and access of motorized uses to bald eagle roost habitat. This positive effect would be combined with similar effects from other adjacent travel management planning efforts on nearby

national forests. Additionally, these management activities may decrease the frequency of disturbance on the majority of roost sites, slightly counteracting the effects of utility line construction and maintenance and short-term disturbances from vegetation management or wildfire.

Alternative 4 – Direct, Indirect, and Cumulative Effects

Nesting Habitat – Effects from this alternative are similar to those described under alternative 3, though alternative 4 would close slightly less roads within 2,500 feet of the Lake Mary nests (0.2 mile), and would allow motorized big game retrieval to occur within the vicinity of the Lake Mary Breeding Area. However, elk hunts would occur after the breeding season so would not impact nesting eagles.

Wintering Habitat – Within 500 feet of known and confirmed bald eagle roosts, 7.5 miles (52.8 percent) of existing roads would be closed, which is 0.5 mile less than under alternative 3. Alternative 4 would close 2,309 miles (55.6 percent) of roads to public use and 28.7 miles (40.4 percent) of motorized trails within the ponderosa pine potential natural vegetation type. Within the potential natural vegetation type, 8.0 miles of road and 18 miles of motorized trails would be added to the system. This alternative generally contributes positively to the forest plan standard and guideline to avoid road development near roosts, the Arizona Conservation Assessment and Strategy (Driscoll et al. 2006) guideline to avoid disturbance within 500 feet of roosts from October 15 to April 15. However, designation of unauthorized roads and trails with the ponderosa potential natural vegetation type moderates this benefit to some degree for potential roosting habitat.

Alternative 4 would allow motorized big game retrieval up to one mile off of designated routes on the Forest, which equals 740,234.4 acres of ponderosa pine habitat; this is 99.4 percent of the ponderosa pine habitat currently open to motorized big game retrieval. Wintering eagles likely occur in multiple game management units in the Forest, including 6A, 6B, 5A, 5B, 11m, and 7E. This alternative may result in occasional disturbance from off-road motorized use to roosting eagles. Despite this expected disturbance, the alternative would still reduce the likelihood of disturbance to roosting bald eagles compared to no action because motorized big game retrieval would be limited to elk only.

Northern Goshawk

Existing Condition

There are 65 goshawk post fledgling family areas on the Coconino National Forest, with an additional two post fledgling family areas that are shared with other forests. A GIS data query of the Coconino post fledgling family areas coverage shows 231 miles of roads within post fledgling family area boundaries. On average, there are 3.6 miles of roads per post fledgling family areas (of those with roads) with a range of 0.8 mile to 10.9 miles. One post fledgling family area has no roads within its boundaries. Nest locations are known for 41 of the 65 post fledgling family areas. Of those, 72.4 miles of road and 10 miles of motorized trail are within 0.3 mile (500 meters) of a goshawk nest. There are 4,624 miles of road and 107 miles of motorized trail within mixed conifer, ponderosa pine and spruce-fir habitats.

For more information on northern goshawks and forest plan direction related to their management, see the Wildlife specialist report.

Environmental Consequences to Northern Goshawk

Alternative 1 – Direct, Indirect, and Cumulative Effects: In general, human activities have been documented to cause disturbance to raptors and in many instances can cause nest abandonment or changes in home range (Anderson et al. 1990). Monitoring of motorized use on northern goshawk, however, has showed very little effect on individual goshawks, causing biologists to consider motor vehicle use a 'minor stressor' (Slauson and Zielinski 2008). 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 0.3 mile (500 meters) of active nests. For the purposes of this analysis, it is assumed that disturbance from vehicles may occur within 0.3 miles (500 meters) from active nests.

In addition to disturbance impacts from motor vehicle use, repeated motor vehicle use may result in the loss of ground vegetation. The loss of ground vegetation can affect prey species including small mammals that are dependent on understory vegetation and downed woody debris.

This alternative has the most roads within northern goshawk post fledgling family areas and the most roads within 0.3 mile of known nest stands. Motorized travel could continue to cause localized disturbance to nesting goshawks. This alternative does not move toward the Forest Plan guideline to manage road densities at the lowest level possible in all forested habitat types.

Under this alternative, unrestricted cross-country motorized use would continue. This would cause localized soil compaction, rutting, loss of vegetative ground cover, accelerated soil erosion, and lack of soil productivity (see Soil and Water specialist report). This potential loss of vegetative ground cover would impact northern goshawk prey species that are ground feeders relying on plant material (i.e., mourning doves, cottontails); and insects which other goshawk prey such as hairy woodpeckers and American robins feed on.

With this alternative, no changes would occur to wood and forest product harvesting. Most woodcutting occurs in northern goshawk habitats (i.e., ponderosa pine and mixed conifer with aspen) and motorized access facilitates firewood cutting. Woody dead and down material is important to northern goshawk prey species such as flickers and chipmunks, as well as for a variety of insects which are important food sources for most northern goshawk prey species. Gambel oak is an important component providing both cavities for nesting birds and acorns for band-tailed pigeons, another goshawk prey species. This alternative would have the most impact to dead and down woody material, Gambel oak and snags.

The largest impact of this alternative would be the cumulative impact on habitat elements such as large standing dead trees and large downed logs, which are key habitat elements for prey on which goshawk depend. This alternative would result in the most roads being accessible in and near goshawk foraging areas. Combined with other Forest activities such as vegetation removal for utility line installation and maintenance and private development (which can result in permanent loss of downed wood, large trees, and snags), wildfires and forest restoration treatments (which can result in short-term reduction in downed wood or snags), this alternative would result in a cumulative impact on prey habitat elements on which the goshawk population depends. In addition, changes in climate resulting from global warming are expected to result in more frequent high-intensity wildfires (Marlon et. al. 2009), which can make large dead standing trees and large downed trees more sparse over the long-term. This alternative, to keep the greatest amount of motorized access, would further exacerbate this situation by maintaining access to these areas for both legal and illegal wood harvest (Wisdom and Bate 2008).

Alternative 3 – Direct, Indirect, and Cumulative Effects: Alternative 3 would designate approximately 10.4 miles of unauthorized road as Forest system road within northern goshawk habitat. None of these roads are located within post fledgling family areas. Miles of roads in post fledgling family areas would be reduced by 170 miles (75 percent). Roads would be reduced in all but one post fledgling family area. An additional nine post fledgling family areas would have no Forest Service jurisdiction roads designated within their boundaries for a total of 10 post fledgling family areas (15 percent) having no roads. The remaining post fledgling family areas have a range of 0.1 to 4.5 miles and an average of 1.1 miles per post fledgling family area. This reduction in roads would eliminate the potential for noise disturbance from motorized vehicles within 10 additional post fledgling family areas and reduce the potential for noise disturbance from motorized vehicles in 54 post fledgling family areas. Alternative 3 would close 2,766 miles (60 percent) of roads and 82.6 miles (83 percent) of motorized trail within ponderosa pine, mixed conifer and spruce-fir potential natural vegetation types.

Unauthorized motorized trails open to motorized use are reduced by 15.1 miles (100 percent) in northern goshawk post fledgling family areas. Of these, 8.1 miles would be removed in areas within 0.3 mile (500 meters) of a goshawk nest location. Alternative 3 reduces the number of post fledgling family areas with motorized trails by 7 (70 percent reduction).

This alternative would reduce motorized big game retrieval in all game management units except game management unit 8 and 7W, which would allow motorized big game retrieval for all elk hunts. This is estimated to result in 74 vehicle trips each year within 49,478 acres of the portion of the Forest within game management units 7W and 8. This would reduce potential disturbance to northern goshawks during early hunts (August and September) that occur during the northern goshawk breeding season. Considering motorized vehicle use is considered a ‘minor stressor’, this very low level of potential disturbance would result in a very small or negligible disturbance effect on northern goshawk.

Under alternative 3, 1,151 acres of camping corridors would be designated within 30 post fledgling family areas. Although the effects of camping on northern goshawks have not been studied, disruption of nesting, roosting and foraging is a distinct possibility. Camping corridors within post fledgling family areas may increase disturbance in 30 PFAs during the breeding season. Camping would be reduced on 174 miles (75 percent) of roads within post fledgling family areas and increased on 57 miles (25 percent) of roads within post fledgling family areas. On roads that would remain open but are not identified as corridors, camping could increase some due to displaced campers who would no longer be able to access closed roads. Since impacts at any one site are expected to be of short duration and low intensity, new hardened sites probably wouldn’t be created; therefore, habitat and disturbance impacts are expected to be minimal.

This reduction in roads, motorized trails, camping and cross-country travel would implement forest plan guidelines and Northern Goshawk Management Recommendations by reducing disturbance in post fledgling family areas during the breeding season. This alternative best meets the Forest Plan direction to manage road densities at the lowest level possible in all habitat types.

The greatest cumulative impact from this alternative would occur from the 1,151 acres of designated camping corridor within goshawk post fledgling family areas. These camping corridors would result in regular disturbance, which may combine with other Forest activities including vegetation management activities, wildfire and wildfire suppression activities, and construction and maintenance of utility lines to result in short-term disturbance to goshawks, This

alternative would also likely result in long-term impacts to key habitat elements such as ground cover and large downed logs, which would be negatively cumulatively affected by other Forest activities such as fuelwood collection, wildfire and vegetation management, and grazing. These negative cumulative effects would be limited to only a small portion of goshawk habitat, the overall effect of this alternative would be to decrease motorized use (and thus disturbance to goshawk habitat) by 75 percent in goshawk post fledgling family areas. Combined with other Forest activities such as forest restoration treatments that are expected to result in long-term (more than 1 year after project implementation) benefits to goshawk habitat, this alternative would result in a long-term cumulative benefit to goshawk populations across the Forest by improving the maintenance and development of key goshawk habitat elements and potentially improving goshawk nesting success.

Alternative 4 – Direct, Indirect, and Cumulative Effects: Effects on northern goshawks from this alternative are similar to those described under alternative 3.

Alternative 4 would designate 9.3 miles of unauthorized road as Forest system road within northern goshawk habitat. Of these 0.8 miles are in post fledgling family areas. Alternative 4 reduces miles of roads in post fledgling family areas by 148 miles (64 percent). Of these, 43 miles would be removed in areas within 0.3 mile (500 meters) of a goshawk nest location. Roads would be reduced in all but one post fledgling family area. An additional four post fledgling family areas have no Forest Service jurisdiction roads within their boundaries for a total of five post fledgling family areas (12 percent) having no roads. The remaining post fledgling family areas have a range of 0.1 to 3.2 miles and an average of 1.4 miles per post fledgling family area. This reduction in roads would eliminate the potential for noise disturbance from motorized vehicles within four additional post fledgling family areas and reduce the potential for noise disturbance from motorized vehicles in 65 post fledgling family areas. Alternative 4 would close 2,036 (44 percent) miles of road and 29.9 miles (38 percent) of unauthorized motorized trail in the ponderosa pine, mixed conifer and spruce fir potential natural vegetation types.

Alternative 4 reduces unauthorized motorized trails by 5.6 miles (37 percent) in northern goshawk post fledgling family areas. Of these 2.8 miles (35 percent) would be removed in areas within 0.3 mile (500 meters) of a goshawk nest location. Alternative 4 reduces the number of post fledgling family areas with motorized trails from 10 to 3 (70 percent reduction). Alternative 4 would close 2,584 miles (56 percent) of road and 29.9 miles (38 percent) of motorized trail within the ponderosa pine, mixed conifer and spruce fir potential natural vegetation types.

This alternative would reduce motorized big game retrieval in all game management units by restricting off-roads travel to retrieval of elk only. This is estimated to result in approximately 2,922 vehicle trips each year within 49,478 acres of the portion of the Coconino National Forest within game management units 7W and 8. This would reduce potential disturbance to northern goshawks during early hunts (September) that occur during the northern goshawk breeding season. Considering motorized vehicle use is considered a minor stressor, this very low level of potential disturbance would result in a very small or negligible disturbance effect on northern goshawk.

Common Black Hawk

Existing Condition

The common black hawk has been observed nesting along all main perennial streams and a few minor perennial streams below the Mogollon Rim. There are approximately 45 miles of roads within 328 feet (100 meters) of perennial streams and 251 miles of road within ¼ mile of perennial streams across the Forest. There are no motorized trails within ¼ mile of perennial streams. Even though black hawks have been observed foraging at tanks above the rim, they nest along lotic riparian below the rim. Using potential natural vegetation types for mid and low elevation riparian zones to more accurately reflect miles of road within black hawk nesting habitat, there are 9.0 miles of roads in cottonwood/willow and mixed broadleaf riparian. Because this is a measure of miles of roads within this potential natural vegetation type, it does not account for a buffer around riparian vegetation.

Alternative 1 – Direct, Indirect, and Cumulative Effects: According to a recent study of common black hawks in Fossil Creek, the greatest threats to common black hawks in Fossil Creek is the clearing or alteration of riparian habitat through the invasion of salt cedar (*Tamarix chinensis*) and recreational use along the creek (Johnson et al. 2006).

Unrestricted cross-country travel, use of roads and motorized trails, and camping can affect common black hawks by increasing access near riparian zones, increasing sedimentation into streams, causing damage to riparian vegetation by vehicles, and increasing activities within line of site of black hawks which may cause flushing, premature fledging, or abandonment.

This alternative would result in the greatest cumulative impact to common black hawks over the next decade within the Fossil Creek and Verde River riparian areas. This alternative would continue to contribute motorized access to riparian areas that may result in degradation of riparian habitat on which black hawk depend and disturbance, which may result in decreased black hawk nesting success. Other activities such as high-impact recreational use (such as in the Fossil Creek area and along the lower Verde), establishment of invasive species in riparian areas, livestock grazing, and short-term recreational and infrastructure developments within low elevation riparian zones would cumulatively impact common black hawks on the Coconino National Forest.

Alternative 3 – Direct, Indirect, and Cumulative Effects: Using potential natural vegetation types for mid and low elevation riparian zones, there are 6.6 miles (73 percent) of roads closed in black hawk habitat under both the action alternatives. With this alternative, there would be no motorized cross-country travel except for permitted activities and for big game retrieval in game management units 8 AND 7W, which are not within the range of common black hawk breeding sites. The closure of roads and the prohibition of cross-country travel would benefit the black hawk by reducing access near riparian zones, reducing sedimentation into streams, reducing damage to riparian vegetation by vehicles, and reducing activities within line of site of black hawks which may cause flushing, premature fledging, or abandonment. Because this alternative allows for less cross-country travel for game retrieval than alternative 4, there is slightly more benefit to species and their habitat. There are no motorized trails within ¼ mile of a perennial stream therefore the closure of 87 miles of motorized trail would not affect the common black hawk.

Alternative 3 eliminates general cross-country travel (including limitations on big game retrieval), closes 73 percent of roads in and near black hawk habitat, reduces motorized trails and 0.3 mile of unauthorized roads. Disturbance resulting from these actions would be greatly reduced, thus beneficially affecting the black hawk by reducing access near riparian zones, reducing sedimentation into streams, reducing damage to riparian vegetation by vehicles, and reducing activities within line of site of black hawks which may cause flushing, premature fledging, or site abandonment. However, alternative 3 designates 31 acres of camping corridors within potential habitat and 0.3 miles of unauthorized roads; disturbance resulting from these actions would result in aural and visual disturbance to black hawks and direct and indirect effects to their habitat.

Under both action alternatives, there would no longer be any motorized-based camping along 6.6 miles of roads to be closed in black hawk habitat (mid- and low-elevation riparian zones), which would have the same benefits as described for road closure and prohibition of cross-country travel, above. Under both action alternatives, a total of 31 acres along roads with camping corridors are identified within mid and low elevation riparian zones. Since most of roads within close proximity to special status species were the roads chosen for closure in the action alternatives, impacts to common black hawks from displaced camping is not likely to occur. Alternative 3 would designate 0.3 mile of unauthorized road within black hawk habitat; regular use of this road may result in minor negative effects to individuals and their habitat.

Though these camping corridors could result in ongoing disturbance that could affect the success of black hawk nests, the large majority of this camping corridor is located in the Fossil Creek corridor, which already receives motorized camping to an extent that it cannot be increased by the designation of camping corridors. Thus, the designation of these 31 acres of camping corridors is not expected to result in an additional effect, and result in no negative cumulative effects. This alternative would result in a beneficial cumulative effect by combining to the restoration of riparian vegetation and cumulatively decreasing the potential for disturbance to nesting black hawks. Other activities such as implementation of the Verde River Wild and Scenic River Management Plan and development of the Fossil Creek Wild and Scenic River Management Plan are expected to reduce high-impact recreation within riparian areas and within key black hawk habitat during nesting season.

Alternative 4 – Direct, Indirect, and Cumulative Effects: This alternative has similar effects to alternative 3. Alternative 4 eliminates general cross-country travel, closes 71 percent of roads in and near black hawk habitat, and reduce motorized trails. However, alternative 4 allows for motorized retrieval of big game, designates 0.6 mile of camping corridors and 0.7 mile of unauthorized roads within potential habitat; disturbance resulting from these actions would result in aural and visual disturbance to the common blackhawk and direct and indirect effects to their habitat.

American Peregrine Falcon

Existing Condition

There are a total of 28 known nesting pairs of peregrine falcons that occur on the Coconino National Forest, some of which overlap with other forests or state parks. Most eyries (nest sites) are on cliff ledges in rugged canyons, but some 2.5 miles of road exist within ¼-mile proximity to known nest sites. There are no motorized trails within ¼ mile of known peregrine falcon nest sites.

Environmental Consequences to American Peregrine Falcon

Alternative 1 – Direct, Indirect, and Cumulative Effects: Peregrines are vulnerable to disturbance and displacement caused by human activities on rock faces. Rock-climbing is an example of recreation that could reduce population fitness of peregrines in nesting areas. Such activities may be facilitated by road access. Unrestricted cross-country travel, use of roads and motorized trails, and camping can affect the peregrine falcon by increasing access near cliffs, increasing noise disturbance near eyries, and increasing activities within line of site of peregrines, which may cause flushing, premature fledging, or abandonment (Richardson and Miller 1997).

This alternative would result in cumulative impacts to peregrine falcons by continuing to provide motorized access and use on 2.5 miles of road within ¼ mile of nest sites in addition to potential disturbance from unrestricted off-road motorized use. This would result in potential frequent disturbances that may combine with other activities, including recreational use and short-term impacts from vegetation management to potentially disturb one or more peregrine falcon nest sites.

Alternative 3 – Direct, Indirect, and Cumulative Effects: Under both action alternatives, a total of 1.4 (56 percent) miles of road would be closed within ¼ mile of peregrine falcon nest sites with this alternative. Under this alternative there would be no motorized cross-country travel except for motorized use authorized under permit, and for big game retrieval in game management units 8 and 7W, which are not within the range of peregrine falcon nest sites. In addition, this alternative would not designate any unauthorized roads within ¼ mile of peregrine nest sites. These actions would all benefit the falcon by reducing access near cliffs, reducing noise disturbance near eyries, and reducing activities within line of site of peregrines, which may cause flushing, premature fledging, or abandonment. Because this alternative allows for less cross-country travel for game retrieval than alternative 4, there is slightly more benefit to species and their habitat. There are no motorized trails within ¼ mile of a peregrine falcon nest sites, therefore the closure of 87 miles of motorized trail would not affect the peregrine falcon. The reduction in roads and motorized trails would implement Forest Plan and peregrine falcon guidelines by reducing disturbance of activities in the vicinity of occupied peregrine falcon nesting habitat during the breeding season (March 1 and August 15).

Under both action alternatives, there would no longer be any motorized-based camping along 1.4 miles of roads to be closed within ¼ mile of peregrine falcon eyries, which would have the same benefits as described for road closure and prohibition of unauthorized cross-country travel, above. All of these changes would beneficially affect the peregrine falcon by reducing visual and aural disturbance to individuals. Even though alternative 3 does not designate camping corridors within ¼ mile of nests; disturbance from displaced camping along non-corridor roads could result in aural and visual disturbance to peregrines and direct and indirect effects to their habitat. However, since most of roads within close proximity to special status species were the roads chosen for closure in the action alternatives, impacts to peregrine falcons from displaced camping are not likely to occur.

This alternative would reduce disturbance to these nest sites primarily caused by recreational use by reducing access to the nest sites and reducing the amount of disturbance from motorized use. Combined with similar management changes to restrict motor vehicle use on public lands throughout the southwest, this alternative would result in a cumulative benefit of reduced human disturbance to nesting peregrine falcons within northern Arizona over the next decade.

Alternative 4 – Direct, Indirect, and Cumulative Effects: This alternative has similar effects as alternative 3, and would reduce disturbance to nest sites primarily caused by recreational use by reducing access to the nest sites and reducing the amount of disturbance from motorized use.

Clark's Grebe

Existing Condition

Clark's grebe populations are variable because some of the nesting locations are ephemeral. There is confirmed nesting at Mormon Lake, southeast of Flagstaff. There are 14.5 miles of road and no motorized trail within or adjacent to the water and wetland cienega potential natural vegetation types.

Environmental Consequences to Clark's Grebe

Alternative 1 – Direct, Indirect, and Cumulative Effects: One of the threats to Clark's grebe is habitat degradation from seasonal recreation use of backwaters and coves used for breeding. Recreation use of the potential breeding areas may be facilitated by road access. Most wetlands have forest road access and provide easy opportunity for off-road dispersed camping and travel. This alternative would provide the most access to potential breeding sites and therefore the most potential for disturbance to nesting colonies using these habitats.

With no action, continued unrestricted cross-country OHV travel would continue. There are about 14.6 miles of forest roads and 3.0 miles of unauthorized roads that are adjacent to or that intersect portions of wetlands. Roads alter surface hydrology and water flow causing loss of water storage, vegetative productivity, and wetland function. Under this alternative, OHV travel is expected to continue in these wetland areas (figure 30) and pose risk to wetland function (Soil and Water specialists report 2010). Loss of vegetative productivity would reduce vegetative cover and could impact survivorship of young. This alternative has the highest potential for habitat degradation of backwaters and coves used for breeding by Clark's grebe.

Figure 30. Off-road motor vehicle use in wetland area on Flagstaff District in 2010. Motor vehicle use as shown in this photo occurs infrequently, and causes substantial resource damage.

This alternative would result in continued potential for habitat degradation from motorized cross-country use and use of 14.6 miles of road, which could combine with impacts from livestock grazing, increased drought severity from climate change, and recreational uses within wetlands. The effects of these activities could combine to result in long-term degradation of wetland and breeding habitat to affect the breeding success of Clark's grebe on the Forest.

Alternative 3 – Direct, Indirect, and Cumulative Effects: This alternative would reduce motorized big game retrieval in all game management units except game management unit 8 and 7W, which would allow motorized big game retrieval for all elk hunts. This is estimated to result in an average of 74 off-road vehicle trips each year within 49,478 acres of the portion of the Forest within game management units 7W and 8. This could reduce potential isolated impacts to Clark's grebe habitat in all areas except game management unit 8 and 7W.

Alternative 3 would not designate unauthorized roads as Forest system road within Clark's grebe potential habitat. This alternative would close 12.7 miles (87 percent) of Forest roads in potential Clark's grebe habitat. There are no motorized trails within these potential natural vegetation types, and this alternative would not designate unauthorized roads as Forest system road within Clark's grebe habitat.

This reduction of roads could reduce impacts to wetland habitats used by the grebe.

In alternative 3, 15 acres of camping corridors would be designated within water and wetland cienega potential natural vegetation types. This could have both direct impacts to Clark's grebe by increased disturbance to nesting colonies and indirect impacts to these ducks by degrading wetland habitat within the corridors. Camping would be reduced on 12.7 miles (87 percent) of roads and increased on 15 acres within these habitats. On roads that would remain open but are not identified as corridors, camping could increase some due to displaced campers who would no longer be able to access closed roads. Since camping at these locations would occur outside of designated camping corridors, impacts at any one site used along existing open roads are expected to be of short duration and low intensity, new hardened sites probably won't be created; therefore, habitat and disturbance impacts are expected to be minimal.

This alternative would reduce existing miles in potential grebe habitat by approximately 87 percent. This change would likely reduce the potential for other activities that would result in degradation to Clark's grebe habitat. Impacts from recreational use, livestock grazing, and increased drought from climate change are expected to be somewhat decreased by a reduction in motorized access and motorized use in grebe's habitat.

Alternative 4 – Direct, Indirect, and Cumulative Effects: This alternative has similar effects to alternative 3. Alternative 4 would close 9.1 miles (63 percent) of Forest roads and an unknown number of unauthorized roads in potential Clark's grebe habitat. This reduction of roads within these potential natural vegetation types would reduce the potential for disturbance of during nesting.

This alternative also allows for motorized big game retrieval for elk harvest, which may cause low-frequency and low-intensity disturbances to Clark's grebe and their habitat.

Western Burrowing Owl

Existing Condition

Burrowing owls are found in flat, open, low-stature grasslands, sparsely vegetated desert shrub, and edges of human disturbed land. These owls take over burrows of prairie dogs and ground squirrels, and dens of coyote, fox and badger. Breeding Bird Atlas surveys confirmed nesting from approximately 100 feet elevation to 6,600 feet elevation in a prairie dog colony near Flagstaff. Though there are no documented nesting burrowing owls on the Forest, potential nesting habitat does exist. Burrowing owls are closely associated with prairie dogs. Prairie dogs often occur in grassland habitats and colonies have a greater chance of being impacted under this alternative due to the high use in these areas. There are 1,091 miles of road and 7.2 miles of unauthorized motorized trail within the primary grassland vegetation types used by prairie dogs on the Forest. Additionally, there are 36.5 miles of road and 0.6 mile of motorized trail that pass through prairie dog towns.

Environmental Consequences to Western Burrowing Owl

Alternative 1 – Direct, Indirect, and Cumulative Effects: Direct effects could occur if roads provide access to existing unknown nest locations. Roads that provide access and potential for disturbance could result in potential reductions in productivity or displacement in population distribution or habitat. Under this alternative, continued cross-country use in montane subalpine grasslands, Great Basin/Colorado Plateau grassland and steppe and semi-desert grasslands could collapse burrows used for nesting. Motorized travel would continue to directly cause localized disturbance to western burrowing owl potential nesting habitats.

Continued cross-country use in montane grasslands, Great Basin/Colorado Plateau grassland and steppe and semi-desert grasslands and on unsatisfactory, impaired or inherently unstable soils or soils with moderate and severe erosion hazard poses substantial risk to long-term soil productivity and vegetative cover. Cross-country travel and use of existing roads in prairie dog habitat would result in a cumulative impact, along with activities such as livestock grazing and high impact recreational use, to limit nesting habitat for burrowing owls. This alternative would result in the most stress on meadow habitats and thus would have the greatest negative contribution to potential burrowing owl habitat. This alternative would allow for the most impact to western burrowing owl habitats.

Alternative 3 – Direct, Indirect, and Cumulative Effects: Alternative 3 would designate 9.2 miles of unauthorized road as Forest system road within burrowing owl potential habitat. The 9.2 miles is not within existing prairie dog towns. This alternative reduces roads by 589 miles (54 percent) and unauthorized motorized trails by 5.4 miles (75 percent) in potential habitat for burrowing owls. Alternative 3 reduces roads in 23.4 miles (64 percent) within known prairie dog towns and eliminates motorized trails in prairie dogs towns. This would improve potential habitat for burrowing owls by protecting burrows from roads and off road vehicle travel.

This alternative would reduce motorized big game retrieval in all game management units except 8 and 7W, which would allow motorized big game retrieval for all elk hunts only. This is estimated to result in 74 vehicle trips each year within 49,478 acres of the portion of the Coconino National Forest within game management units 7W and 8. This could reduce potential isolated impacts grasslands (when wet) in all areas except game management units 8 and 7W.

Under this alternative, 4,413 miles of camping corridors would be designated within grassland habitats that provide potential habitat to prairie dogs and burrowing owls. There would be 2.5 miles of camping corridors designated in prairie dog towns. This could have both direct impacts to prairie dogs and burrowing owls by collapsing burrows, and indirect impacts to prairie dogs and burrowing owls by degrading habitat within the corridors. Camping would be reduced on 35,255 acres (89 percent) and increased on 4,413 acres (11 percent) within these habitats. On roads that would remain open but are not identified as corridors, camping could increase some due to displaced campers who would no longer be able to access closed roads. Since impacts at any one site are expected to be of short duration and low intensity, new hardened sites probably won't be created; therefore, habitat and disturbance impacts are expected to be minimal.

Localized effects from dispersed camping in grassland habitat would result in the potential displacement of several prairie dog towns located within 2.5 miles of designated dispersed camping corridor and 5.4 miles of road in potential burrowing owl habitat. This impact may combine with short-term cumulative impacts from mechanical thinning activities, prescribed fire treatments, and wildfire and wildfire suppression and the continued impact from nonjurisdictional roads in meadow habitat to limit or fragment prairie dog populations (and thus burrowing owl habitat) in a limited area.

As a result of this alternative, the habitat as a whole would be more likely to support a greater prairie dog population in meadow systems in the Forest and surrounding areas, thus supporting more potential burrowing owl habitat. Cumulative activities such as the Travel Management planning on the Tonto, Kaibab, and Apache-Sitgreaves National Forests are likely to have a similar individual effect and result in cumulative effects with each other where undisturbed prairie dog habitat overlaps. This combined with forest restoration activities (such as 4FRI) could open up more habitat or provide more contiguous swaths of meadow and grassland habitat key to supporting thriving prairie dog colonies.

Alternative 4 – Direct, Indirect, and Cumulative Effects: This alternative has similar effects to alternative 3, though alternative 4 would designate 5.6 miles of unauthorized roads to Forest system road within burrowing owl grassland habitats. The 5.6 miles would not be within existing prairie dog towns. Alternative 4 closes 546 miles (50 percent) of roads in grassland habitats but does not reduce motorized trails within prairie dog towns. Within prairie dog towns, burrowing owl habitat, there would be no unauthorized roads and 0.6 miles of motorized trail. This alternative would also allow motorized travel for big game retrieval for elk, which could result in displacing prairie dogs and collapsing burrows, thereby reducing burrowing owl habitat.

Ferruginous Hawk

Existing Condition

Breeding bird atlases found nesting ferruginous hawks occupying a fairly narrow range of elevations, from 4,700 feet to 6,400 feet (Corman and Wise-Gervais 2005) with no documented nesting on the Coconino National Forest. Ferruginous hawks forage in montane subalpine grasslands in the Flagstaff vicinity. Prairie dogs were likely important in determining the historic breeding distribution of the ferruginous hawk in Arizona (Glinski 1998). Coupled with the loss of habitat, the widespread extirpation of these rodents has greatly reduced the hawk's nesting distribution (Corman and Wise-Gervais 2005).

Ferruginous hawks are associated with the Great Basin/Colorado Plateau grassland and steppe, montane subalpine and semi-desert grasslands as they provide foraging habitat where prairie dogs exist. There are 1,091 miles of roads and 9.5 miles of motorized trail within these potential natural vegetation types. There are 36.5 miles of road and 0.6 miles of motorized trail that pass through prairie dog towns on the Forest.

Environmental Consequences to Ferruginous Hawk

Alternative 1 – Direct, Indirect, and Cumulative Effects: Under this alternative, OHV travel and travel on existing roads and motorized trails are expected to continue in these grassland habitats and pose risk to ferruginous hawk prey species by providing access to hunters, collapsing burrows and reducing available habitat.

Direct effects could occur if roads provide access to unknown nest locations. There are no documented nesting ferruginous hawk sites known on the Forest; however, potential nesting habitat does exist. These hawks are sensitive to harassment or human presence, which is often facilitated by road access. Roads that provide access and potential for disturbance could result in potential reductions in productivity, increase in energy expenditures or displacement in population distribution or habitat use. The 36.5 miles of road and 0.6 mile of motorized trail that pass through prairie dog towns potentially reduce the amount of prey habitat for this hawk.

Cross-country travel and use of existing roads in potential habitat would result in a cumulative impact along with activities such as livestock grazing and high impact recreational use to limit the viability of potential ferruginous hawk nesting habitat, and could result in direct impacts should ferruginous hawks establish nests within the Forest. This alternative would result in the most impact to potential habitat and greatest potential for direct impacts and thus would have the greatest negative contribution to Ferruginous hawk long-term survival in northern Arizona.

Alternative 3 – Direct, Indirect, and Cumulative Effects: These hawks are sensitive to harassment or human presence, which is often facilitated by road access; potential reductions in productivity, increase in energy expenditures or displacement in population distribution or habitat use can occur (Bennett 1991, Mader 1984). Direct effects could occur if roads provide access to unknown nest locations. However, as there are no documented nesting Ferruginous hawk sites known on the Forest, no direct effects are expected.

Indirect effects could occur if potential prey is impacted by roads. Alternative 3 would designate 2.6 miles of unauthorized road as Forest system road within ferruginous hawk potential habitat. The 2.6 miles is not within existing prairie dog towns. This alternative reduces roads by 589 miles (54 percent) and unauthorized motorized trails by 5.4 miles (75 percent) in potential foraging habitat for ferruginous hawks and their prey, leaving 502 miles of open road and 1.8 miles of unauthorized motorized trail in grassland areas on the Forest.

Reduction of motorized big game retrieval in all by game management units 8 and 7W could reduce potential isolated impacts to montane grasslands (when wet) in all other areas, thereby reducing impacts to ferruginous hawk prey species.

Under alternative 3, 4,413 acres of camping corridors would be designated within grassland habitats that provide potential habitat for prairie dogs. There would be 2.5 miles of camping corridors designated in prairie dog towns. This could have both direct impacts by displacing prairie dogs and collapsing burrows, and indirect impacts to prairie dogs and ferruginous hawks

by degrading habitat. Camping would be increased on 4,413 acres within grassland habitats and prairie dog towns. On roads that would remain open but are not identified as corridors, camping could increase some due to displaced campers who would no longer be able to access closed roads. Since impacts at any one site are expected to be of short duration and low intensity, new hardened sites probably won't be created; therefore, habitat and disturbance impacts are expected to be minimal.

The impacts above may combine with short-term cumulative impacts from mechanical thinning activities, prescribed fire treatments, and wildfire and wildfire suppression and the continued impact from nonjurisdictional roads in meadow habitat to limit or fragment ferruginous hawk habitat in a limited area.

Alternative 3 would have a more pronounced impact of decreasing motorized use in meadows and grasslands by 54 percent, thus decreasing impacts to potential ferruginous hawk habitat and on their prey. As a result, the habitat as a whole would be more likely to support a greater prairie dog population in meadow systems in the Forest and surrounding areas, thus supporting more potential ferruginous hawk habitat. Cumulative activities such as the Travel Management planning on the Tonto, Kaibab, and Apache-Sitgreaves National Forests are likely to have a similar individual effect and result in cumulative effects with each other where undisturbed prairie dog habitat overlaps. This combined with forest restoration activities (such as 4FRI) could open up more habitat over the next several decade to provide more contiguous swaths of meadow and grassland habitat key to supporting ferruginous hawk nesting habitat and prey.

Alternative 4 – Direct, Indirect, and Cumulative Effects: This alternative has similar effects to alternative 3. Under alternative 4, unrestricted cross-country travel would not occur (except for motorized elk retrieval). Alternative 4 would designate 5.6 miles of unauthorized road to Forest system road within ferruginous hawk grassland habitats. The 5.6 miles would not be within existing prairie dog towns. Alternative 4 would close 546 miles (50 percent) of roads and maintain 2.9 miles of motorized trails within potential natural vegetation types. Within known prairie dog towns, there would be a reduction of 21.6 (59 percent) miles of roads, but motorized trails would not be reduced in those areas.

Reducing access would limit potential for recreational shooting of prairie dogs and would protect burrows used by this prey from off road vehicle travel.

Abert's Towhee

Existing Condition

Abert's towhees are common in the appropriate habitat within their range. Towhee habitat is comprised of cottonwood willow riparian forests with dense understory, thickets of shrubs and vines, mesquite bosques, willows, cottonwoods, and mistletoe clumps. Abert's towhees nest low in trees or shrubs near watercourses and forage on the ground for insects. Arizona has 80-90 percent of entire range for this species. Their population trend is variable but is increasing in some areas like the Verde River and the lower reaches of Oak Creek. Using potential natural vegetation types for mid and low elevation riparian zones to reflect miles of road within towhee habitat, there are 9.0 miles of roads in cottonwood/willow and mixed broadleaf riparian. There are no motorized trails within mid and low elevation riparian areas, or within ¼ mile of perennial streams.

Environmental Consequences to Abert's Towhee

Alternative 1 – Direct, Indirect, and Cumulative Effects: Unrestricted cross-country travel, use of roads and motorized trails, and camping can affect towhees by increasing access near riparian zones, increasing sedimentation into streams, causing damage to riparian vegetation, and increasing activities within line of site of towhees which may cause flushing, premature fledging, or abandonment. There are approximately 45 miles of roads within 328 feet (100 meters) of streams that support riparian vegetation.

Though population trends for Abert's towhees are increasing in some areas of the Forest, this alternative could combine cumulatively with other impacts to riparian habitat such as livestock grazing, streamside recreation, and private land development to limit towhee population growth. It is possible that given impacts from the aforementioned activities and potential increased impacts from drought and wildfire from climate change, the trend in towhee population growth could be reversed if unmanaged motorized use continues to grow and increase in impact to riparian areas in mid- and low elevations.

Alternative 3 – Direct, Indirect, and Cumulative Effects: Using potential natural vegetation types for mid and low elevation riparian zones, there are 6.6 miles (73 percent) of roads closed in towhee habitat under both the action alternatives. Under this alternative there would be no motorized cross-country travel except for off-road motorized use authorized under permit, and for big game retrieval in game management units 8 and 7W, which are not within the range of towhee breeding sites. The closure of roads and the prohibition of cross-country travel would benefit towhees by reducing access near riparian zones, reducing sedimentation into streams, reducing damage to riparian vegetation by vehicles, and reducing activities within line of site of towhees which may cause flushing, premature fledging, or abandonment. Because this alternative allows for less cross-country travel for game retrieval than alternative 4, there is slightly more benefit to species and their habitat. There are no motorized trails within ¼ mile of a perennial stream therefore the closure of 87 miles of motorized trail will not affect the Abert's towhee.

Under both action alternatives, there would no longer be any motorized-based camping along 6.6 miles of roads to be closed in towhee habitat (mid and low elevation riparian zones), which would have the same benefits as described for road closure and prohibition of unauthorized cross-country travel, above. Under both action alternatives, a total of 31 acres along roads with camping corridors are identified within mid and low elevation riparian zones. Since most of roads within close proximity to special status species were the roads chosen for closure in the action alternatives, impacts to Abert's towhees from displaced camping is not likely to occur. Alternative 3 would designate 0.3 miles of unauthorized road within towhee habitat; this would result in some would result in some aural and visual disturbance to towhees and direct and indirect effects to their habitat.

This alternative may result in localized cumulative effects in the 31 acres of designated camping corridor and 3 miles of designated unauthorized road by combining effects with other activities such as livestock grazing, private land development, use and maintenance of nonjurisdictional roads, and stream side recreational use to degradation of riparian habitat in these areas. The overall cumulative effect to Abert's towhee habitat, however, would be a cumulative beneficial effect by limiting impacts to mid- and low elevation riparian habitat from motorized use. Similar travel planning efforts on the Kaibab, Apache-Sitgreaves, Tonto, and Prescott national forests and on nearby BLM lands would result in similar effects to cumulatively reduce motorized impacts on towhee habitat throughout much of its range.

Alternative 4 – Direct, Indirect, and Cumulative Effects: This alternative has similar effects to alternative 3. With this alternative there would be no motorized cross-country travel except for off-road motorized use authorized under permit, or big game retrieval (except for retrieval of elk). Off-road motorized travel for retrieval of elk is highly unlikely to occur in understory thickets of shrubs such as mesquite and willow where towhee occur and would likely have no effect on the species.

Four-spotted Skipperling

Existing Condition

This butterfly ranges throughout central and northern Arizona. The habitat of the spotted skipperling consists of moist meadows and streamsides in high elevation mountains. The spotted skipperling is associated with mixed broadleaf deciduous and montane willow riparian forest, wetland cienega and montane subalpine grassland potential natural vegetation types. There are 234 miles of road and 1.9 miles of motorized trail within these habitats.

Environmental Consequences to Four-spotted Skipperling

Alternative 1 –Direct, Indirect, and Cumulative Effects: With this alternative, continued cross-country travel, use of road and motorized trails and camping in montane subalpine grasslands, wetland cienegas and riparian areas could reduce understory vegetation and therefore reduce availability of food and reproductive sites for this species over the long term. Cross-country vehicle travel and travel on roads and motorized trails and camping is expected to continue and possibly increase in these habitats causing loss of suitable habitat.

The No Action Alternative would maintain road densities at existing levels. These roads would continue to facilitate human access into habitats for collecting and killing invertebrates.

This alternative would continue to result in indirect impacts by causing loss of understory vegetation and would continue direct impacts from maintaining motorized access to sensitive skipperling habitat. Based on information that climate change is expected to increase temperatures and potentially change vegetation communities at higher elevations more than in other areas (Furniss et al. 2010), this alternative may result in cumulative impacts to skipperling habitat.

Alternative 3 – Direct, Indirect, and Cumulative Effects: Under alternative 3, unrestricted cross-country travel would not occur. Alternative 3 would designate 0.40 miles of unauthorized road as Forest system road within four-spotted skipperling habitat. This alternative closes 131 miles (56 percent) of roads and 1.1 miles (100 percent) of unauthorized motorized trails in skipperling habitat. Over time, roads would heal and herbaceous vegetation would increase (USDA Forest Service 2004) providing more habitat for this butterfly.

Roads facilitate human access into habitats for collecting and killing invertebrates. By reducing roads 56 percent there would be an added benefit of reducing easy access to areas that may be used for butterfly collecting.

Reducing motorized big game retrieval on all but game management units 8 and 7W would reduce potential isolated impacts to skipperling habitat in all other areas.

Under alternative 3, 503 acres of camping corridors would be designated within potential natural vegetation types associated with this butterfly. This could have both direct impacts to the spotted skipperling by increased disturbance to foraging butterflies and indirect impacts to this butterfly by degrading habitat within the corridors. On roads that would remain open but are not identified as corridors, camping could increase some due to displaced campers who would no longer be able to access closed roads. Since impacts at any one site are expected to be of short duration and low intensity, new hardened sites probably won't be created; therefore, habitat and disturbance impacts are expected to be minimal.

This alternative would have the overall effect of reducing motorized use in four-spotted skipperling habitat, thus resulting in a cumulative beneficial effect by reducing current impacts to their habitat within the Coconino National Forest and nearby national forests and BLM lands with similar habitat undergoing similar travel management planning efforts. Additionally, by decreasing impacts to high elevation vegetation in skipperling habitat this alternative may slightly temper impacts to this species' habitat resulting from increased temperatures and changes in vegetation at high elevations from climate change (Furniss et al. 2010).

Alternative 4 – Direct, Indirect, and Cumulative Effects: Effects from this alternative are similar to those for alternative 3, though alternative 4 would designate 0.55 more miles of unauthorized road as Forest system road within four-spotted skipperling habitat. Alternative 4 would close 118 miles of road (13 fewer road miles than alternative 3), which would result in a 50 percent decrease in open roads, and 0.9 mile (60 percent) of motorized trail (0.2 mile less than alternative 3) in these habitats. Though this alternative would also designate 1.1 miles of unauthorized motorized trail, overall there would be an increase in potential habitat for this species.

This alternative would have the overall effect of reducing motorized use in four-spotted skipperling habitat, thus resulting in a cumulative beneficial effect by reducing current impacts to their habitat within the Coconino National Forest and nearby national forests and BLM lands with similar habitat undergoing similar travel management planning efforts. Additionally, by decreasing impacts to high elevation vegetation in skipperling habitat this alternative may slightly temper impacts to this species' habitat resulting from increased temperatures and changes in vegetation at high elevations from climate change (Furniss et al. 2010).

Nitocris Fritillary

Existing Condition

This butterfly is known from Apache and Coconino (Kehls Spring, Clover Spring) Counties in Arizona. Their habitat includes mixed conifer, ponderosa pine, spruce fir, montane willow riparian forests and wetland cienega vegetation types. There are 4,638 miles of road and 100 miles of motorized trail in the mixed conifer, ponderosa pine, spruce fir, montane willow riparian and wetland cienega potential natural vegetation types.

Environmental Consequences to Nitocris Fritillary

Alternative 1 – Direct, Indirect, and Cumulative Effects: Under the no action alternative, unrestricted cross-country travel, use of roads and motorized trails and camping would continue, causing loss of suitable habitat for this butterfly.

The No Action Alternative would maintain road densities at existing levels. These roads would continue to facilitate human access into habitats for collecting and killing invertebrates.

This alternative may result in impacts that contribute cumulatively with other Forest and non-Forest activities. For example, activities that impact understory vegetation such as livestock grazing, vegetation management projects, and concentrated recreational activities near water may impact suitable habitat for this butterfly. Should motorized use continue at current levels or potentially increase based on current trends, this alternative would result in a cumulative effect to nitocris fritillary habitat on the Coconino National Forest.

Alternative 3 – Direct, Indirect, and Cumulative Effects: Under alternative 3, unrestricted cross-country travel would not occur. Alternative 3 would designate 7.8 miles of unauthorized road as Forest system road within nitocris fritillary habitat. There would be a reduction of 2,834 miles (61 percent) of roads and a decrease of 78.6 miles of unauthorized motorized trail in these habitats. Over time, roads would heal and herbaceous vegetation would increase, providing more habitat for this butterfly. No new motorized trail would be constructed in nitocris habitat. There would be an overall increase in potential habitat for this species.

Roads facilitate human access into habitats for collecting and killing invertebrates. By reducing roads 61 percent there would be an added benefit of reducing easy access to areas that may be used for butterfly collecting.

Under alternative 3, 32,802 acres of camping corridors would be designated within potential natural vegetation types that this butterfly is associated with. There would be no camping corridors in the spruce-fir. This could have direct impacts to the nitocris fritillary by increased disturbance to foraging butterflies and indirect impacts to this butterfly by degrading habitat within the corridors. Camping would be reduced on 2,834 miles (61 percent) of roads and increased on 1,796 miles (39 percent) of roads within these habitats. On roads that would remain open but are not identified as corridors, camping could increase some due to displaced campers who would no longer be able to access closed roads. Since impacts at any one site are expected to be of short duration and low intensity, new hardened sites probably won't be created; therefore, habitat and disturbance impacts are expected to be minimal.

This alternative would restrict all off road travel in areas with known nitocris fritillary habitat (Kehls Spring), by not allowing off road motorized use for retrieval of elk in Game Management Unit 5A and surrounding areas.

Although there are expected to be localized increases in impact from designation of camping corridors, the overall effect of this alternative would be largely beneficial throughout the Forest. Due to similar travel management planning efforts on the Apache-Sitgreaves National Forest, which are expected to result in similar positive effects as this alternative, the designation of motorized use under this alternative and on other Forests is expected to reduce impacts to understory vegetation within nitocris fritillary potential habitat, thus increasing the quality of potential habitat throughout its known range.

Alternative 4 – Direct, Indirect, and Cumulative Effects: Effects for this alternative would be similar to those for alternative 3, though alternative 4 would close 243 fewer miles of road and 48.6 miles of motorized trail in these habitats.

New motorized trail would be constructed within 78 miles of nitocris habitat (includes all trails in forest vegetation types). This could slightly reduce availability of food and reproductive sites for this species over the long term. Overall there would be an increase in potential habitat for this species.

This alternative would allow off road motorized big game retrieval for harvested elk across all game management units, which may cause disturbance to nitocris fritillary and their habitat. Nitocris fritillary are known from the Kehls Spring area on the Coconino National Forest, which is located in game management unit 5A. It is expected there would be an average of 136 off-road vehicular trips in the game management unit to retrieve killed elk. Off road use from motorized big game retrieval could impact nitocris habitat by crushing host plants or impacting individuals.

Nokomis Fritillary

Existing Condition

These butterflies utilize forest with Viola in the understory. They are known from Apache, Coconino, Greenlee Counties; San Francisco and White Mountain drainages; Oak Creek Canyon; Alpine, White Mountains. They are associated with aspen and viola. Their habitat includes mixed conifer, ponderosa pine, spruce fir and wetland cienega vegetation types. There are 4,628 miles of road and 108 miles of motorized trail in the mixed conifer, ponderosa pine, spruce fir and wetland cienega vegetation types.

Environmental Consequences to Nokomis Fritillary

Alternative 1 – Direct, Indirect, and Cumulative Effects: Under the No Action alternative, off highway vehicle travel and the use of roads and motorized trails and camping are expected to continue in these habitats, causing loss of suitable habitat for this butterfly.

This alternative may result in impacts that contribute cumulatively with other Forest and non-Forest activities. For example, activities that impact understory vegetation such as livestock grazing, vegetation management projects, and concentrated recreational activities near water may impact suitable habitat for this butterfly. Should motorized use continue at current levels or potentially increase based on current trends, this alternative would result in a cumulative effect to nokomis fritillary habitat on the Forest.

Alternative 3 – Direct, Indirect, and Cumulative Effects: Alternative 3 would designate 7.7 miles of unauthorized road as Forest system road within nokomis fritillary habitat. There would be a reduction of 2,834 miles of roads (61 percent) and 78.6 miles (73 percent) of motorized trails in these habitats. No new motorized trail would be constructed in nitocris habitat. There would be an overall increase in potential habitat for this species.

Roads facilitate human access into habitats for collecting and killing invertebrates. By reducing roads 61 percent there would be an added benefit of reducing easy access to areas that may be used for butterfly collecting.

Under alternative 3, 32,802 acres of camping corridors would be designated within potential natural vegetation types associated with this butterfly. There would be no camping corridors in the spruce-fir. This could have both direct impacts to the nokomis fritillary by increased disturbance to foraging butterflies and indirect impacts to this butterfly by degrading habitat within the corridors. Camping would be reduced on 2,834 miles (61 percent) of roads and

increased on 1,795 miles (39 percent) of roads within these habitats. On roads that would remain open but are not identified as corridors, camping could increase some due to displaced campers who would no longer be able to access closed roads. Since impacts at any one site are expected to be of short duration and low intensity, new hardened sites probably won't be created; therefore, habitat and disturbance impacts are expected to be minimal.

Although there are expected to be localized increases in impact from designation of camping corridors, the overall effect of this alternative would be largely beneficial throughout the Forest. Due to similar travel management planning efforts on the Apache-Sitgreaves National Forest, which are expected to result in similar positive effects as this alternative, the designation of motorized use under this alternative and on other Forests is expected to reduce impacts to understory vegetation within nokomis fritillary potential habitat, thus increasing the quality of potential habitat throughout its known range.

Alternative 4 – Direct, Indirect, and Cumulative Effects: Alternative 4 would have similar effects to alternative 3, though this alternative would designate 1.6 more miles of unauthorized road as Forest system road within nokomis fritillary habitat. Alternative 4 would also close 2,591 miles (56 percent) of road and 78 mile (72 percent) of motorized trail in these habitats, which is 243 and 0.6 fewer miles, respectively, than alternative 3.

New motorized trail would be constructed within 78 miles of nokomis habitat. This could reduce availability of food and reproductive sites for this species over the long term; however overall there would be an increase in potential habitat for this species.

This alternative allows off road motorized use for retrieval of harvested elk. Nokomis, however, are generally known from the Oak Creek Canyon area on the Coconino National; which is unavailable to off-road motorized travel due to portions being in designated wilderness and the closure order. Thus off-road motor vehicle use for retrieval of elk is not expected to affect known nokomis fritillary habitat, but could have a slight impact on potential habitat from crushing of host plants or individuals.

Southwestern River Otter

Existing Condition

The southwestern river otter occur along the Verde River, up Oak Creek as far as Red Rock State Park, and in Sycamore Canyon, Wet Beaver, West Clear, and Fossil Creek. There are approximately 45 miles of roads within 328 feet (100 meters) of perennial streams and 251 miles of road within ¼ mile of perennial streams across the forest; however, not all of these streams provide potential or suitable habitat. Using potential natural vegetation types for mid and low elevation riparian zones to more accurately reflect miles of road within otter habitat, there are 9.0 miles of roads in cottonwood/willow and mixed broadleaf riparian. Because this is a measure of miles of roads within this potential natural vegetation type; it does not account for a buffer around riparian vegetation. There are no motorized trails within ¼ mile of perennial streams.

Environmental Consequences to Southwestern River Otter

Alternative 1 – Direct, Indirect, and Cumulative Effects: Unrestricted cross-country travel, use of roads and motorized trails, and camping can affect the southwestern river otters by increasing access to riparian zones, increasing sedimentation into streams, and increasing damage

to riparian vegetation by vehicles. Motorized activities occurring within close proximity to occupied sites may cause aural and visual disturbance.

This alternative would continue to result in potential disturbance to otters and degradation of their habitat through loss of riparian vegetation and increased sedimentation. These effects would cumulatively combine with impacts from streamside recreational use, livestock grazing, use and maintenance of nonjurisdictional roads, and private land development. Additionally, climate change could result in additional sedimentation from loss of ground cover and additional stresses on southwestern river otter from increases in temperature and changes in stream flow from drought and modified snowmelt (Ffolliott and Gottfried 2010). This alternative would continue to result in affects to the southwestern river otter that would combine cumulatively with the aforementioned activities to limit the success of the otter population in its historic range in central and northern Arizona.

Alternative 3 – Direct, Indirect, and Cumulative Effects: Using potential natural vegetation types for mid and low elevation riparian zones, there are 6.6 miles (73 percent) of roads closed in otter habitat under both the action alternatives. Under this alternative there would be no motorized cross-country travel except for wood harvesting and Forest product gathering under permit, and for motorized big game retrieval in game management units 8 AND 7W, which are not within the range of the river otter. The closure of roads and the prohibition of cross-country travel would benefit the river otter by reducing access near riparian zones, reducing sedimentation into streams, and reducing damage to riparian vegetation by vehicles. Because this alternative allows for less cross-country travel for game retrieval than alternative 4, there is slightly more benefit to species and their habitat. There are no motorized trails within ¼ mile of a perennial stream therefore the closure of 87 miles of motorized trail would not affect the southwestern river otter.

Under alternative 3, there would no longer be any motorized-based camping along 6.6 miles of roads to be closed in river otter habitat (mid and low elevation riparian zones), which would have the same benefits as described for road closure and prohibition of unauthorized cross-country travel, above. Under both action alternatives, a total of 31 acres along roads with camping corridors are identified within mid and low elevation riparian zones. Since most of roads within close proximity to special status species were the roads chosen for closure in the action alternatives, impacts to otters from displaced camping is not likely to occur. Alternative 3 would designate 0.3 miles of unauthorized road within river otter habitat; this would result in some negative effects to individuals and their habitat.

This alternative would likely result in beneficial cumulative effects with similar efforts on nearby national forests including travel management planning on the Kaibab, Prescott, and Tonto National Forests. These efforts may counteract the increases in sedimentation and loss of riparian habitat caused by other Forest activities such as streamside recreational use, livestock grazing, climate change, and private land development.

Alternative 4 – Direct, Indirect, and Cumulative Effects: Alternative 4 would have similar effects as alternative 3, though motorized cross-country travel would be allowed more extensively for retrieval of legally killed elk.

Although alternative 4 may result in localized impacts within designated camping corridors and from the designated of unauthorized road, this alternative would result in overall beneficial

affects by substantially reducing the number of roads near perennial streams and riparian habitat that make up otter habitat.

Navajo Mogollon Vole

Existing Condition

Locations for the Navajo Mogollon vole have been reported from 3,800 to 9,700 feet in elevation with a number of locations around the San Francisco Peaks area. Voles occupy meadows and riparian areas above the Mogollon Rim. They also occur within the forested areas where tree densities are low. Navajo Mogollon voles can be found in mixed conifer, montane subalpine grassland, pinyon-juniper woodland, ponderosa pine and spruce fir vegetation. There are 5,904 miles of road and 110 miles of motorized trail within these vegetation types.

Environmental Consequences to Navajo Mogollon Vole

Alternative 1 – Direct, Indirect, and Cumulative Effects: Under the No Action alternative unrestricted cross-country travel, use of roads and motorized trails and camping would continue in all vegetation types that the vole uses. Unrestricted off-road travel could directly impact voles by increasing the potential for motorized vehicles to run over above ground nests, burrows and runways. Under this alternative, roads would continue to restrict the movements of voles potentially functioning as barriers to population dispersal and movement.

Loss of vegetative cover removes food and shelter for voles and this alternative would have the highest level of loss or degradation in riparian, pinyon–juniper woodland, meadow and grassland habitats as well as all other vegetation types used by this vole.

This alternative results in impacts that may combine cumulatively with other Forest and non-Forest activities including wildfire and wildfire suppression activities, illegal and legal fuelwood harvest, private land development, and use and maintenance of nonjurisdictional Forest roads. All these activities result in impacts by affecting vole habitat or creating barriers to dispersal and movement.

Alternative 3 – Direct, Indirect, and Cumulative Effects: Under alternative 3, unrestricted cross-country travel would not occur. This would reduce the potential for burrows and runways to be damaged by off-road travel. Alternative 3 would designate 16.8 miles of unauthorized road as Forest system road within Navajo Mogollon vole habitat. This alternative closes 3,554 miles (60 percent) of roads and 80 miles (73 percent) of motorized trail, which would benefit the Mogollon vole by reducing barriers to movements and providing more opportunity for population dispersal and movement.

Over time obliterated roads would heal and herbaceous vegetation would increase proving more food and cover for voles (USDA Forest Service 2004).

This alternative would eliminate off-road use for big game retrieval in all game management units except 8 and 7W, which would allow motorized big game retrieval for all elk hunts. This is estimated to result in 15 vehicle trips each year within 49,478 acres of the portion of the Coconino National Forest within game management units 7W and 8. This could reduce potential isolated impacts to montane grasslands and meadows (when wet) and reduce the potential for burrows and runways to be damaged by cross-country travel.

Under alternative 3, 34,689 acres of camping corridors would be designated within potential natural vegetation types associated with the Navajo Mogollon vole. There would be no camping corridors in the spruce-fir. This could have both direct impacts to the Navajo Mogollon vole by increased disturbance to above ground nests, burrows and runways and indirect impacts by degrading habitat within the corridors. Camping would be reduced on 3,554 miles (60 percent) of roads and increased on 2,350 miles (40 percent) of roads within these habitats. On roads that would remain open but are not identified as corridors, camping could increase some due to displaced campers who would no longer be able to access closed roads. Since impacts at any one site are expected to be of short duration and low intensity, new hardened sites probably won't be created; therefore, habitat and disturbance impacts are expected to be minimal.

This alternative may result in cumulative effects within the 2,350 acres of designated camping corridors by combining with activities such as illegal and legal fuelwood harvest, livestock grazing, and wildfire to impact habitat within these areas. The cumulative effect from this designation would be somewhat muted since areas designated as camping corridors generally already receive some level of impact from motorized camping. The largest cumulative effect from this alternative would be to reduce impacts to vole habitat by decreasing motorized use in vole habitat and decreasing motorized access, which would limit activities (such as illegal fuelwood harvest) that can negatively impact vole habitat. These habitat benefits would combine with those resulting from similar travel management planning efforts on the nearby Kaibab National Forest to cumulatively reduce impacts on thousands of acres of vole habitat. Additionally, forest restoration efforts, such as Hart Prairie Forest Restoration, Marshall Forest Restoration, Upper Beaver Creek Forest Restoration, Clints Well Forest Restoration, and through the 4FRI EIS are likely to further enhance existing vole habitat by reducing tree densities in forested areas and reducing the potential of high-intensity wildfire.

Alternative 4 – Direct, Indirect, and Cumulative Effects: Effects from this alternative would be similar to alternative 3. Alternative 4 would designate 2.5 more miles of unauthorized road as Forest system road within Navajo Mogollon vole habitat, and would approximately 286 more miles of road and 50 miles of motorized trail would remain open.

Motorized use on 18 miles of trails would be designated within vole habitat. This could reduce availability of food and affect vole movements, but at a very limited scale. In addition, approximately 37 miles of unauthorized trails would remain undesignated, which could decrease impacts to potential habitat.

Long-tailed Vole

Existing Condition

Most of the species range is outside Arizona. But within Arizona the range includes Coconino, Apache-Sitgreaves and Kaibab Forests. Their habitat is montane subalpine grassland with minimal canopy cover, mixed conifer and spruce-fir with dispersion of structure and openings, including meadows with well developed herbaceous understory and wet ground. They burrow in and use soil for cover. Long-tailed vole habitat can be found in alpine-tundra, mixed conifer, montane subalpine grassland, and spruce-fir potential natural vegetation types. There are 697 miles of road and 38.5 miles of motorized trails within these potential natural vegetation types.

Environmental Consequences to Long-tailed Vole

Alternative 1 – Direct, Indirect, and Cumulative Effects: Under this alternative unrestricted cross-country travel, use of roads and motorized trails and camping would continue in mixed conifer, montane subalpine grassland and spruce-fir habitats. Alpine tundra would remain unaffected by cross-country travel. Under this alternative roads would continue to restrict the movements of voles potentially functioning as barriers to population dispersal and movement. There would be no protection of burrows or runways from off-road vehicle travel.

Loss of vegetative cover removes food and shelter for voles and this alternative would have the highest level of loss or degradation in montane grassland vegetation as well as other vegetation types used by this vole.

This alternative would result in impacts that may combine cumulatively with other Forest and non-Forest activities including wildfire and wildfire suppression activities, livestock grazing, and increased temperatures and predicted vegetation shifts at higher elevations from climate change. All these activities result in impacts by affecting vole habitat and potentially directly affecting vole burrows.

Alternative 3 – Direct, Indirect, and Cumulative Effects: Alternative 3 would designate 1.4 miles of unauthorized road as Forest system road within long-tailed vole habitat. Alternative 3 would close 436 miles (63 percent) of road and 33 miles (86 percent) of motorized trail. This reduction would benefit the long-tailed vole by reducing fragmentation and potential for runways and burrows to be destroyed. Overtime some nondesignated roads would heal and herbaceous vegetation would increase proving more food and cover for voles (USDA Forest Service 2004).

This alternative would eliminate off-road travel for motorized big game retrieval in all game management units except 8 and 7W, which would allow motorized big game retrieval for all elk hunts. This is estimated to result in 74 vehicle trips each year within 49,478 acres of the portion of the Coconino National Forest within game management units 7W and 8. This could reduce potential isolated impacts to grasslands and meadows (when wet) and reduce the potential for burrows to be damaged by cross-country travel.

Camping would be reduced on 436 miles (63 percent) of roads and increased on 261 miles (37 percent) of roads within these habitats. Though this alternative may result in increased impacts in the 3,707 acres of designated camping corridors within potential natural vegetation types associated with the vole, these impacts are expected to be very small because camping corridors generally include areas where motorized dispersed camping is already included and because camping corridors were designated outside of montane meadows, which is the main habitat of long-tailed voles. Regardless, this small effect from designated camping corridors could result in cumulative effects from increased potential to collapse burrows and decrease ground cover with other Forest activities including livestock grazing, wildfire and wildfire suppression activities, and short-term impacts from vegetation management. Since impacts at any one site are expected to be of short duration and low intensity, new hardened sites probably won't be created; therefore, habitat and disturbance impacts are expected to be minimal.

The overall effect from this alternative would be a reduction in impacts to montane meadow habitat from a 63 percent decrease in roads and an 86 percent decrease in motorized trails open to motorized use in potential habitat. This would result in a much greater (both in magnitude and in geographical extent) beneficial effect on long-tailed vole habitat by reducing motorized impacts

and impacts from motorized access to ground cover and burrows. Similar travel management planning efforts on the Kaibab and Apache-Sitgreaves National Forests would result in cumulative beneficial impacts across the vole's range in Arizona.

Alternative 4 – Direct, Indirect, and Cumulative Effects: Effects from this alternative would be similar to alternative 3, though alternative 4 would designate 0.6 more miles of unauthorized road as Forest system road within long-tailed vole habitat. Under this alternative, approximately 44 more miles of road and 32 miles of motorized trail would remain open than under alternative 3. This would still result in a reduction of about 56 percent and 3 percent, respectively. Motorized big game retrieval would also occur to a greater extend across the Forest than under alternative 3, but would still be a reduction from existing conditions.

Motorized travel would be designated on unauthorized roads within 37.4 miles of vole habitat. This could reduce availability of food and cover for this species over the long term. Overall there would be an increase in potential habitat for this species. Overtime obliterated roads would heal and herbaceous vegetation would increase proving more food and cover for voles (USDA Forest Service 2004).

Wupatki Arizona Pocket Mouse

Existing Condition

This subspecies is known from the Wupatki area on the Flagstaff Ranger District. There are 352 miles of road and no motorized trail with the Great Basin/Colorado Plateau grassland and steppe vegetation type. Most areas of this potential natural vegetation type are in impaired soil condition.

Environmental Consequences to Wupatki Arizona Pocket Mouse

Alternative 1 – Direct, Indirect, and Cumulative Effects: Under the No Action alternative continued cross-country travel, use of roads and motorized trails and camping in Great Basin/Colorado Plateau grassland and steppe would continue. The Wupatki Arizona pocket mouse has a restricted distribution and is sensitive to habitat loss and fragmentation. Roads would continue to restrict the movements of small mammals and function as barriers to population dispersal and movement of the Wupatki pocket mouse. Most areas within the Great Basin/Colorado Plateau grassland and steppe are in impaired soil condition. Indicators signify a reduction in soil function, reducing vegetative cover overtime.

Loss of vegetative cover removes food and shelter for mice and this alternative would have the highest level of loss or degradation in Great Basin/Colorado Plateau grassland and steppe potential natural vegetation type. This alternative may result in cumulative effects when combined with other activities that reduce vegetation cover and increase soil erosion in the Wupatki area such as livestock grazing and access and maintenance to utility lines. Climate change may cause a reduction in ground cover from persistent drought or changes in species composition (Collins et. al. 2010) which would cumulatively add to habitat loss, fragmentation, and increasing erosion rates.

Alternative 3 – Direct, Indirect, and Cumulative Effects: The Wupatki Arizona pocket mouse has a restricted distribution and is sensitive to habitat loss and fragmentation. Alternative 3 would designate 1.0 mile of unauthorized road as Forest system road within Wupatki Arizona pocket mouse habitat. This alternative closes 168 miles of roads (48 percent) which would have a

beneficial effect to the Wupatki pocket mouse by reducing fragmentation and reducing barriers to population dispersal and movement of this pocket mouse. Overtime obliterated roads would heal and herbaceous vegetation would increase proving more food and cover for voles.

Alternative 3 would largely benefit Wupatki Arizona pocket mouse by eliminating off-road motorized use (except in Cinder Hills OHV Area, for big game retrieval for elk in Units 7W and 8, or as authorized under federal permit); restricting off-road motorized use for camping to camping corridors within pocket mouse habitats and closing 48 percent of roads within Wupatki Arizona pocket mouse habitat. This would positively affect pocket mice by reducing access to and activity near occupied sites, reducing disturbance to individuals and their habitat. However, alternative 3 would designate 1,222 acres of camping corridors and designate 1.0 mile of unauthorized road as Forest system road in Wupatki Arizona pocket mouse habitat increasing access and disturbance in habitat. This would reduce vegetation used by this pocket mouse for food and cover.

This alternative would designate 1,222 acres of camping corridors and one mile of unauthorized road, which could cumulatively contribute to soil erosion and habitat fragmentation within localized areas along with other reasonably foreseeable activities such as continued livestock grazing, construction to replace the Wupatki National Monument wastewater system (http://parkplanning.nps.gov/projectHome.cfm?projectID=27173), and access and maintenance of utility lines. This alternative would have a much larger effect of reducing fragmentation and soil erosion from roads, unrestricted cross-country travel, and unmanaged motorized camping throughout the range of the Wupatki pocket mouse on the Forest. These changes may slightly counteract the potential of increased erosion and loss of vegetation resulting from increased severity of drought from climate change.

Alternative 4 – Direct, Indirect, and Cumulative Effects: Effects from this alternative would be similar to alternative 3, though alternative 4 would designate 2.6 more miles of unauthorized road as Forest system road within Wupatki Arizona pocket mouse habitat. Alternative 4 would close 148 miles of road, which is 20 miles less than under alternative 3. Motorized big game retrieval would allowed across more areas of the Forest under this alternative, though overall would still result in a reduction from existing conditions.

Dwarf Shrew

Existing Condition

This species has a limited range and is known to occur on the Kaibab Plateau, San Francisco Peaks, and White Mountains (Hoffmeister 1986). For the primary habitat (montane subalpine grasslands, spruce fir and alpine tundra) there are 235 miles of roads and 1.9 miles of motorized trails. In ponderosa pine and pinyon – juniper woodlands there are 5,207 miles of roads and 71.1 miles of motorized trails.

Environmental Consequences to Dwarf Shrew

Alternative 1 – Direct, Indirect, and Cumulative Effects: Under the No Action alternative, continued cross-country travel, use of roads and trails and camping in dwarf shrew habitat, with the exception of alpine tundra, would continue. There would be 235 miles of road and 1.9 mile of motorized trail in primary shrew habitat. There is no impact to alpine tundra habitat and little impact to spruce- fir habitat or talus slopes from roads and motorized trails. Of most impact are

roads and cross-country travel in montane subalpine grasslands that are reducing soil function and increasing vulnerability to degradation. There would be 5,207 miles of road and 71.1 miles of motorized trail in the ponderosa pine and pinyon – juniper potential natural vegetation types, also used by the dwarf shrew. Roads would continue to restrict the movements of some small mammals and function as barriers to population dispersal and movement of small mammals. There would be no protection of burrows from off-road vehicle travel.

Roads, trails and cross-country OHV travel in shrew habitat would continue to degrade shrew habitat by reducing vegetative cover. Loss of vegetative cover removes food and shelter for insects that provide food for shrews.

This alternative would continue to allow unrestricted motorized use in a majority of the forest that occurs outside of closure areas. Over the next several decades, continued off-road motorized use would result in a cumulative loss of vegetation and direct impact to shrew burrows along with activities such as short-term impacts of vegetation treatment, livestock grazing, private land development, utility line construction and maintenance, and legal and illegal fuelwood harvest. Climate change is also expected to result in a higher frequency of high-severity wildfires (Marlon et al. 2009) and prolonged periods of drought (Furniss et al. 2010), which would also cumulatively contribute to decreases in vegetative ground cover.

This species is primarily known from the Kaibab Plateau, San Francisco Peaks, and White Mountains. This alternative would continue to result in slowly increasing amounts of loss and fragmentation of dwarf shrew habitat in ponderosa pine and pinyon-juniper vegetation types on the San Francisco Peaks. This loss and fragmentation of vegetation would cumulatively add to vegetation loss and fragmentation from major large-scale impacts such as the 500,000-acre-plus Wallow fire that has affected a large majority of potential dwarf shrew habitat on the White Mountains. Over time this impact would decrease, however, key dwarf shrew habitat types would be limited in the northern Arizona ecoregion over the next several years.

Alternative 3 – Direct, Indirect, and Cumulative Effects: Alternative 3 closes 134 miles of roads (57 percent) and 1.1 mile (58 percent) of motorized trail in primary dwarf shrew habitat (montane subalpine grassland, spruce fir and alpine tundra). Alternative 3 would largely benefit dwarf shrew by restricting off-road motorized use outside of the Cinder Hills OHV area, game management units 7W and 8 for retrieval of elk, 30,982 acres for dispersed camping, and as approved under federal permit. This alternative would also benefit the dwarf shrew by closing 57 percent of roads within dwarf shrew habitat. This would positively affect shrews by reducing access to and activity near occupied sites, reducing disturbance to individuals and their habitat. However, alternative 3 would designate 488 acres of camping corridors and 0.1 mile of unauthorized roads to Forest system roads in dwarf shrew habitat increasing access and disturbance in habitat.

Camping would be reduced on 134 miles (57 percent) of roads in montane grasslands and increased on 101 miles (63 percent) of roads within these habitats. Camping would be reduced on 3,118 miles (60 percent) and increased on 2,089 miles (40 percent) in the ponderosa pine and pinyon-juniper habitats. On roads that would remain open but are not identified as corridors, camping could increase some due to displaced campers who would no longer be able to access closed roads. Since impacts at any one site are expected to be of short duration and low intensity, new hardened sites probably won't be created; therefore, habitat and disturbance impacts are expected to be minimal.

The designation of 3,488 acres of camping corridors and 0.1 miles of unauthorized road may result in cumulative effect of vegetation loss and habitat fragmentation for the dwarf shrew in localized areas where these activities are occurring with other activities such as livestock grazing, and implementation of vegetation management projects. This alternative would have a much larger beneficial cumulative effect from reducing motorized use on 60 percent of Forest roads and 66 percent of motorized trail. This change would result in less disturbance and fragmentation to shrew habitat, which would cumulatively contribute to similar travel management planning efforts on the Kaibab, Apache-Sitgreaves, and Tonto national forests that would have the effect of decreasing habitat loss and fragmentation. This reduction would benefit the dwarf shrew by reducing fragmentation in their primary habitat. Alpine tundra and rocky and talus slopes would not be affected by this alternative. The primary benefit would be to montane subalpine grasslands, which would see the greatest improvement in soil function and therefore vegetation. For ponderosa pine and pinyon –juniper woodland habitat, other habitats used by the shrew, there would be a reduction of 3,118 miles (60 percent) of road and 46.7 miles (66 percent) of motorized trail, which would reduce fragmentation and provide for movement of shrews in these habitats. Over time, obliterated roads would heal and herbaceous vegetation would increase improving habitat for insects that provide food for shrews (USDA Forest Service 2004).

Alternative 4 – Direct, Indirect, and Cumulative Effects: Effects from this alternative would be similar to alternative 3; however, alternative 4 would designate 0.5 more miles of unauthorized road as Forest system road within primary dwarf shrew habitat. Alternative 4 would close 122 miles (52 percent) of road, which is 12 miles less than under alternative 3. In addition, this alternative would not close motorized trail in primary shrew habitat. Off road motorized use for motorized big game retrieval would be limited to elk retrieval, which would result in a decrease in motorized cross-country travel, though to a lesser extent than under alternative 3. For ponderosa pine and pinyon –juniper habitat there would be a reduction of 2,876 miles of road and 28.7 miles of motorized trail, which would reduce fragmentation and provide for movement of shrews in these habitats.

This alternative would designate 44.3 miles of motorized trails in shrew habitat. This could reduce availability of food and cover for this species over the long term. Overall there would be an increase in potential habitat for this species. Over time obliterated roads would heal and herbaceous vegetation would increase improving habitat for insects that provide food for shrews (USDA Forest Service 2004).

Western Red Bat

Existing Condition

In Arizona, the western red bat is thought to be a summer resident only. It occurs statewide, except in desert areas, but primarily along riparian corridors among oaks, sycamores, and cottonwoods at elevations between 2,400 and 7,200 feet. Red bats have been recently observed at Kachina Village, upper West Clear Creek Wilderness, and Page Springs Fish Hatchery. There are approximately 136 miles of roads within 328 feet (100 meters) of perennial and riparian streams and 601 miles of road within ¼ mile of perennial streams. There are no motorized trails within 328 feet (100 meters) of perennial and riparian streams. There are 0.5 miles of motorized trail within ¼ mile of perennial and riparian streams.

Environmental Consequences to Western Red Bat

Alternative 1 – Direct, Indirect, and Cumulative Effects: Unrestricted cross-country travel, use of roads and motorized trails, and camping can affect the red bat by increasing access near riparian zones, increasing sedimentation into streams, causing damage to riparian vegetation, and increasing activities within line of site of red bats which may cause flushing or roost abandonment. This alternative would result in 91 miles and 86 miles more (within 328 feet [100 meters] of perennial and riparian streams) than alternatives 3 and 4, respectively. The 0.5 miles of motorized trail within ¼ mile of perennial and riparian streams could potentially result in aural disturbance of roosting bats.

This alternative would contribute to the most potential for disturbance to western red bats. The effects from this alternative could contribute with other activities occurring in northern Arizona that effect western red bat populations such as private or public development (e.g., Construction of proposed recreation facilities in Fossil Creek) and road construction in riparian areas (Tobias-Flynn Access Road Project), Maintenance of power lines that go through riparian areas (Flagstaff to Pinnacle Peak 345kV transmission line maintenance in the area of West Clear Creek and Fossil Creek), construction of a 63 turbine windfarm in Williams, Arizona, and a windfarm to be developed in Grapevine Canyon on the east boundary of the Coconino National Forest. Effects from these activities could result in negative cumulative impacts that limit the population growth of western red bats in northern Arizona.

Alternative 3 – Direct, Indirect, and Cumulative Effects: A total of 92 miles of roads would be closed within 328 feet (100 meters) of perennial and riparian stream under alternative 3. A total of 392 miles of roads would be closed within ¼ mile of perennial and riparian streams under this alternative. There are no motorized trails within ¼ mile of a perennial stream. Under this alternative there would be no motorized off-road travel except for activities authorized under federal permit, for elk retrieval in game management unit 8 AND 7W, which are within the range of red bats, and in the Cinder Hills OHV area (which is in the range of the red bat, but likely does not contain viable habitat). The closure of roads and the prohibition of cross-country travel would benefit red bats by reducing access near riparian zones, reducing sedimentation into streams, reducing damage to riparian vegetation by vehicles, and reducing activities within line of site of red bats, which may cause flushing, or roost abandonment. Because this alternative allows for less cross-country travel for game retrieval than alternative 4, there may be slightly more benefit to species and their habitat.

Under this alternative, there would no longer be any motorized-based camping along 92 and 392 miles of roads to be closed within 328 feet (100 meters) and ¼ mile, respectively of red bat habitat (perennial riparian habitat), which would have the same benefits as described for road closure and prohibition of cross-country travel, above. Under both action alternatives, a total of 263 and 2,480 acres along roads with camping corridors are identified within 328 feet (100 meters) and ¼ mile, respectively of perennial and intermittent riparian habitat.

Alternative 3 would designate 0.8 miles of unauthorized roads as forest system roads within 100 meters of a perennial stream (and 1.5 miles within ¼ mile). This could cause aural and visual disturbance to roosting red bats and degrade their habitat.

This alternative may result in localized cumulative impacts from designation of camping corridors and unauthorized roads within quarter miles of riparian habitat, where other activities resulting in similar disturbance to the species may be occurring such as high-impact recreation,

livestock grazing, or infrastructure development or maintenance (e.g., bridge replacement). This alternative, however, would have a much broader beneficial cumulative effect by reducing disturbance to roosting western red bats and reducing impacts on riparian habitats throughout the Forest on which they depend. This alternative would have similar effects to similar travel management efforts on nearby national forests (Kaibab, Apache-Sitgreaves, Prescott, Tonto) and BLM lands, which would result in a cumulative net decrease in potential disturbance to roosts of this species and their habitat.

Alternative 4 – Direct, Indirect, and Cumulative Effects: Alternative 4 eliminates general cross-country travel, closes 86 miles of roads in red bat habitat (6 fewer miles than alternative 3) and reduces motorized trails, all of which would benefit the red bat by reducing access near riparian zones, reducing sedimentation into streams, reducing damage to riparian vegetation by vehicles, and reducing activities within line of site of red bats which may cause flushing or roost abandonment. Effects from this alternative would be similar to alternative 3, though alternative 4 allows for motorized retrieval of elk across the Forest and would add 1.6 miles of unauthorized roads within ¼ mile of potential habitat, which could result in disturbance to individuals and adverse impacts to habitat.

Allen's Lappet-browed Bat

Existing Condition

Allen's lappet-browed bats have been found in a variety of habitats in Arizona, including ponderosa pine, pinyon-juniper, Mexican woodland, white fir forests and Mohave desert scrub. A GIS query of Allen's lappet-browed bat known ephemeral roost sites identified 15.6 miles of road within one-quarter mile of known roosts. There are 6,303 miles of road and 113.5 miles of motorized trail within potential natural vegetation types that Allen's lappet-browed bat is associated with. These are pinyon-juniper woodland, pinyon-juniper evergreen shrub, ponderosa pine, mixed conifer and cottonwood willow riparian forest potential natural vegetation types.

Environmental Consequences to Allen's Lappet-browed Bat

Alternative 1 – Direct, Indirect, and Cumulative Effects: Under the No Action Alternative, continued, unrestricted, cross-country travel and use of roads and motorized trails could affect the Allen's lappet-browed bat by increasing access to roost locations and habitats. Allen's lappet-browed bats rely on snags for ephemeral roosts and are vulnerable to increased harvest of these structures along roads and are thought to select taller snags closer to forest roads as maternity roosts (Solvesky and Chambers 2009, Wisdom and Bate 2008). This alternative has the highest number of road miles and therefore the greatest potential for snags to be removed due to hazards they may pose to motorized user.

This alternative would result in a cumulative decline in snags over the long-term (more than 10 years) throughout the forested areas of the Coconino National Forest by providing access to areas with mature stands of ponderosa pine, which could provide key roosting habitat. Other activities such as high-severity wildfire, construction and maintenance of utility corridors, maintenance of snags along non-Forest roads, and private land development will also reduce the number of snags available for roosting Allen's lappet-browed bats in the long-term.

Alternative 3 – Direct, Indirect, and Cumulative Effects: Alternative 3 would designate 26.0 miles of unauthorized road as Forest system road within Allen's lappet-browed bat habitat. A

total of 3,735 miles (59 percent) of road and 81.4 miles (72 percent) of unauthorized motorized trail would be closed under alternative 3. Benefits to Allen's lappet-browed bats would occur due to the reduction of roads within potential roosting and foraging habitats. The large majority of roads that are closed would still provide an open corridor but would reduce the need for snags to be removed due to hazards they may pose to people using the roads. Allen's lappet-browed bats rely on snags for ephemeral roosts and are vulnerable to increased harvest of these structures along roads. Motorized access facilitates firewood cutting as well as commercial harvest of these structures (Wisdom and Bate 2008). Large snags would remain in increased densities as there would be less roads and therefore less need to remove hazard trees along those roads. This alternative would provide more snags across the landscape in the long term.

Under alternative 3, 38,775 acres of camping corridors would be designated within potential natural vegetation types that Allen's lappet-browed bat is associated with. There are 211 acres of camping corridors designated within one quarter mile of a known roost. Corridors in these habitats, especially where located adjacent or in stands of large tall Ponderosa pine trees, could have indirect impacts by degrading habitat within the corridors and potentially interfering with bats' ability to effectively use echo location for communication, navigation, and prey detection. Camping would be reduced on 2,657 acres (61 percent) and increased on 211 acres (39 percent) within these habitats. On roads that would remain open but are not identified as corridors, camping could increase some due to displaced campers who would no longer be able to access closed roads. Since impacts at any one site are expected to be of short duration and low intensity, new hardened sites probably won't be created; therefore, habitat and disturbance impacts are expected to be minimal.

The main effect of this alternative would be to reduce motorized use on 59 percent of roads and 72 percent of trails in Allen's lappet-browed bat habitat, which would result in more snags in the forested areas of the Coconino National Forest over the long-term. This effect would result in a cumulative increase in snags from similar travel management efforts on nearby national forests including the Kaibab, Tonto, and Apache-Sitgreaves. Other management activities such as the 4FRI EIS, may also result in large-scale restoration treatments, which could result in cumulative effects of increased snags into the future by decreasing the potential for large high-severity wildfires. Large high-severity wildfires such as the Wallow Fire, the Schultz Fire, and others have created a very large abundance of snags to provide habitat over the next 7 to 10 years; however, this short-term abundance in snags could result in a dearth of snags several decades from now. The future potential lack of snags would be somewhat mitigated by the effect of this alternative.

Alternative 4 – Direct, Indirect, and Cumulative Effects: Effects from this alternative would be similar to alternative 3, though alternative 4 would designate 2.9 more miles of unauthorized road as Forest system road within Allen's lappet-browed bat habitat. Alternative 4 would also close 3,453 miles (55 percent) of road and 32.7 miles (29 percent) of motorized trail, which would mean that 282 more miles of road and 48.7 more miles of trail would remain open than under alternative 3.This alternative would designate 81 miles of motorized trail in bat habitat. This could reduce availability of food and cover for this species over the long term; however overall there would be an increase in potential habitat for this species. Under this alternative, motorized big game retrieval would be allowed across more areas of the Forest than under alternative 3, though this would still be a reduction from existing conditions.

Pale Townsend's Big-eared Bat

Existing Condition

There are 6,241 miles of road and 77 miles of motorized trail within Pale Townsend's big-eared bat habitat. These habitats include desert communities, Great Basin/Colorado Plateau grassland and steppe, interior chaparral, pinyon-juniper and ponderosa pine potential natural vegetation types.

Environmental Consequences to Pale Townsend's Big-eared Bat

Alternative 1 – Direct, Indirect, and Cumulative Effects: Under the No Action Alternative, unrestricted, cross-country travel would continue to provide access to caves that provide roosting habitat for Pale Townsend's big-eared bats. The two roads identified by Arizona Game and Fish as a priority for closure due to the potential for disturbance to roosting bats would remain open and continue to provide access to two caves used by Pale Townsend big-eared bats. This alternative provides access for increased visitation during stressful periods for bats increasing the potential for population declines and abandonment.

Roads, trails and cross-country OHV travel in Pale Townsend's big-eared bat habitat would continue to degrade habitat. Loss of vegetative cover removes food and shelter for insects that provide food for this bat.

This alternative would result in cumulative effects to Pale Townsend's big-eared bat populations by continuing direct disturbance by facilitating motorized access to roost sites and facilitating indirect impacts by removing key habitat features such as snags (Wisdom and Bate 2008). Other direct disturbances that would cumulatively contribute to loss of individual bats include the development of two wind farms – one with 63 turbines in Williams, Arizona and one of undetermined size to be located in Grapevine Canyon on the eastern boundary of the Coconino National Forest. This alternative would also result in a cumulative decline of habitat features including snags over the long-term (more than 10 years) throughout the forested areas of the Coconino National Forest. Other activities such as high-severity wildfire, construction and maintenance of utility corridors, maintenance of snags along non-Forest roads, and private land development will also reduce the number of snags available for potential roost sites. This alternative would also allow for the highest potential for the spread of white-nosed syndrome by continuing providing motorized access to known bat hibernating sites (Elliott 2011).

Alternative 3 – Direct, Indirect, and Cumulative Effects: Alternative 3 would designate 26.8 miles of unauthorized road as Forest system road within pale Townsend's habitat. A total of 3,636 miles (58 percent) of road and 27.5 miles (64 percent) of motorized trail would be closed under alternative 3. Over time pinyon–juniper and Great Basin/Colorado Plateau grassland and steppe would heal and herbaceous vegetation would increase improving habitat for insects that provide food for bats.

This alternative would reduce access to caves used by the Townsend's big-eared bat lowering the potential for visitation during stressful periods for bats (i.e., hibernation or rearing of young) reducing potential for population declines and roost abandonment. Reducing access to caves would also reduce the risk of the spread of white-nosed syndrome (Elliott 2011).

Under alternative 3, 36,836 acres of camping corridors would be designated within potential natural vegetation types that pale Townsend's big-eared bat is associated with. There are 13 acres

of camping corridors designated within one quarter mile of a known roost. Corridors in these habitats could have indirect impacts by degrading habitat within the corridors and potentially interfering with bats' ability to effectively use echo location for communication, navigation, and prey detection. Camping would be reduced on 3,636 miles (58 percent) of roads and increased on 2,605 miles (62 percent) of roads within these habitats.

Although this alternative designates 36,836 acres of camping corridors and 26.8 miles of unauthorized roads in or adjacent to Pale Townsend's big-eared bat habitat, these effects would primarily result in indirect effects of localized extent. By not designating 58 percent of roads on the Forest and 64 percent of motorized trails, this alternative will have a beneficial cumulative effect of both decreasing disturbance to roosting bats in known inhabited caves and would result in more snags in the forested areas of the Coconino National Forest over the long-term. This effect would result in a cumulative increase in snags from similar travel management efforts on nearby national forests including the Kaibab, Tonto, and Apache-Sitgreaves. Other management activities such as 4FRI, may also result in large-scale restoration treatments, which could result in cumulative effects of increased snags into the future by decreasing the potential for large high-severity wildfires. Lastly, by not designating two roads that provide access to caves with known bat hibernating, this alternative would decrease the potential for infection by white-nosed syndrome and could decrease the cumulative impact of direct disturbance should infection spread to these populations.

Alternative 4 – Direct, Indirect, and Cumulative Effects: Effects from this alternative would be similar to alternative 3, though alternative 4 would designate 5.4 more miles of unauthorized road as Forest system road within pale Townsend's big-eared bat habitat. A total of 3,365 miles (54 percent) of road and 45.4 miles (59 percent) of motorized trail would be closed under alternative 4, which would result in 271 more miles of road and 17.9 more miles of motorized trail remaining open than under alternative 3. This alternative would also designate 45.4 miles of motorized trails in bat habitat. This could have a very slight impact of reducing productivity and thus may reduce availability of food and cover for this species over the long term in areas adjacent to these trails

Under alternative 4, off-road motorized travel would be restricted (to big game retrieval for elk, to use of the Cinder Hills OHV Area, in designated dispersed camping corridors, and as authorized under federal permit). Though more of the Forest would be open to motorized big game retrieval under this alternative, no adverse impacts to Pale Townsend's big-eared bats are anticipated.

Greater Western Mastiff Bat

Existing Condition

Range for this bat includes all Arizona counties, except Yavapai, Navajo, Apache and Santa Cruz. There is one specimen collected after death near Flagstaff in 1992. They are documented to be located mostly on the North Kaibab in Arizona. Though population information is unknown, it is suspected they are declining. There are no roost locations known to occur on the Forest. Greater western mastiff bats are habitat generalists and use multiple potential natural vegetation types for foraging.

Environmental Consequences to Greater Western Mastiff Bat

Alternative 1 – Direct, Indirect, and Cumulative Effects: Under the No Action alternative there is low probability that cliffs, canyons or crevices used by the greater western mastiff bat for roosting or hibernacula are directly impacted by roads, motorized trails or cross-country travel. Roads could affect the greater western mastiff bat by providing access to roost locations for recreation activities such as rock climbing that may disturb roosting bats. Disturbance at roosts could reduce population fitness at roost sites.

The greater western mastiff bat uses multiple potential natural vegetation types and cross-country travel, use of roads and motorized trails and camping are not expected to have adverse impacts to this bat.

This alternative would facilitate the greatest potential impact from access to roost sites and impacts to habitat from motorized use. This alternative would also result in a cumulative decline of habitat features including snags over the long-term (more than 10 years) throughout the forested areas of the Coconino National Forest. Other activities such as high-severity wildfire, construction and maintenance of utility corridors, maintenance of snags along non-Forest roads, and private land development will also reduce the number of snags available for potential roost sites.

Alternative 3 – Direct, Indirect, and Cumulative Effects: Under alternative 3, there is low probability that cliffs, canyons or crevices used by the greater western mastiff bat for roosting or hibernacula are directly impacted by roads, motorized trails or off-road travel. Alternative 3 would not designate unauthorized road as Forest system road that would provide access to cliffs, canyons or crevices used by greater western mastiff bats. Roads could affect the greater western mastiff bat by providing access to roost locations for recreation activities such as rock climbing that may disturb roosting bats. Disturbance at roosts could reduce population fitness at roost sites.

The greater western mastiff bat uses multiple potential natural vegetation types and cross-country travel and use of roads and motorized trails are not expected to have adverse impacts to this bat.

The main effect of this alternative would be to reduce motorized use on a majority of roads and trails in greater western mastiff bat habitat, which would result in more snags in the forested areas of the Coconino National Forest over the long-term. This effect would result in a cumulative increase in snags from similar travel management efforts on nearby national forests including the Kaibab National Forest. Other management activities such as 4FRI, may also result in large-scale restoration treatments, which could result in cumulative effects of increased snags into the future by decreasing the potential for large high-severity wildfires.

Alternative 4 – Direct, Indirect, and Cumulative Effects: Effects from this alternative would be similar to alternative 3. Alternative 4 would also not designate unauthorized road as Forest system road that would provide access to cliffs, canyons or crevices used by greater western mastiff bats. And as with alternative 3, the main effect of this alternative would be to reduce motorized use on a majority of roads and trails in greater western mastiff bat habitat, which would result in more snags in the forested areas of the Coconino National Forest over the long-term.

Spotted Bat

Existing Condition

Historic records suggest that the spotted bat was widely distributed but quite rare over its range, although it may have been locally abundant at certain sites. There are no roost locations known to occur on the Forest. This species is a habitat generalist and could forage across the entire Forest.

Environmental Consequences to Spotted Bat

Alternative 1 – Direct, Indirect, and Cumulative Effects: Under the No Action alternative there is low probability that crevices in cliffs used by the spotted bat for roosting or hibernacula are directly impacted by roads, motorized trails or off-road travel. Roads could affect the spotted bat by providing access to roost locations for recreation activities such as rock climbing that may disturb roosting bats. Isolated occurrences of disturbance may impact individuals but because this bat roosts singly would not have an impact on an entire colony of spotted bats.

The spotted bat is associated with multiple potential natural vegetation types and could forage anywhere on the Forest. Roads could provide travel corridors and are not expected to have an adverse affect on these canopy foraging bats. Since there is no effect expected to result from this alternative, there is no cumulative effect.

Alternative 3 – Direct, Indirect, and Cumulative Effects: Alternative 3 would have no direct effects to the spotted bat but may have a slight effect of reducing access to and activity near potential habitat, reducing potential disturbance to individuals. This effect would likely be very slight considering there are no known roost locations on the Coconino National Forest, and would likely not result in a cumulative impact.

Alternative 4 – Direct, Indirect, and Cumulative Effects: Effects from this alternative on the spotted bat are the same as those described for alternative 3.

Merriam's Shrew

Existing Condition

The range of this species is distributed throughout the west. In Arizona, the distribution of Merriam's shrew occurs primarily along the Mogollon Rim (Hoffmeister 1986). Grassland interspersed or associated with water and wetland cienegas and montane subalpine and Great Basin/Colorado Plateau grassland and steppe are potential natural vegetation types this shrew is associated with. There are 590 miles of road and 1.9 miles of motorized trail within these potential natural vegetation types. For a summary of open and closed roads, motorized trails and camping corridors in Merriam's shrew habitat, see the Wildlife specialist report.

Environmental Consequences to Merriam's Shrew

Alternative 1 – Direct, Indirect, and Cumulative Effects: Under this alternative, unrestricted cross-country travel, use of roads and motorized trails and camping would continue in Merriam's shrew habitat. This shrew is associated with multiple potential natural vegetation types. All of the grassland habitats, riparian and wetland cienegas would continue to be impacted by existing roads and motorized trails. There are 590 miles of road and 1.9 miles of motorized trail within these habitats. Under this alternative roads would continue to restrict the movements of shrews

potentially functioning as barriers to population dispersal and movement. There would be no protection of burrows from off-road vehicle travel.

Loss of vegetative cover removes food and shelter for shrews and this alternative would have the highest level of loss or degradation in riparian, meadow and grassland habitats as well as all other vegetation types used by this shrew and its prey.

This alternative would continue to allow unmanaged motorized use that would result in a cumulative loss of vegetation and direct impact to shrew burrows along with activities such as short-term impacts of vegetation treatment, livestock grazing, and legal and illegal fuelwood harvest. Climate change is also expected to result in a higher frequency of high-severity wildfires (Marlon et al. 2009) such as the Rodeo-Chedeski and the Wallow wildfires that affected portions of Merriam's shrew habitat on the Mogollon rim of the Apache-Sitgreaves National Forest. Climate change is also expected to result in prolonged periods of drought (Furniss et al. 2010), which would also cumulatively contribute to decreases in vegetative ground cover and potential loss of wetland areas on which the shrew depends.

Alternative 3 – Direct, Indirect, and Cumulative Effects: A total of 303 miles (51 percent) of roads and 1.1 miles (58 percent) of motorized trail would be closed under alternative 3. This would have a positive effect to the Merriam's shrew by reducing habitat degradation fragmentation. However, alternative 3 would also designate 1.2 miles of unauthorized road as Forest system road within Merriam's shrew habitat.

Under alternative 3, 1,725 acres of camping corridors would be designated within potential natural vegetation types that Merriam's shrew is associated with. Corridors in these habitats could have indirect impacts by degrading habitat within the corridors. Camping would be reduced on 303 miles (51 percent) of roads and increased on 287 miles (49 percent) of roads within these habitats. On roads that would remain open but are not identified as corridors, camping could increase some due to displaced campers who would no longer be able to access closed roads. Since impacts at any one site are expected to be of short duration and low intensity, new hardened sites probably won't be created; therefore, habitat and disturbance impacts are expected to be minimal.

The designation of 1,725 acres of camping corridors and 1.2 miles of unauthorized road may result in cumulative effect of vegetation loss and habitat fragmentation for the Merriam's shrew in localized areas where these activities are occurring with other activities such as livestock grazing, and implementation of vegetation management projects. This alternative would have a much larger beneficial cumulative effect from reducing motorized use on 51 percent of Forest roads and 58 percent of motorized trail. This change would result in less disturbance and fragmentation to shrew habitat, which would cumulatively contribute to similar travel management planning efforts on the Kaibab, Apache-Sitgreaves, and Tonto national forests. Also, road closures and decommissioning that is ongoing under the East Clear Creek project, which occurs in the known range for this species, would result in more undisturbed vegetation cover and remove risk of burrow collapse from motor vehicle use, thus resulting in cumulative decreases in fragmentation and direct impacts.

Alternative 4 – Direct, Indirect, and Cumulative Effects: Effects from this alternative would be similar to alternative 3, though alternative 4 would designate 3 more miles of unauthorized road as Forest system road within Merriam's shrew habitat, and would close 32 fewer miles of

roads (which would still result in a reduction of 46 percent). It would also designate 1.9 miles of unauthorized motorized trail (0.7 mile more than alternative 3), which could potentially result in a slight increase in fragmentation.

This alternative allows off-road motorized use for retrieval of harvested elk and may cause disturbance to Merriam's shrew and their habitat. Merriam's shrew primarily occurs along the Mogollon rim, which is known for excellent elk hunting. This alternative would result in an average of 136 off-road vehicle trips per year in Game Management Unit 5A, which includes grassland habitats and cienegas along the known habitat on the Mogollon rim (figure 31). This would be a decrease from current off-road travel, but may continue impacts to the shrew, albeit at a lower and more infrequent level.

Figure 31. A small cienega in Poverty Draw in the East Clear Creek Watershed adjacent to an unauthorized route

Plains Harvest Mouse

Existing Condition

The plains harvest mouse may be found in desert scrub, chaparral, and semi-desert grasslands and are known to occur in the Verde Valley. There are 569 miles of road and 9.7 miles of motorized trails within the potential natural vegetation types known to be used by harvest mice.

Environmental Consequences to Plains Harvest Mouse

Alternative 1 – Direct, Indirect, and Cumulative Effects: Roads often restrict the movements of small mammals (Mader 1984, Merrian et al. 1989, Swihart and Slade 1984 in Trombulak 2000). Consequently roads can function as barriers to population dispersal and movement of some species of small mammals (Oxley and Fenton 1974 in Trombulak 2000). Unrestricted cross-country travel, use of roads and motorized trails, and camping can affect harvest mice by increasing road densities through habitat, increasing barriers to movement and restricting movement, increasing the potential for motorized vehicles to run over above ground nests in the summer, increasing the potential for motorized vehicles to collapse burrows used by mice in the winter, and increasing the potential for motorized vehicles to destroy the types of vegetation upon

which this mice feeds. The plains harvest mouse may be found in desert scrub, chaparral, and semi-desert grasslands and are known to occur in the Verde Valley. This alternative would result in 334 and 322 miles more of road compared to alternative 3 and 4, respectively.

This alternative would continue to cause direct impacts to plains harvest mouse nest and burrows and degrade and fragment habitat. This alternative would result in cumulative impacts to mouse nests and burrows and the vegetation they depend by combining with effects from activities including livestock grazing, private land development, recreation and infrastructure development, and implementation of vegetation management projects.

Alternative 3 – Direct, Indirect, and Cumulative Effects: Under alternative 3, there would be 334 miles (59 percent) of road and 4.3 miles (44 percent) of motorized trails closed within the potential natural vegetation types used by harvest mice. Roads often restrict the movements of small mammals (Mader 1984, Merrian et al. 1989, Swihart and Slade 1984 in Trombulak 2000). Consequently roads can function as barriers to population dispersal and movement of some species of small mammals (Oxley and Fenton 1974 in Trombulak 2000). Under this alternative there will be no motorized off-road travel except as authorized under federal permit, in designated dispersed camping areas, in the Cinder Hills OHV area, and for big game retrieval (game management units 8 and 7W, which is outside the range of harvest mice). The closure of roads and the restrictions on off-road motorized travel will benefit harvest mice by reducing road densities through habitat, reducing barriers to movement, allowing for increased movement, reducing the potential for motorized vehicles to run over above ground nests in the summer, reduce the potential for motorized vehicles to collapse burrows used by mice in the winter, and reducing the potential for motorized vehicles to destroy or prevent reestablishment of the types of vegetation upon which this mice feeds.

Under this alternative, there will no longer be any motorized-based camping along 334 miles of roads within the potential natural vegetation types used by harvest mice, which would have the same benefits as described for road closure and prohibition of cross-country travel, above. Under both action alternatives, a total of 2,780 acres along roads with camping corridors are identified within harvest mouse habitat. Since most of roads within close proximity to special status species were the roads chosen for closure in the action alternatives, impacts to harvest mice from displaced camping is not likely to occur.

Alternative 3 would designate 2.5 miles of unauthorized roads and 1.8 miles of unauthorized motorized trails (Lower Smasher Canyon Trail) as forest system roads within harvest mouse habitat. This would result in negative direct and indirect effects to individuals as well as their habitat by altering their habitat, increasing barriers to movement, and reducing their food source.

This alternative may result in cumulative impacts in the 2,780 acres of designated camping corridor and 4.2 miles of designated unauthorized routes where other activities such as livestock grazing, recreational uses, recreation and infrastructure development, and vegetation management are causing similar disturbances to disturb nests and burrows or remove vegetation. This alternative would have a much larger beneficial cumulative effect from reducing motorized use on 59 percent of Forest roads and 44 percent of motorized trail. This change would result in less disturbance and fragmentation to plains harvest mouse habitat, which would cumulatively contribute to similar travel management planning efforts on the Tonto and Prescott National Forests.

Alternative 4 – Direct, Indirect, and Cumulative Effects: Effects from this alternative would be similar to alternative 3, though alternative 4 would close 12 fewer miles of road (322 miles, or a reduction of 57 percent) within the potential natural vegetation types used by harvest mice. Alternative 4 would close the same amount of motorized trails within the potential natural vegetation types used by harvest mice, and would also designate the same amount of unauthorized roads and unauthorized motorized trail (Lower Smasher Canyon Trail) within harvest mouse habitat as alternative 3.

Motorized big game retrieval could result in some impacts from disturbance to plains harvest mouse. Habitat for the harvest mouse occurs in the southern portions of game management units 6A and 6B. The reduction in motorized big game retrieval by limiting it to elk only in game management units 6A and 6B would benefit the plains harvest mouse by reducing the frequency of disturbance and extent of impacts to vegetation from off-road motorized use.

Narrow-headed Garter Snake

Existing Condition

On the Coconino National Forest, narrow-headed garter snakes are currently known from Oak Creek Canyon and a few sightings from the Verde River, although historic records exist for above the rim in the Happy Jack area. Population numbers in Oak Creek Canyon have decreased significantly, particularly in the lower 1/3 of the canyon and absent entirely downstream of the canyon, since the late 1980s. There are approximately 45 miles of roads within 328 feet (100 meters) of perennial streams and 251 miles of road within ¼ mile of perennial streams across the Forest; however, not all of these streams provide potential or suitable habitat. Using potential natural vegetation types for mid and low elevation riparian zones to more accurately reflect miles of road within Mexican garter snake habitat, there are 9.0 miles of roads in cottonwood/willow and mixed broadleaf riparian. Because this is a measure of miles of roads within this potential natural vegetation type, it does not account for a buffer around riparian vegetation. There are no motorized trails within ¼ mile of perennial streams.

Environmental Consequences to Narrow-headed Garter Snake

Alternative 1 – Direct, Indirect, and Cumulative Effects: Unrestricted cross-country travel, use of roads and motorized trails, and motorized camping can affect narrow-headed garter snakes by increasing access to riparian zones, increasing sedimentation into streams, causing damage to riparian vegetation by vehicles, increasing the potential spread of nonnative aquatic organisms and diseases, and increasing the potential for forest users to handle/collect garter snakes.

This alternative would result in cumulative impacts to garter snakes by degradation of riparian habitat and potential spread of nonnative species, which are also a result of activities including private land and road development (such as the Tobias-Flynn Road Access Project); high-impact recreation and development of infrastructure in riparian areas such as in Fossil Creek, West Clear Creek and along the Verde; and livestock grazing. Climate change may also result in a cumulative increase in effects on the garter snake by increasing the competitiveness of nonnative species (Rahel and Olden 2008) and by causing persistent drought.

Alternative 3 – Direct, Indirect, and Cumulative Effects: A total of 32.6 miles of roads would be closed within 328 feet (100 meters) of perennial stream. A total of 161 miles of roads would be closed within ¼ mile of perennial streams under this alternative. Using potential natural

vegetation types to more accurately target mid and low elevation riparian zones, there would be 6.6 (73 percent) miles of roads closed in cottonwood/willow and mixed broadleaf deciduous riparian. Under this alternative there would be restricted off-road travel limited to areas outside of garter snake habitat. The closure of roads and the restriction of off-road travel would benefit garter snakes by reducing access near riparian zones, reducing sedimentation into streams, reducing damage to riparian vegetation by vehicles, reducing the potential spread of nonnative aquatic organisms and diseases, and reducing the potential for forest users to handle/collect garter snakes. Because this alternative allows for less off-road travel for game retrieval than alternative 4, there is slightly more benefit to species and their habitat.

Under both action alternatives, there would no longer be any motorized-based camping along 6.6 miles of roads to be closed in narrow-headed garter snake habitat (mid and low elevation riparian zones), which will have the same benefits as described for road closure and prohibition of cross-country travel, above. Under both action alternatives, a total of 31 acres along roads with camping corridors are identified within mid and low elevation riparian zones. Since most of roads within close proximity to special status species were the roads chosen for closure in the action alternatives, impacts to narrow-headed garter snakes from displaced camping is not likely to occur.

Alternative 3 would designate 0.3 miles of unauthorized road within narrow-headed garter snake habitat; this would result in some negative effects to individuals and their habitat.

This alternative may result in negative cumulative impacts to garter snake habitat within the 31 acres of designated camping corridor and 0.3 miles of designated unauthorized road where other activities such as livestock grazing, streamside recreation, private development, and development of recreation and infrastructure in riparian areas are also reducing coverage of riparian habitat and increasing sedimentation. Yet these effects would be somewhat limited considering both camping corridor and unauthorized road designation mainly captures existing use (and thus existing impacts). This alternative would result in a larger beneficial cumulative effect of reducing impacts to riparian vegetation and sedimentation into garter snake habitat when combined with similar travel management efforts on the Tonto and Prescott National Forest and with vegetation management projects designed to reduce the long-term sediment impacts from potential wildfire. This alternative would also slightly counteract the potential for impacts from climate change including prolonged drought and increased competitiveness of nonnative species by reducing impacts on riparian vegetation and increasing the resilience of the system to other disturbances.

Alternative 4 – Direct, Indirect, and Cumulative Effects: Effects from this alternative are similar to alternative 3, though motorized big game retrieval would occur to a greater extent. This could result in some impacts from disturbance to garter snake potential habitat. There is potential habitat along Oak Creek and Verde River and tributaries in game management units 6A 6B. However, the reduction in motorized big game retrieval by limiting it to elk only in game management units 6A and 6B would benefit narrow headed garter snakes by reducing sedimentation into streams, reducing damage to riparian vegetation by vehicles, reducing the potential spread of nonnative aquatic organisms and diseases, and reducing disturbance to garter snakes that undertake foraging forays into the uplands.

Reticulate Gila Monster

Existing Condition

The Gila monster is known to occur throughout the Verde Valley except for the Sedona and immediate surrounding red rock country. They are known to occur in shrubby, grassy, and succulent desert, occasionally oak woodland and canyon bottoms or arroyos with permanent or intermittent streams. They use rocky bajadas, hillsides, mountainous terrain with rocky shelters and foothills. There is little population information for this species but the consensus is that the Gila monster is less abundant & less widespread now than it was formerly. There are 578 miles of road in desert, chaparral, low and mid-elevation riparian, and semi-desert grassland zones, which are the potential natural vegetation type known to be used by Gila monsters. There are 9.7 miles of road within these potential natural vegetation types.

Environmental Consequences to Reticulate Gila Monster

Alternative 1 – Direct, Indirect, and Cumulative Effects: Unrestricted cross-country travel, use of roads and motorized trails, and camping can affect Gila monsters by increasing access and human-Gila monster interactions, creating barriers to movement thereby restricting movement, and increasing the potential for motorized vehicles to collapse burrows used by Gila monsters. These effects could combine with effects of private land development, use and maintenance of nonjurisdictional roads, and high-impact recreation in areas such as in Fossil Creek to result in cumulative effects to the reticulate Gila monster and its habitat.

Alternative 3 – Direct, Indirect, and Cumulative Effects: There would be 341 miles of road (59 percent) and 4.3 miles of motorized trails (44 percent) closed in Gila monster habitat under this alternative. The closure of roads and the restriction of off-road motorized travel would benefit Gila monsters by reducing road densities through habitat, reducing barriers to movement, allowing for increased movement, and reducing the potential for motorized vehicles to collapse burrows used by Gila monsters. Because this alternative allows for less cross-country travel for game retrieval than alternative 4, there is slightly more benefit to species and their habitat.

Under both action alternatives, there would no longer be any motorized-based camping along 341 miles of roads within the potential natural vegetation types used by Gila monsters, which would have the same benefits as described for road closure and restriction of motorized off-road travel, above. Under both action alternatives, a total of 2,811 acres along roads with camping corridors are identified within Gila monster habitat. Since most of roads within close proximity to special status species were the roads chosen for closure in the action alternatives, impacts to Gila monsters from displaced camping is not likely to occur. Alternative 3 would designate 2.8 miles of unauthorized road within Gila monster habitat; this would result in negative effects to individuals and their habitat by directly disturbing individuals (through harassment or crushing) and affect habitat of their prey species.

Alternative 3 would allow motorized big game retrieval for elk in Game Management Units 7W and 8, which include no Gila monster habitat and thus would remove all potential impacts to the Gila monster from motorized big game retrieval.

This alternative may result in negative cumulative impacts to Gila monster habitat within the 2,811 acres of designated camping corridor and 2.8 miles of designated unauthorized road where other activities such as high-impact recreation, livestock grazing, private development, and use and maintenance of nonjurisdictional roads are also degraded habitat, limiting movement, and

impacting burrows. Yet these effects would be somewhat limited considering both camping corridor and unauthorized road designation mainly captures existing use (and thus existing impacts). This alternative would result in a larger beneficial cumulative effect of reducing impacts to Gila monster habitat by removing open motorized use on 341 miles of road when combined with similar travel management efforts on the Prescott and Tonto national forests and other BLM lands.

Alternative 4 – Direct, Indirect, and Cumulative Effects: Effects from this alternative are similar to alternative 3, though alternative 4 would close 13 fewer miles of road in Gila monster habitat. Alternative 4 would also designate 2.5 miles of unauthorized road and 1.8 miles of unauthorized motorized trail (Smasher Canyon) within Gila monster habitat; this would result in negative effects to individuals and their habitat by directly disturbing individuals (through harassment or crushing) and affect habitat of their prey species.

Alternative 4 would allow motorized retrieval of elk across the Forest, which includes Gila monster habitat in game management units 6A and 6B. While game management unit 6A provides approximately 20 percent of the elk hunting opportunity in Arizona, elk are less numerous in the southern portion of the unit where desert grassland and shrub habitat exists (see Arizona Game and Fish website at: http://www.azgfd.gov/h_f/hunting_units_6a.shtml). game management unit 6B provides quality elk hunts in the north part of the unit, above the Mogollon Rim (http://www.azgfd.gov/h_f/hunting_units_6b.shtml). As a result, it seems very unlikely that designation of off-road travel up to a mile off of designated roads under this alternative would result in any impact to the Gila monster.

Bald and Golden Eagle Protection Act

Existing Condition

All golden and bald eagles, regardless of status, are protected under the Bald and Golden Eagle Protection Act (Eagle Act). For bald eagles, details of the Existing Condition can be found in this document where bald eagles were addressed as a federally listed species and as a Forest Service Sensitive species. For golden eagles, there are 10 confirmed nests representing nine nesting areas (Red Mountain has two nests identified). An additional 10 sites are potential golden eagle nesting areas, but have not been confirmed. More information on known and potential eagle nest sites can be found in the Wildlife specialist report.

Environmental Consequences to Bald and Golden Eagle Protection Act

Alternative 1 – Direct, Indirect, and Cumulative Effects: Use of roads and motorized trails, and unrestricted cross-country travel and camping would continue in the vicinity of nesting and roosting bald and golden eagles. These activities can affect eagles by increasing access to breeding and roosting areas, causing damage to vegetation, and increasing activities within line of site of eagles which may cause flushing, premature fledging, and nest or roost abandonment. Use of roads and trails during the breeding season and within close proximity to nesting sites, or during the winter within close proximity to night roosts or key foraging areas, could cause aural and visual disturbance to nesting eagles. Because snow and wet conditions make much of the Forest difficult to access during the months when wintering bald eagles are on the Forest, disturbance impacts from motorized travel are likely to be relatively small.

This alternative would result in continued disturbance from motor vehicles to existing or potential eagle nest and roosts. Over time, the repeated low-level disturbance, such as the effect of repeated flushing as was observed from the Beaver breeding area, may result in reduced breeding success. Other activities occurring that may have similar effects include temporary disturbances caused by forest restoration treatments, low-intensity wildfire, or effects to roosting habitat from nonjurisdictional roads. These activities may cumulatively result in repeated disturbance, thus reducing eagle viability over the long-term. Repeated disturbance from motorized use may also combine cumulatively with activities that affect eagle roosting and foraging habitat such as high-intensity wildfire, wildfire suppression activities, or utility infrastructure development and maintenance.

Alternative 3 – Direct, Indirect, and Cumulative Effects: Refer to the federally-listed and as a Forest Service Sensitive species sections in this document for the analysis on the bald eagle.

Off-road travel would no longer be allowed outside of the Cinder Hills OHV Area, except under federal permit, in designated dispersed camping corridors, or for motorized retrieval of elk in game management units 7W and 8. This is likely to reduce disturbance at golden eagle nesting and roosting areas.

For the 20 confirmed and potential golden eagle nests known on the Forest, 8.9 miles (52.4 percent) of existing roads would be closed within 2,500 feet of nests as follows: 0.2 miles within 500-1,000 feet, and 8.7 miles within 1,000-2,500 feet. No unauthorized roads would be designated with 2,500 feet of nests and there would be no off-road motorized trails within 2,500 feet of nests. There would be 126.9 acres of motorized dispersed camping corridors designated between within 2,500 feet from the Upper Lake Mary South confirmed nest site and the Upper Mary North and Dry Lake sites. None of the three sites are within line-of-sight of the corridor. The Lake Mary sites are below the edge of a mesa and are protected from disturbance by the slope and vegetation. The Dry Lake potential site is on the interior of a crater, with the well-used road on the other side of the hill, therefore protecting the site from potential disturbance.

The two Red Mountain golden eagle nest sites are within game management unit 7W where an average of 70 off-road vehicle trips are expected to occur each year for retrieval of elk. Motorized big game retrieval thus can occur in eagle habitat, but their placement on the cliff face makes it unlikely that any motorized big game retrieval that may occur would affect golden eagles.

This alternative would reduce motorized access to a level where frequent disturbance to known eagle roost sites would be eliminated, and lack of cross-country travel would further reduce disturbance to foraging and roosting eagles. This would result in a cumulative effect of reducing disturbance to bald and golden eagle nests, roosts and foraging areas in adjacent national Forests and BLM lands where travel management planning is occurring. Also, the limited and less frequent disturbance to eagle roost areas and foraging habitat would likely result in fewer overall displacements of eagles making for stronger population maintenance or growth levels.

Alternative 4 – Direct, Indirect, and Cumulative Effects: Effects from this alternative are similar to alternative 3, although alternative 4 would 8.0 miles (47.1 percent) of existing road within 2,500 feet of the 20 confirmed and potential golden eagle nests known on the Forest. This is 0.9 mile less closed than under alternative 3. The breakdown for these closures is as follows: 0.2 miles within 500-1,000 feet, and 7.8 miles within 1,000-2,500 feet. No unauthorized roads

would be designated with 2,500 feet of nests and there would be no off-road motorized trails within 2,500 feet of nests.

Alternative 4 would allow motorized big game retrieval up to one mile off of designated routes on the Forest, which equals 96.6 percent of what is currently open to motorized big game retrieval. This is some reduction compared to the No Action Alternative, but could result in greater disturbance to nesting golden eagles compared to alternative 3.

Management Indicator Species

Sixteen wildlife management indicator species have been identified as indicators for habitats on the Coconino National Forest (table 43). This report tiers to and summarizes Forestwide habitat and population trends from the Forest's MIS status report (Coconino National Forest midwinter bald eagle survey files 2002). More recent data were included in trend findings as appropriate.

Analysis of project effects for management indicator species focuses on habitat changes within potential natural vegetation types of which species are associated. Those species-habitat relationships are summarized in table 43. Species with Sensitive or threatened and endangered species status are discussed previously in this report and their existing conditions will not be discussed here. More information on these species is available in the full wildlife specialist report.

Table 43. Potential natural vegetation types within the Coconino National Forest with the associated management indicator species

Species	Indicator habitat	Potential natural vegetation type	Potential natural vegetation type acres
Abert's squirrel	Early seral ponderosa pine	Ponderosa Pine	807,424
Northern goshawk	Late seral ponderosa pine	Ponderosa Pine	807,424
Pygmy nuthatch	Late seral ponderosa pine	Ponderosa Pine	807,424
Turkey	Late seral ponderosa pine	Ponderosa Pine	807,424
Mexican spotted owl	Late seral mixed conifer and spruce-fir	Mixed Conifer Spruce-fir	79,060 13,942
Red squirrel	Late seral mixed conifer and spruce-fir	Mixed Conifer Spruce-fir	79,060 13,942
Elk	Early seral ponderosa pine, mixed conifer, and spruce-fir	Ponderosa Pine Mixed Conifer Spruce-fir	807,424 79,060 13,942
Hairy woodpecker	Snag component of ponderosa pine, mixed conifer, and spruce-fir	Ponderosa Pine Mixed Conifer Spruce-fir	807,424 79,060 13,942
Red-naped (yellow-bellied) sapsucker	Late seral and snag component of aspen	Aspen	4,487*
Juniper (plain) titmouse	Late seral and snag component of pinyon-juniper	Pinyon-juniper evergreen shrub Pinyon-juniper woodland	300,154 301,675

Table 43. Potential natural vegetation types within the Coconino National Forest with the associated management indicator species

Species	Indicator habitat	Potential natural vegetation type	Potential natural vegetation type acres
Mule deer	Early seral aspen and pinyon-juniper	Aspen Pinyon-juniper evergreen shrub Pinyon-juniper Woodland	4,487* 300,154 301,675
Pronghorn	Early and late seral grasslands	Semi-desert Grasslands Great Basin Grasslands Montane/subalpine Grassland	147,573 94,277 24,199
Lincoln's sparrow	Late seral, high elevation riparian (>7000 feet)	Montane Willow Riparian Forest	557
Lucy's warbler	Late seral, low elevation riparian (<7000 feet)	Cottonwood-willow Mixed Broadleaf	2,017 2,562
Yellow-breasted Chat	Late seral, low elevation riparian (<7000 feet)	Cottonwood-willow Mixed Broadleaf	2,017 2,562
Cinnamon teal	Wetlands/aquatics	Wetland Cienega	1,140

* Aspen acres are provided from the current forest plan (USDA Forest Service 1987) since they were not calculated in the ESR.

Abert's Squirrel

Existing Condition

The Forest Plan designates the Abert's squirrel as a management indicator species for early seral stage ponderosa pine forests. There are 4,150.2 miles of road and 71.1 miles of motorized trail within the ponderosa pine potential natural vegetation type. For more information on Abert's squirrels see the Wildlife specialist report.

Pygmy Nuthatch

Existing Condition

The Forest Plan designates the Pygmy nuthatch a MIS for late seral stage ponderosa pine forests. There are 4,150.2 miles of road and 71.1 miles of motorized trail within the ponderosa pine potential natural vegetation type. For more information on the pygmy nuthatch, see the Wildlife specialist report.

Turkey

Existing Condition

The Forest Plan designates turkey as a MIS for late seral stage ponderosa pine forests, based on roost habitat requirements. There are 4,150.2 miles of road and 71.1 miles of motorized trail within the ponderosa pine potential natural vegetation type. For more information on Turkey as an MIS on the Forest, see the Wildlife specialist report.

Environmental Consequences to Abert's Squirrel, Northern Goshawk, Pygmy Nuthatch, and Turkey - Ponderosa Pine Indicator Habitat

Alternative 1 – Direct, Indirect, and Cumulative Effects: There would be no direct effects to early, mid or late seral structural stage quantity in the ponderosa pine. The presence of roads open to motorized travel has been shown to result in a decline over time in large snags and large downed trees (Wisdom and Bate 2008, Ganey and Vojta 2010). Both large snags and large downed trees are important elements to late seral stage ponderosa pine indicator habitat for the goshawk, pygmy nuthatch and turkey. Under the No Action alternative, continued unrestricted off-road motorized travel and use of roads and motorized trails and car camping would continue in the ponderosa pine. Use of roads and motorized trails, off road travel and dispersed camping could also cause noise disturbance within all structural stages of ponderosa pine, causing displacement and avoidance of areas within these indicator habitats.

This alternative would result in continued lack of key habitat elements such as large snags and large downed trees in areas adjacent to roads. Considering over 93 percent of the forest is within one-half mile of a road outside of designated wilderness and approximately 50 percent of Ponderosa pine stands currently lack sufficient levels of large trees (Ganey and Vojta 2010); this alternative would make it unlikely forest plan desired conditions for snags and old growth would be accomplished.

The indirect impact of roads on habitat fragmentation and loss of key habitat elements would contribute to cumulative effects of other activities including short-term impacts of vegetation management and long-term impacts of maintenance of nonjurisdictional roads, private land development, and legal and illegal fuelwood harvest. In addition, wildfires such as the 15,051-acre Schultz Fire and subsequent hazard tree clearance along forest roads such as FR420 and FR126, have also contribute to the conversion of large tracts of ponderosa pine and loss of thousands of large trees. These fires would contribute to abundant large snags in the short-term but would likely contribute expected decline in snag abundance over the next several decades. In many instances, such as the 26,000-acre Horseshoe-Hochderffer fires of 1996, uncharacteristic wildfire has resulted in stand conversion likely contributing to long-term loss of ponderosa pine habitat of all age classes (Montes-Helu et al. 2009).

Alternative 3 – Direct, Indirect, and Cumulative Effects: There would be no effects to early, mid or late seral structural stage quantity in ponderosa pine with implementation of alternative 3. Therefore, there would be no effects to quantity of indicator habitat for elk, mule deer, northern goshawk, pygmy nuthatch, turkey, or Abert's squirrel. This alternative may result in effects to the quality of this habitat by changing the patterns of habitat available (reduced fragmentation from road use) and potentially affecting the abundance of key habitat elements such as large snags or large downed trees (Wisdom and Bate 2008, Ganey and Vojta 2010).

This alternative would close 2,520 miles (60.7 percent) of road to public use and 46miles (65.7 percent) of motorized trail within the ponderosa pine potential natural vegetation type. Closure of roads, motorized trails and restrictions on off-road travel in this indicator habitat could reduce noise and disturbance and improve habitat quality for elk, mule deer, northern goshawk, pygmy nuthatch, turkey and Abert's squirrel. However, even with 60.7 percent of existing roads being closed to public use within the ponderosa pine cover type, approximately 78.6 percent of Forest lands outside of designated wilderness areas would be within ½ mile of an open road.

In the ponderosa pine potential natural vegetation type, 6.4 miles of unauthorized roads would be added to the road system and be open for public travel. No unauthorized motorized trails would be added to the system of trails within the potential natural vegetation type. A large majority of research has shown that traffic on roads is a major factor affecting wildlife disturbance and avoidance (Gruell et al. 1976, Livezey 1991, Lovallo and Anderson 1996, Morgantini and Hudson 1977, Perry and Overly 1974). Use is expected to increase on remaining open roads, since there would be fewer roads available to drive on. These changes would likely increase disturbance to wildlife species in those areas while decreasing impacts to wildlife on all undesignated routes.

Designating 29,581 acres of camping corridors would focus motorized camping on approximately 4 percent of the ponderosa pine potential natural vegetation type. Motorized camping could still occur within a car length of any open road. Camping could increase some along these roads due to displaced campers who would no longer be able to access the 2,520 miles of closed roads. Increased densities in camping corridors and along non-corridor roads would result in increased disturbance to wildlife in those areas. However, since unrestricted cross-country travel would be prohibited, and 60.7 percent of existing roads would be closed to public use, motorized camping use would decrease in the remainder of the ponderosa pine potential natural vegetation type. This would reduce noise and disturbance and improve habitat quality for MIS.

Alternative 3 would allow motorized big game retrieval for elk in the portions of game management units 7W and 8 that occur on the Forest, or 39,031 acres of ponderosa pine habitat. This is 5.2 percent of the ponderosa pine habitat currently open to motorized big game retrieval. It is expected that there would be an average of 74 off-road vehicle trips per year for game retrieval in game management units 7W and 8. This is expected to be generally insignificant as the hunting and killing of elk, mule deer and turkey are generally of much greater impact on MIS populations than use of infrequent motor vehicle use to retrieve the harvest.

Alternative 3 would not change the amount or age class distribution of indicator habitat. Habitat quality could improve, given the elimination of cross-country travel and reductions in the amount of open roads, motorized trails, and motorized big game retrieval, lessening disturbance to MIS. Addition of 6.4 miles of unauthorized roads, increased use within designated motorized camping corridors, and the large amount of the ponderosa pine cover type that would remain within ½ mile of a road moderates this improvement to habitat quality somewhat. While this alternative may result in some improvement to habitat quality, it would be unlikely that these changes would impact reproductive success to the degree that Forestwide population change would occur. Overall, this alternative is not expected to change Forestwide habitat or population trends for ponderosa pine MIS.

The effects of this alternative may combine with other activities to result in a beneficial cumulative effect to ponderosa pine dependent MIS species over a much broader area. For example, similar efforts to manage motor vehicle use are occurring on the Kaibab, Tonto, and Apache-Sitgreaves National Forests, which cover a majority of the ponderosa pine habitat in Arizona. Additionally forest restoration efforts such as those currently being planned under 4FRI are expected to result in cumulatively beneficial effects of maintaining and improving early, mid, and late seral stage ponderosa pine habitat across the ponderosa pine belt in Arizona for the next several decades.

Alternative 4 – Direct, Indirect, and Cumulative Effects: Effects from this alternative would be similar to those described under alternative 3, though this alternative would close 2309 miles (55.6 percent) of road to public use and 28.7 miles (40.4 percent) of motorized trail within the ponderosa pine potential natural vegetation type, which is a closure of 211 miles less road and 17.3 miles less motorized trail than under alternative 3. In the ponderosa pine potential natural vegetation type, 8.0 miles of unauthorized roads and 18 miles of motorized trail would be added to the system and be open for public travel.

Alternative 4 would allow motorized big game retrieval up to one mile off of all designated routes on the Forest, which equals 740,234.4 acres of ponderosa pine habitat. This is 99.4 percent of the ponderosa pine habitat currently open to motorized big game retrieval.

Alternative 4 would not change the amount or age class distribution of indicator habitat. Overall, this alternative is not expected to change Forestwide habitat or population trends for ponderosa pine management indicator species, but would provide fewer benefits and have greater impacts from disturbance compared to alternative 3.

Red Squirrel

Existing Condition

The Forest Plan designates the red squirrel as an indicator for late-seral mixed-conifer and spruce fir habitat. There are 461.7 miles of road and 36.63 miles of motorized trail within the mixed conifer potential natural vegetation type, and 12.0 miles of road and 0 miles of motorized trail within the spruce-fir potential natural vegetation type. More information on the red squirrel can be found in the Wildlife specialist report.

Environmental Consequences to Mexican Spotted Owl and Red Squirrel - Mixed Conifer and Spruce-fir Indicator Habitat

Alternative 1 – Direct, Indirect, and Cumulative Effects: There would be no direct effects to early, mid or late seral structural stage quantity in the mixed-conifer or spruce fir potential natural vegetation types. Therefore there would be no effects to indicator habitat quantity for the Mexican spotted owl or red squirrel. There may, however, be indirect effects from continuing use of the road system to key habitat elements. The presence of roads open to motorized travel, however, may result in a decline over time in large snags and large downed trees (Wisdom and Bate 2008). These are key habitat components to late seral stage mixed conifer and spruce-fir forests (USDA Forest Service 1987: 65-5 p.).

Use of roads and motorized trails, off-road travel and dispersed camping could cause noise disturbance within all structural stages of mixed conifer and spruce fir.

This alternative would most strongly affect important habitat elements (large snags and downed logs) relating to forest structure and habitat for prey species. The removal and loss of snags and downed logs under this alternative would result in a cumulative impact from powerline construction and maintenance, development of private lands, removal of hazard trees on Forest System roads and trails and nonjurisdictional roads, and increased wildfire severity resulting from climate change. This alternative would also contribute along with the aforementioned activities to cumulative effects of disturbance to individuals of these species.

Studies in northern Arizona have concluded that most mixed-conifer plots met or exceeded Forest Service guidelines for retention of large logs (Ganey and Vojta 2010), yet long-term changes in climate could increase the mortality of large trees in higher elevation forest types from drought or wildfire (Marlon et. al. 2009, Van Mantgem et. al. 2009), potentially resulting in a long-term cumulative decrease in snags and large downed woody debris. This alternative would cumulatively contribute to a decrease in key habitat components such as snags and large woody debris that are expected to be at risk from future ecological change.

Alternative 3 – Direct, Indirect, and Cumulative Effects: There would be no direct effects to early, mid or late seral structural stage quantity in the mixed-conifer or spruce-fir potential natural vegetation types with implementation of alternative 3. Therefore, there would be no direct effects to indicator habitat quantity for the Mexican spotted owl or red squirrel.

This alternative would close 310.7 miles (65.6 percent) of roads to public use and 31.9 miles (87.2 percent) of motorized trail within mixed conifer and spruce-fir potential natural vegetation types. Closure of roads, motorized trails and off road travel in this indicator habitat could reduce noise and disturbance and improve habitat quality for Mexican spotted owls and red squirrels. However, even with 65.6 percent of existing roads and 87.2 percent of existing trails being closed to public use within mixed conifer and spruce-fir potential natural vegetation types , approximately 78.6 percent of Forest lands outside of designated wilderness areas would be within ½ mile of an open road. In mixed-conifer, 1.3 miles of unauthorized road would be added to the road system and open for public use; no miles would be added in spruce-fir. No unauthorized motorized trails would be added to the system in either potential natural vegetation type. Use is expected to increase on remaining open roads, since there will be fewer roads available to drive on, increasing disturbance to wildlife species in those areas (Gruell et al. 1976, Livezey 1991, Lovallo and Anderson 1996, Morgantini and Hudson 1977, Perry and Overly 1974).

Designating 3,219 acres of motorized camping corridors would focus motorized camping on approximately 4.6 percent of the mixed conifer potential natural vegetation type (no acres designated in the spruce-fir potential natural vegetation type). Motorized camping could still occur within a car length of any open road. Camping could increase some along these roads due to displaced campers who would no longer be able to access the 310.7 miles of closed roads. Increased use in camping corridors and along non-corridor roads would result in increased disturbance to wildlife in those areas. However, since unrestricted cross-country travel would be prohibited, and 65.6 percent of existing roads would be closed to public use, motorized camping use would decrease in the remainder of the mixed conifer and spruce-fir potential natural vegetation types. This would reduce noise and disturbance and improve habitat quality.

Alternative 3 would allow motorized big game retrieval in the portions of game management units 7W and 8 for elk, or 1,658 acres of mixed conifer habitat (no spruce-fir habitat is open to motorized big game retrieval). This is 2.4 percent of the mixed conifer habitat currently open to motorized big game retrieval. Thus effects from the average estimated 74 off-road vehicle trips per year for elk retrieval would have very infrequent only a very limited potential impact to mixed-conifer habitat on the forest.

Alternative 3 would not change the amount or age class distribution of indicator habitat. Habitat quality could improve, given the reduction of off-road motorized travel and reductions in the amount of open roads, motorized trails, and motorized big game retrieval, lessening disturbance

to MIS and decreasing the potential of decline of large snags and downed trees, which are key elements of late seral stage forests (USDA Forest Service 1987: 65-5 p.).

The addition of 1.3 miles of unauthorized roads, increased use within designated motorized camping corridors, and the large proportion of the Forest that would remain within ½ mile of a road moderates this improvement to habitat quality somewhat. While this alternative may result in some improvement to habitat quality, it would be unlikely that these changes would impact reproductive success to the degree that Forestwide population change would occur. Overall, this alternative is not expected to change Forestwide habitat or population trends for mixed conifer and spruce-fir MIS.

The effects of this alternative may combine with other activities to result in a beneficial cumulative effect to mixed conifer and spruce-fir habitat quality over a much broader area. For example similar efforts to manage motor vehicle use are occurring on the Kaibab, Tonto, and Apache-Sitgreaves National Forests, which cover a majority of the mixed conifer and spruce-fir habitat in Arizona.

This alternative would likely have a slight counteractive effect when considering the cumulative impacts of loss and fragmentation of later seral mixed conifer and spruce-fir habitat caused by large-scale high-intensity wildfire such as the 2011 Wallow fire and 2010 Schultz fire. This alternative is expected to result in an overall effect of decreasing impacts to mixed conifer habitat and decreasing disturbance to the species that use it for habitat. This alternative‘s reduction of roads to improve habitat is supported by studies that have found “…the best method for attaining full use of habitat appears to be effective road closures.” (Lyon 1983).

Alternative 4 – Direct, Indirect, and Cumulative Effects: Effects from this alternative would be similar to those described under alternative 3, though this alternative would close 279.2 miles (58.9 percent) of roads to public use and 1.2 miles (3.3 percent) of motorized trail within mixed conifer and spruce-fir potential natural vegetation types. This is 31.5 fewer miles of road and 30.7 fewer miles of motorized trail that would be closed compared to alternative 3. A total of 30.8 miles of unauthorized motorized trails would be added to the system with alternative 4.

Alternative 4 would allow motorized big game retrieval up to one mile off of all designated routes on the Forest, which equals 70,808.2 acres of mixed conifer and spruce-fir habitat. This is 97.2 percent of the mixed conifer and spruce-fir currently open to motorized big game retrieval. This alternative would result in up to 3,000 off-road vehicle trips per year in all habitat types; which could cause disturbance to species in these habitats, but likely would not result in any long-term (more than 1 year) impacts to habitat.

Overall, this alternative is not expected to change Forestwide habitat or population trends for mixed conifer and spruce-fir MIS, but would provide fewer benefits and have greater impacts from disturbance compared to alternative 3.

Elk

Existing Condition

Elk is an indicator of early seral stages of ponderosa pine, mixed conifer, and spruce-fir forests. There are 4,623.9 miles of road and 107.7 miles of motorized trail within the ponderosa pine,

mixed conifer and spruce-fir potential natural vegetation types. For more information on elk, refer to the Wildlife specialist report.

Hairy Woodpecker

Existing Condition

This species is an indicator of snags in ponderosa pine, mixed conifer, and spruce-fir forests for suitable nesting and feeding habitat. There are 4,623.9 miles of road and 107.7 miles of motorized trail within the ponderosa pine, mixed conifer and spruce-fir potential natural vegetation types. For more information on the hairy woodpecker, please see the Wildlife specialist report.

Environmental Consequences to Elk and Hairy Woodpecker - Ponderosa Pine, Mixed Conifer, and Spruce-fir Indicator Habitat

Alternative 1 – Direct, Indirect, and Cumulative Effects: For the effects of this alternative on ponderosa pine, see the No Action analysis in the "Abert's Squirrel, Goshawk, Pygmy Nuthatch, and Turkey" section above.

For the effects on mixed conifer and spruce-fir, see the No Action analysis in the "Mexican Spotted Owl and Red Squirrel" section above.

Additionally, under the No Action alternative, wood and forest product harvesting would continue. Snags along roads and campsites that pose a hazard would continue to be removed, reducing this indicator habitat for the hairy woodpecker. Species dependent on large snags, particularly cavity nesting birds, are vulnerable to increases harvest of these structures along roads.

Alternative 3 – Direct, Indirect, and Cumulative Effects: For the effects of this alternative on ponderosa pine, see the alternative 3 analysis in the "Abert's Squirrel, Goshawk, Pygmy Nuthatch, and Turkey" section above.

For the effects on mixed conifer and spruce-fir, see the alternative 3 analysis in the "Mexican Spotted Owl and Red Squirrel" section above.

Alternative 3 is not expected to change Forestwide trends for ponderosa pine, mixed conifer, and spruce-fir indicator species and their habitats. Similarly, this alternative is not expected to change Forestwide trends for elk.

For hairy woodpeckers and the snag component, road closures would reduce the need to remove snags that may have posed a hazard to motorist using these roads. Designation of camping corridors may have the effect of concentrating use, removal of hazard trees, and activities such as fuelwood gathering in these areas. This would impact snags within and near camping corridors designated in indicator habitat potential natural vegetation types. Though there would be impacts on key habitat elements in localized areas (where camping and use occurs), the restriction of motorized access would reduce the overall amount of snag deficits (Wisdom and Bate 2008).

Overall, there may be more snags within indicator potential natural vegetation types for the hairy woodpecker. The current Forestwide trend is declining for ponderosa pine snags, increasing for mixed conifer, and stable for pinyon-juniper. Despite recent high-intensity wildfires (e.g., 2010

Schultz fire) that have created large tracts of burned forest with abundant snags, these snags will fall in 7 to 10 years and would provide fewer potential snags over the long-term (more than 10 years). This alternative would contribute positively to habitat trend due to fewer hazard trees being removed and less motorized access for personal fuelwood gathering, but greater impacts within camping corridors moderates this effect to some degree. It would be unlikely that these changes would impact reproductive success to the degree that Forestwide population change would occur. Overall, Forestwide habitat and population trends for the hairy woodpecker are not expected to change under this alternative.

The effects of this alternative may combine with other activities to result in a beneficial cumulative effect to ponderosa pine, mixed conifer, and spruce-fir habitat over a much broader area. For example similar efforts to manage motor vehicle use are occurring on the Kaibab, Tonto, and Apache-Sitgreaves National Forests, which cover a majority of the ponderosa pine, mixed conifer and spruce-fir habitat in Arizona and would contribute to the beneficial cumulative impacts of more snags over the long term. Additionally large-scale forest restoration projects such as 4FRI are expected to reduce the risk of high-severity wildfire, which would also cumulatively increase the amount of snags in ponderosa pine habitat and potentially low elevation mixed conifer habitat in the long-term.

Alternative 4 – Direct, Indirect, and Cumulative Effects: For the effects of this alternative on ponderosa pine, see the alternative 4 analysis in the "Abert's Squirrel, Goshawk, Pygmy Nuthatch, and Turkey" section above.

For the effects on mixed conifer and spruce-fir, see the alternative 4 analysis in the "Mexican Spotted Owl and Red Squirrel" section above.

Alternative 4 is not expected to change Forestwide trends for ponderosa pine, mixed conifer, and spruce-fir indicator species and their habitats, but would provide fewer benefits and have greater impacts from disturbance compared to alternative 3.

Red-naped Sapsucker

Existing Condition

The red-naped sapsucker is a management indicator species for late seral stage and snag component for aspen. This analysis uses the mixed conifer potential natural vegetation type to indicate effects of the project, since most aspen is contained within that potential natural vegetation type. There are 461.7 miles of road and 36.8 miles of motorized trail within the mixed conifer potential natural vegetation type. More information on the red-naped sapsucker can be found in the Wildlife specialist report.

Environmental Consequences to Red-naped Sapsucker - Aspen Indicator Habitat

Alternative 1 – Direct, Indirect, and Cumulative Effects: There would be no direct effects to early, mid or late seral structural stage quantity in the mixed-conifer potential natural vegetation type, which includes most of the aspen on the Forest. Therefore, there would be no effects to indicator habitat quantity for the red-naped sapsucker.

Motorized use authorized under this alternative could result in cumulative effects to disturbance of sapsuckers from other activities causing disturbance in mixed conifer habitat such as implementation of vegetation management activities, hunting, and fuelwood harvest.

Alternative 3 – Direct, Indirect, and Cumulative Effects: This alternative closes 301.3 miles (65.3 percent) of roads to public use and 31.9 miles (87.2 percent) of motorized trail within mixed conifer potential natural vegetation type. There would be no effects to early, mid or late seral structural stage quantity in the mixed-conifer potential natural vegetation type with implementation of alternative 3. Therefore, there would be no effects to indicator habitat quantity for the red-naped sapsucker.

In mixed-conifer, 1.3 miles of unauthorized road would be added to the road system and open for public use under both action alternatives. No unauthorized motorized trails would be added in mixed conifer habitat.

Designating 3,218.7 acres of camping corridors would focus motorized camping on approximately 4.6 percent of the mixed conifer potential natural vegetation type. Motorized camping can still occur within a car length of any open road. Increased use in camping corridors and along non-corridor roads would result in increased disturbance to wildlife in those areas. Fuelwood gathering and hazard tree management are expected to impact snags within and near motorized camping corridors. However, since motorized off-road use would be restricted, and 65.3 percent of existing roads would be closed to public use, motorized camping use would decrease in the remainder of the mixed conifer potential natural vegetation type. This would reduce noise and disturbance and improve habitat quality.

Alternative 3 would allow motorized big game retrieval in 1,658 acres of mixed conifer habitat (in game management units 7W and 8). This is 2.4 percent of the mixed conifer habitat currently open to motorized big game retrieval. An estimated 74 off-road vehicle trips per year would occur for retrieval of elk, which may result in the potential for low-frequency disturbance from motor vehicle noise. This effect is also considered to be very low impact since off-road travel for game retrieval would occur outside of the breeding seasons for most wildlife.

Alternative 3 would not change the amount or age class distribution of indicator habitat. Habitat quality could improve, given the elimination of cross-country travel and reductions in the amount of open roads, motorized trails, and motorized big game retrieval, lessening disturbance to MIS. The snag component would benefit from fewer hazard trees being removed (since fewer miles of roads would be open), and less motorized (Wisdom and Bate 2008). The addition of 1.3 miles of unauthorized roads, increased use within designated motorized camping corridors, and the large proportion of the Forest that would remain within ½ mile of a road moderates this improvement to habitat quality. While this alternative may result in some improvement to habitat quality, it would be unlikely that these changes would impact reproductive success to the degree that Forestwide population change would occur. Overall, this alternative is not expected to change Forestwide habitat or population trends for red-naped sapsuckers.

This alternative is expected to result in a beneficial cumulative effect when considered in conjunction with the effects of similar travel management planning efforts on the Kaibab and Apache-Sitgreaves national forests. Additionally, large-scale high-elevation wildfires such as the 2010 Schultz fire and forest restoration efforts such as 4FRI, Hart Prairie Fuels Reduction and forest Restoration Project, and the Wing Mountain Fuels Reduction and Forest Restoration Project are expected to result in increased aspen patches over the long-term, which combined with this alternative would result in more large aspen trees and snags over the following several decades.

Alternative 4 – Direct, Indirect, and Cumulative Effects: Effects from this alternative are similar to those described under alternative 3. There would be no effects to early, mid or late seral structural stage quantity in the mixed-conifer potential natural vegetation type with implementation of alternative 4. Therefore, there would be no effects to indicator habitat quantity for the red-naped sapsucker.

This alternative would close 269.9 miles (58.5 percent) of roads to public use and 1.2 miles (3.3 percent) of motorized trail within mixed conifer potential natural vegetation type, which is 31.4 miles and 30.7 miles less than alternative 3, respectively. In mixed conifer, 30.8 miles of motorized trail would be added to the road system and open for public use.

Alternative 4 would allow motorized big game retrieval up to one mile off of all designated routes for retrieval of elk on the Forest, which equals 69,036.6 acres of mixed conifer habitat. This is 98.4 percent of the mixed conifer potential natural vegetation type currently open to motorized big game retrieval.

While this alternative may result in some improvements and some negative impacts to habitat quality, it would be unlikely that these changes would impact reproductive success to the degree that Forestwide population change would occur.

Juniper Titmouse

Existing Condition

Juniper titmouse is an indicator of late seral and snag component of pinyon-juniper and is represented by the pinyon-juniper woodland and pinyon-juniper evergreen shrub potential natural vegetation types. There are 1,685.9 miles of roads and 5.8 miles of motorized trails within the pinyon-juniper potential natural vegetation types. For more information on the juniper titmouse, see the Wildlife specialist report.

Environmental Consequences to Juniper Titmouse - Pinyon-Juniper Indicator Habitat

Alternative 1 – Direct, Indirect, and Cumulative Effects: There would be no direct effects to early, mid or late seral structural stage acreage in the pinyon-juniper (pinyon-juniper evergreen shrub and pinyon-juniper woodland potential natural vegetation types). However, continued wood and forest product harvesting would continue. Snags along roads and campsites that pose a hazard would continue to be removed reducing this indicator habitat for the juniper titmouse. Species dependent on large snags, particularly cavity nesting birds, are vulnerable to increases in harvest of these structures along roads. Therefore, there would be no direct or indirect effects to the overall acreage of indicator habitat for the juniper titmouse, but the snag component would continue to be impacted.

Under the No Action alternative, continued unrestricted off-road travel and use of roads and motorized trails and camping would continue in pinyon-juniper habitats. Use of roads and motorized trails, cross-country travel and motorized dispersed camping could cause noise disturbance within all structural stages of pinyon-juniper, causing displacement and avoidance of areas within these indicator habitats.

This alternative would be additive to other activities that cause disturbance to the juniper titmouse causing a cumulative effect. Other activities that could result in displacement of juniper titmouse include recreational use (such as at Fossil Creek or Jacks Canyon), vegetation management,

access and maintenance of utility corridors, use and maintenance of nonjurisdictional roads, and development of recreation infrastructure in pinyon-juniper habitats.

Alternative 3 – Direct, Indirect, and Cumulative Effects: There would be no effects to early, mid or late seral structural stage quantity in pinyon-juniper with implementation of alternative 3. Therefore, there would be no effects to quantity of indicator habitat for the juniper titmouse.

This alternative closes 909.8 miles (54.0 percent) of roads to public use and 2.8 miles (48.3 percent) of motorized trail within the pinyon-juniper. Closure of roads, motorized trails and off road travel in this indicator habitat could reduce noise and disturbance and improve habitat quality for the juniper titmouse. In pinyon-juniper, 18.3 miles of unauthorized roads and no unauthorized motorized trails would be added to the system and be open for public travel.

Additionally, for the snag component in pinyon-juniper, road closures would reduce the need to remove snags that may have posed a hazard to motorist using these roads. The restriction of cross-country travel and the reduction in miles of roads open to public travel could reduce the likelihood of reduced pinyon and juniper snags along roads (Wisdom and Bate 2008).

Designating 5,957 acres of camping corridors would focus motorized camping on approximately 1 percent of pinyon-juniper habitats potential natural vegetation type. Impacts from camping corridors are the same as those described for the red-naped sapsucker under alternative 3.

Alternative 3 would allow motorized big game retrieval in 3,450.4 acres of pinyon-juniper. This is 0.6 percent of pinyon-juniper habitat currently open to motorized big game retrieval. However, since elk primarily occur in ponderosa pine and higher elevation forests, the frequency of off-road vehicle use for elk retrieval in pinyon-juniper vegetation is very low and considered negligible.

While this alternative may result in some improvement to habitat quality, it would be unlikely that these changes would impact reproductive success to the degree that Forestwide population change would occur. Overall, this alternative is not expected to change Forestwide habitat or population trends for the juniper titmouse.

Alternative 4 – Direct, Indirect, and Cumulative Effects: Effects from this alternative are similar to alternative 3. Alternative 4 would close 870.2 miles (51.6 percent) of roads to public use and 2.8 miles (48.3 percent) of motorized trail within pinyon-juniper. In addition, 19.6 miles of unauthorized roads would be added to the system and be open for public travel, which is 1.3 miles more than alternative 3.

Alternative 4 would allow motorized big game retrieval up to one mile off of all designated routes on the Forest, which equals 465,844.9 acres of pinyon-juniper habitat. This is 95.1 percent of the pinyon-juniper habitat currently open to motorized big game retrieval. Effects are the same as those described for motorized big game retrieval under alternative 3.

This alternative is not expected to change Forestwide habitat or population trends for the juniper titmouse, but would provide fewer benefits and greater impacts from disturbance compared to alternative 3.

Mule Deer

Existing Condition

The Forest Plan designates mule deer as an indicator of early seral stages of aspen and pinyon-juniper woodlands (table 41). There are 1,685.9 miles of road and no motorized trail within the pinyon-juniper potential natural vegetation types and 461.7 miles of road and 36.6 miles of motorized trail within the mixed conifer potential natural vegetation type. More information on mule deer can be found in the Wildlife specialist report.

Environmental Consequences to Mule Deer – Aspen and Pinyon-juniper Indicator Habitat

Alternative 1 – Direct, Indirect, and Cumulative Effects: For the effects of this alternative on aspen, see the No Action analysis in the "Red-naped Sapsucker" section above.

For the effects on pinyon-juniper habitats, see the No Action analysis in the "Juniper Titmouse" section above.

Alternative 3 – Direct, Indirect, and Cumulative Effects: For the effects of this alternative on aspen, see the alternative 3 analysis in the "Red-naped Sapsucker" section above.

For the effects on pinyon-juniper habitats, see the alternative 3 analysis in the "Juniper Titmouse" section above.

Alternative 3 is not expected to change Forestwide trends for aspen and pinyon-juniper indicator species and their habitats. Similarly, this alternative is not expected to change Forestwide trends for mule deer.

Alternative 4 – Direct, Indirect, and Cumulative Effects: For the effects of this alternative on aspen, see the alternative 4 analysis in the "Red-naped Sapsucker" section above.

For the effects on pinyon-juniper habitats, see the alternative 4 analysis in the "Juniper Titmouse" section above.

Alternative 4 is not expected to change Forestwide trends for aspen and pinyon-juniper indicator species and their habitats, but would provide fewer benefits and have greater impacts from disturbance compared to alternative 3.

Pronghorn Antelope

Existing Condition

Pronghorn antelope is a MIS for early and late seral grassland type, which is represented by Montane Subalpine Grassland, Great Basin Grassland and Semi-desert Grassland potential natural vegetation types. There are 1,098.8 miles of roads and 9.5 miles of motorized trails within these grassland habitats. For more information on pronghorn antelope, see the Wildlife specialist report.

Environmental Consequences to Pronghorn Antelope - Grassland Indicator Habitat

Alternative 1 – Direct, Indirect, and Cumulative Effects: Continued cross-country use in grassland potential natural vegetation types (Semi-desert Grasslands, Great Basin Grasslands, and Montane/subalpine Grassland) and on unsatisfactory, impaired or inherently unstable soils or soils

with moderate and severe erosion hazard poses substantial risk to long-term soil productivity and water quality. This alternative would allow for the most impact to indicator habitat for pronghorn antelope.

Under this alternative, unrestricted off-road motorized use would likely continue to impact pronghorn populations on the forest by causing disturbance and avoidance of habitat near roads (Ockenfels et al. 2006). Studies on wildlife show that some species react very strongly to off-road motorized use (Wisdom et al. 2004). This is especially true in more open habitat types such as in portions of Anderson Mesa where grassland habitat pronghorn is most abundant (Perry and Overly 1974).

This alternative would contribute to cumulative effects of disturbance and increased soil erosion and thus decreased grassland vegetation when combined with activities including utility line construction, access, and maintenance such as under the Grapevine Canyon Wind Project; livestock grazing, and private land development.

Alternative 3 – Direct, Indirect, and Cumulative Effects: This alternative closes 588.7 miles (54 percent) of roads and 5.4 miles of unauthorized motorized trails within the Great Basin Grassland, Montane/Subalpine Grassland, and Semi-desert Grassland PNVTS. Within these potential natural vegetation types , 2.6 miles of unauthorized roads and 1.1 miles of unauthorized motorized trails would be added to the system and be open to public use. Use is expected to increase on remaining open roads, since there would be fewer roads available to drive on, increasing disturbance to wildlife in those areas.

Designating 4,413 acres of camping corridors within grassland habitats would focus motorized camping on approximates 1.8 percent of the grassland potential natural vegetation types. Increased densities within camping corridors and along non-corridor roads would result in increased disturbance in those areas. However, since off-road motorized use would be restricted, and 54 percent of existing roads in grasslands would be closed to public use, motorized camping use would decrease in the remainder of grassland habitat. This would improve the quality of indicator habitat for pronghorn overall by reducing fragmentation and disturbances.

Alternative 3 would allow motorized big game retrieval in 5,191.6 acres of grassland habitat. This is 2.1 percent of grassland habitat that is currently open to motorized big game retrieval. This would completely close all off-road motorized travel for game retrieval in important grassland habitat in Anderson Mesa (game management units 5A and 5B) and minimize disturbance to pronghorn.

The 2.6 miles of new roads added to the system represents a minor decrease in the amount of grassland indicator habitat; however, pronghorn's ability to use habitats may increase with the restriction on off-road travel, and reductions in open roads, motorized trails, and motorized big game retrieval. The addition of 2.6 miles of unauthorized roads and 1.8 miles of motorized trails, increased use within designated motorized camping corridors, and the large proportion of the Forest that would remain within ½ mile of a road moderates this improvement to habitat quality somewhat. While this alternative may result in some improvement to habitat quality, it would be unlikely that these changes would impact reproductive success to the degree that Forestwide population change would occur. Overall, this alternative is not expected to change Forestwide habitat or population trends for pronghorn.

Alternative 4 – Direct, Indirect, and Cumulative Effects: Effects from this alternative are similar to alternative 3, though under alternative 4, 2.8 miles more of roads and 1.1 miles more of trail would remain open. Within the potential natural vegetation types , 5.6 miles of unauthorized roads and 2.9 miles of unauthorized motorized trails would also be added to the system and open to public use.

Alternative 4 would allow motorized big game retrieval for elk only up to one mile off of all designated routes on the Forest, which equals 231,794.4 acres of grassland habitat. This is 92.8 percent of grassland habitat currently open to motorized big game retrieval. This alternative would result in an overall decrease in off-road travel in grassland habitat by limiting motorized big game retrieval to elk only and restricting off-road travel for other activities. Motorized big game retrieval for elk under this alternative would include portions of Anderson Mesa (game management units 5A and 5B), which include primary habitat for pronghorn on the Coconino. It is estimated there would be over 1,000 off-road vehicle trips per year on Anderson Mesa under this alternative, which could result in a moderate to high level of disturbance during the hunting season (October and November). This level of off-road travel would result in disturbance to pronghorn.

Overall, this alternative is not expected to change Forestwide habitat or population trends for pronghorn, but would provide fewer benefits and greater impacts from disturbance compared to alternative 3.

Lincoln's Sparrow

Existing Condition

Lincoln's sparrow is an indicator for late seral, high elevation riparian (more than 7,000 feet) and is represented by the montane willow and mixed broadleaf riparian forest potential natural vegetation types. There are 6.1 miles of road and no motorized trail within the montane willow riparian forest and the mixed broadleaf deciduous riparian forest potential natural vegetation types. The Wildlife specialist report contains more information on the Lincoln's sparrow.

Environmental Consequences to Lincoln's Sparrow - High Elevation Riparian Indicator Habitat

Alternative 1 – Direct, Indirect, and Cumulative Effects: Under this alternative, off-road motorized use and traffic on roads in riparian habitat is expected to continue and pose risk to riparian function (Soil and Water specialist report 2008). In addition to roads in riparian vegetation, repeated off-road travel has contributed to riparian degradation by churning up and removing riparian vegetation and has contributed to streambank erosion and instability (see Soil and Water specialist report 2010). This alternative has the highest potential for habitat degradation to indicator habitat for Lincoln's sparrow.

This alternative would contribute to cumulative effects of potential Lincoln's sparrow habitat within the Coconino National Forest by resulting in continued degradation of riparian habitat that is also occurring from activities including livestock grazing, streamside recreational use such as at Fossil Creek and West Clear Creek, and recreation and infrastructure development in riparian areas.

Alternative 3 – Direct, Indirect, and Cumulative Effects: Under this alternative, there would be no change to the amount of riparian indicator habitat. Alternative 3 would close 0.6 miles (31.6 percent) of roads in the montane willow potential natural vegetation type. Use is expected to increase on remaining open roads, since there would be fewer roads available to drive on, increasing disturbance to wildlife species in those areas. No unauthorized roads would be added to the system of roads. No motorized trails currently exist, and none would be added in this vegetation type. In addition, no camping corridors will be designated within montane willow habitat.

Alternative 3 would allow motorized big game retrieval in the portions of game management units 7W and 8 that occur on the Forest, but there is no cottonwood willow or mixed broadleaf habitat within these game management units and thus all motorized use associated with big game retrieval would have no effect to the sparrow under this alternative.

This alternative would result in improvement to habitat quality, but it would be unlikely that these changes would impact reproductive success to the degree that Forestwide population trend would occur. This alternative would result in a cumulative beneficial effect to the quality of cottonwood willow and mixed broadleaf habitat due to similar effects resulting from travel management planning efforts on the Apache-Sitgreaves, Tonto, and Prescott national forests. Additionally, implementation of the Verde Wild and Scenic River Management Plan, and interim protection measures currently in place and development of a management plan for the Fossil Creek wild and scenic river will also result in cumulative habitat improvements to these vegetation types.

Alternative 4 – Direct, Indirect, and Cumulative Effects: Effects from this alternative would be similar to alternative 3, though alternative 4 would close 0.5 miles (26.3 percent) of roads in the montane willow potential natural vegetation type. Currently, motorized big game retrieval is allowed in 279.7 acres of montane willow potential natural vegetation type. Alternative 4 would continue to allow motorized big game retrieval on those acres of habitat. This would likely result in minor short-term (less than 1 year) impacts to habitat.

This alternative would result in improvement to habitat quality, but it would be unlikely that these changes would impact reproductive success to the degree that Forestwide population trend would occur.

Lucy's Warbler

Existing Condition

Lucy's warbler can be found in mesquite forests of the desert southwest and in mountain foothills. Lucy's warbler is an indicator for late seral, low elevation riparian zones (less than 7,000 feet). There are 4.8 miles of road and no motorized trails within the Cottonwood Willow potential natural vegetation type that represents low elevation riparian habitat. More information on Lucy's warbler can be found in the Wildlife specialist report.

Yellow-breasted Chat

Existing Condition

The yellow-breasted chat is a common species within its habitat. It is an indicator for late seral, low elevation riparian zones (less than 7,000 feet). There are 4.8 miles of road and no motorized trails within the Cottonwood Willow potential natural vegetation type that represents low

elevation riparian habitat. More information on the yellow-breasted chat can be found in the Wildlife specialist report.

Environmental Consequences to Lucy's Warbler and Yellow-breasted Chat - Low Elevation Riparian Indicator Habitat

Alternative 1 – Direct, Indirect, and Cumulative Effects: Under this alternative, unrestricted off-road motorized use and travel on roads is expected to continue and pose risk to riparian function (Soil and Water specialist report 2011). This alternative has the highest potential for habitat degradation to indicator habitat for Lucy's warbler and yellow-breasted chat.

This alternative would result in cumulative effects of degradation of cottonwood willow habitat in areas where high-impact recreational use is currently impacting riparian vegetation such as in Fossil Creek or, to a lesser degree, portions of oak creek and west clear creek.

Alternative 3 – Direct, Indirect, and Cumulative Effects: Under this alternative, there would be no change to the amount of riparian indicator habitat. Alternative 3 would close 6.6 miles (73.3 percent) of roads within the cottonwood-willow and mixed broadleaf potential natural vegetation types. Use is expected to increase on remaining open roads, since there would be fewer roads available to drive on, increasing disturbance to wildlife species in those areas. Within the mixed broadleaf potential natural vegetation type, 0.3 miles (7.1 percent) of unauthorized roads would be added to the system and open for public use. No motorized trails currently exist, and none would be added.

Designating 31 acres of camping corridors within these riparian habitats would focus motorized camping on approximately 0.7 percent of the cottonwood willow and mixed broadleaf potential natural vegetation types. Camping could increase some along the 2.4 miles of roads that would remain open, which could result in increased disturbance to wildlife in those areas. However, since unrestricted cross-country travel would be prohibited, and 73.3 percent of existing roads would be closed to public use, motorized camping use would decrease in the remainder of these potential natural vegetation types.

There is no cottonwood willow or mixed broadleaf habitat within these game management units proposed for motorized big game retrieval and thus this alternative would remove all potential impact from off-road travel for game retrieval.

While this alternative would result in some improvement to habitat quality, it would be unlikely that these changes would impact reproductive success to the degree that Forestwide population trend would occur.

Alternative 4 – Direct, Indirect, and Cumulative Effects: Effects from this alternative are similar to those under alternative 3, though alternative 4 would close 0.2 fewer miles of roads.

Alternative 4 would allow motorized big game retrieval up to one mile off of all designated routes on the Forest which equals 2,226.6 acres of high elevation riparian currently open for motorized big game retrieval. This is 84.9 percent of cottonwood willow and mixed broadleaf riparian open to motorized big game retrieval. Since elk generally occur in high elevation areas, off-road motorized use for retrieval of elk under this alternative would likely result in a negligible impact to cottonwood willow and mixed broadleaf potential natural vegetation types.

This alternative would result in improvement to habitat quality, but it would be unlikely that these changes would impact reproductive success to the degree that Forestwide population trend would occur.

Cinnamon Teal

Existing Condition

Cinnamon teal is an indicator for wetlands and aquatic habitat. There are 14.6 miles of roads and no motorized trail within Wetland-Cienega and Water potential natural vegetation types that represent cinnamon teal habitats. There are 4.8 miles of road and no motorized trails within the Cottonwood Willow potential natural vegetation type that represents low elevation riparian habitat. More information on the cinnamon teal can be found in the Wildlife specialist report.

Environmental Consequences to Cinnamon Teal - Wetland Indicator Habitat

Alternative 1 – Direct, Indirect, and Cumulative Effects: Roads alter surface hydrology and water flow causing loss of water storage, vegetative productivity and wetland function (Soil and Water specialist report 2008). Under this alternative, OHV travel is expected to continue in these water and wetland areas and pose risk to wetland function (Soil and Water specialist report 2008). The No Action alternative has the highest potential for habitat degradation to cinnamon teal indicator habitat.

This alternative would continue to result in impacts to wetland areas that would result in cumulative effects with other activities resulting in wetland habitat degradation such as increased drought from climate change, recreational use of wetland areas, and livestock grazing.

Alternative 3 – Direct, Indirect, and Cumulative Effects: There would be no effects to the quantity of wetland-cienega habitat with implementation of alternative 3. Therefore, there would be no effects to indicator habitat quantity for cinnamon teal.

While this alternative would result in some improvement to habitat quality, it would be unlikely that these changes would impact reproductive success to the degree that Forestwide population trend would change.

Alternative 4 – Direct, Indirect, and Cumulative Effects: There would be no effects to the quantity of wetland-cienega habitat with implementation of alternative 4. Therefore, there would be no effects to indicator habitat quantity for cinnamon teal.

Alternative 4 would result in some improvement to habitat quality, but it would be unlikely that these changes would impact reproductive success to the degree that Forestwide population trends would change.

Migratory Birds

Existing Condition

The APIF Plan and the Birds of Conservation Concern identify priority species of concern. A total of 26 species have been identified as species of concern in Coconino National Forest habitats (see the Wildlife specialist report). Project effects to Western yellow-billed cuckoo, Southwestern willow flycatcher, common black hawk, Yuma clapper rail, Mexican spotted owl, northern

goshawk, ferruginous hawk, burrowing owl, red-naped sapsucker and juniper titmouse are discussed in detail under the Threatened, Endangered, Sensitive Species and MIS sections of this report and will not be discussed here.

There are two "important bird areas" on the Coconino National Forest, Anderson Mesa and Lower Oak Creek with 629.6 miles of road and no motorized trail within their boundaries. The Wildlife specialist report contains more information on migratory birds, the miles of existing roads and motorized trails, and the miles of roads and motorized trails that would be closed in each species' habitat under each action alternative.

Environmental Consequences to Migratory Birds

Alternative 1 – Direct, Indirect, and Cumulative Effects: Under the No Action Alternative, no road or motorized trail closures would occur in any migratory bird habitats. Unrestricted off-road motorized travel would continue to be allowed and unauthorized roads and motorized trails would likely increase as population growth would result in increasing demands for forest recreation. Under the No Action alternative road densities in important bird areas (629.6 miles) would continue to provide motorized access within these areas.

Effects of the No Action alternative on migratory bird habitat would continue to occur primarily in grasslands, pinyon-juniper woodlands, wetland and riparian habitats where soil conditions may lead to degradation of vegetation important in providing food and cover and nesting habitats for migratory birds using these habitats.

Direct harm or mortality from vehicle strikes or driving over ground nests would continue to occur. Additional direct harm or mortality could also occasionally occur from recreationists and other forest users trampling nests, knocking nests out of trees, and picking up nestlings or eggs. Since roads are present in all vegetation types that support priority migratory bird species and within important bird areas, some unintentional take is ongoing and would continue under the No Action, but is not likely to be occurring to such an extent to have a measurable negative effect on migratory bird populations.

This alternative would result in direct impacts to migratory birds and impacts to migratory bird habitat that would result in cumulative effects with activities such as wildfire and wildfire suppression activities, private land development, vegetation maintenance under utility lines, livestock grazing, and legal and illegal fuelwood harvest. In addition this alternative would continue to result in low-level population and habitat impacts that could eventually result in cumulative long-term effects to populations with increased drought-severity and vegetation changes resulting from climate change.

Alternative 3 – Direct, Indirect, and Cumulative Effects: In all potential natural vegetation type groupings that support priority migratory bird species, from 47.1 to 83.3 percent of existing roads would be closed to public use in alternative 3. Overall, 4,374.4 miles (58.6 percent) of roads would be closed in potential natural vegetation types used by priority migratory birds. This would reduce the potential for vehicles to strike birds along closed roads. Vehicle use would be more concentrated on remaining open roads, so more strikes could occur on those, but would be outweighed by the great reduction in motorized use. However, there would be 30.0 miles of unauthorized roads added to the system of roads open for public use in potential natural

vegetation types used by priority migratory bird species, which moderates this benefit to a small degree.

Within designated important bird areas, there would be a reduction of 354.4 miles (56.3 percent) of high-clearance vehicle roads within designated important bird areas. Passenger car roads would continue to provide motorized access to these important bird areas, but the reduction of roads and cross-country travel would reduce disturbance to birds and reduce the potential for vehicle strikes. There would be 2.0 miles of unauthorized roads added to the system of roads open for public use within important bird areas. This moderates the benefits of road closures to a small degree in important bird areas.

In all potential natural vegetation type groupings that support priority migratory bird species, from 48.3 to 87.2 percent of existing motorized trails would be closed to public use in alternative 3. This may benefit migratory birds, but the number of birds killed by users of motorized trails is probably minor. There would also be 1.8 miles of unauthorized trails added to the system of motorized trail open for public use in the Semi-desert Grassland potential natural vegetation type. This moderates the benefits of road closures to some degree in that potential natural vegetation type.

Under this alternative, 43,277.9 acres of camping corridors would be designated in potential natural vegetation type habitats for priority migratory birds. A subset of this total, 3,731.7 acres would be designated in important bird areas. There could be some take of migratory birds in designated corridors from recreationists knocking nests out of trees, picking up eggs or nestlings. Since camping corridors were generally designated in areas where motorized camping is already observed to be occurring, these impacts would not be new but may be intensified in designated camping corridors.

Alternative 3 would allow motorized big game retrieval on 49,331.0 acres (3.1) of potential natural vegetation type habitats for priority migratory birds. No motorized big game retrieval would occur within important bird areas.

Although the alternative would result in some unintentional take of migratory birds, the amount of vehicle strikes and recreation impacts is not likely to occur to an extent that there would be a measurable negative effect on migratory bird populations. Rather, the restrictions on off-road travel and reduction in road density would likely support an increase in migratory bird populations over time.

This alternative may result in cumulative impacts from the 32 miles of unauthorized routes and the additional impacts from designated camping corridors in important bird areas. Activities causing loss of vegetation and fragmentation of key bird habitats such as grasslands, pinyon-juniper, and riparian and wetland habitats such as livestock grazing, implementation of vegetation management projects, utility line construction and maintenance, private land development, streamside recreation, recreation infrastructure development and maintenance, and construction and maintenance of nonjurisdictional roads will combine with the impacts of this alternative to result in a cumulative degradation of key migratory bird habitat within localized areas. This alternative will contribute to a much larger cumulative effect of reducing degradation and fragmentation of grassland, pinyon-juniper, riparian and wetland habitats on which migratory birds and their prey species depend. Activities that may have similar impacts to this alternative resulting in this beneficial cumulative effect include similar travel management planning efforts

on the Tonto, Kaibab, Prescott, and Apache-Sitgreaves National Forests and several BLM managed lands; grassland, wetland, and pinyon-juniper restoration projects such as the Marshall Fuels Reduction and Forest Restoration Project, and projects such as development of a management plan for the Fossil Creek Wild and Scenic River, which is meant to decrease recreational impacts in several habitat types (including pinyon-juniper) and riparian along Fossil Creek.

By decreasing the amount of open motorized roads by 47.1 to 83.3 percent and trails by 48.3 to 87.2 percent in each habitat type, this alternative would reduce the widespread and ubiquitous impacts of motorized travel on disturbance, habitat degradation, and fragmentation which may slightly counteract the effects of climate change by providing slightly larger areas of refugia where key migratory bird habitats are less impacted from cumulative stresses of prolonged drought, increased temperatures, degradation from motorized travel, aural disturbances, and fragmentation.

Alternative 4 – Direct, Indirect, and Cumulative Effects: Effects for this alternative are similar to those discussed under alternative 3. In all potential natural vegetation type groupings that support priority migratory bird species, from 41.4 to 79.2 percent of existing roads would be closed to public use in alternative 4. Overall, 4,048.5 miles (54.7 percent) of roads would be closed in potential natural vegetation types used by priority migratory birds. However, there would be 35.9 miles of unauthorized roads added to the system of roads open for public use in potential natural vegetation types used by priority migratory bird species.

Within designated important bird areas, there would be a reduction of 326.6 miles (51.9 percent) of high-clearance vehicle roads within designated important bird areas. There would be 2.1 miles of unauthorized roads added to the system of roads open for public use within important bird areas.

In all potential natural vegetation type groupings that support priority migratory bird species, from 3.3 to 56.6 percent of existing motorized trails would be closed to public use in alternative 4. This represents a smaller proportion of motorized trails closed than with alternative 3. As with alternative 3, there would also be 1.8 miles of unauthorized trails added to the system of motorized trails open for public use in the Semi-desert Grassland potential natural vegetation type.

Acres and effects of camping corridors designated are the same as alternative 3.

Currently, motorized big game retrieval is allowed on between 1,434,592 acres and 1,496,246 acres (depending on time of year) of potential natural vegetation types used by priority migratory bird species. Alternative 4 would allow motorized big game retrieval up to one mile off of all designated routes for elk only, which equals 1,434,592 acres (95 percent) of potential natural vegetation type habitats for priority migratory birds. Within important bird areas, motorized big game retrieval could occur within 176,032.9 acres (95.3 percent) of areas currently open to motorized big game retrieval under the No Action. However, elk hunting occurs in some potential natural vegetation types more than others, so not all potential natural vegetation types would experience the same level of motorized big game retrieval.

This alternative is expected to result in almost 3,000 off-road vehicle trips per year for the retrieval of elk. Much of this would occur in important bird areas, which could cause direct or

indirect impacts to migratory birds. Overall, there could be greater disturbance (striking or driving over nests) to migratory birds from motorized big game retrieval than with alternative 3.

Alternative 4 would close fewer miles of roads and motorized trails and add more miles of unauthorized roads to the system than alternative 3. Alternative 4 continues to allow motorized big game retrieval on a much larger portion of potential natural vegetation types used by priority migratory birds than alternative 3. Although alternative 4 would result in some unintentional take of migratory birds, the amount of vehicle strikes and recreation impacts is not likely to occur to an extent that there would be a measurable negative effect on migratory bird populations.

Botany

This section describes the direct, indirect, and cumulative effects of implementing each alternative and consequences for noxious or invasive weeds and the threatened, endangered or Region 3 sensitive plants in the project area.

Noxious or Invasive Weeds

This discussion applies to the noxious or invasive weeds that are known to occur on the Coconino National Forest as well as to potential introductions of additional species. The species included in table 44 were analyzed in the "Final Environmental Impact Statement for Integrated Treatment of Noxious or Invasive Weeds" (USDA Forest Service 2005). The species are ranked on the perceived difficulty of control for each species as well the projected success of meeting the management objective of prevent, eradicate, contain or control. Factors considered in difficulty for control include the lifecycle of the plant (perennial vs. annual), mode(s) of reproduction, and population size. Projected success of control considers these factors and history of success locally and elsewhere.

Specific descriptions of each species can be found in the Botany specialist report, located in the project record.

Environmental Consequences to Noxious or Invasive Weeds

Cumulative Effects Common to all Alternatives

The boundary for this cumulative effects analysis is the Coconino National Forest and adjacent areas of the Kaibab, Tonto, and Apache-Sitgreaves National Forests in addition to state, county, and private lands within and adjacent to these boundaries. This discussion includes management actions related to noxious or invasive weeds since 1995. Prior to 1995, occurrences and distribution of noxious or invasive weeds on the forest were largely unknown. Beginning in 1995, the Forest began surveying and documenting noxious or invasive weed occurrences on the Coconino National Forest.

Table 44. Noxious or invasive weeds with occurrences on the Coconino National Forest

Common Name	Species	Species Rank	Objective
Leafy spurge	*Euphorbia esula*	1	Eradicate
Yellow starthistle	*Centaurea solstitialis*	2	Eradicate
Malta starthistle	*Centaurea melitensis*	3	Eradicate
Camelthorn	*Alhaghi pseudoalhagi*	4	Contain/Control
Russian knapweed	*Acroptilon repens*	5	Contain/Control
Whitetop	*Cardaria draba*	6	Eradicate
Mediterranean sage	*Salvia aethiopis*	7	Eradicate
Musk thistle	*Carduus nutans*	8	Eradicate
Diffuse knapweed	*Centaurea diffusa*	9	Contain/Control
Spotted knapweed	*Centaurea maculosa*	10	Eradicate
Scotch thistle	*Onopordum acanthium*	11	Eradicate/Control
Russian olive	*Elaeagnus angustifolia*	12	Contain/Control
Tamarisk	*Tamarix* spp.	13	Contain/Control
Himalayan blackberry	*Rubus procerus*	14	Contain/Control
Houndstongue	*Cynoglossum officinale*	15	Eradicate
Giant reed	*Arundo donax*	16	Contain/Control
Sulfur cinquefoil	*Potentilla recta*	17	Prevent/Eradicate
Dalmatian toadflax	*Linaria dalmatica*	18	Contain/Control
Tree of Heaven	*Ailanthus altissima*	19	Contain/Control
Bull thistle	*Cirsium vulgare*	20	Contain/Control
Siberian elm	*Ulmus pumila*	21	Contain/Control
Cheatgrass	*Bromus tectorum*	22	Contain/Control specific populations
Wild oats	*Avena fatua*	23	Contain/Control
Common teasel	*Dipsacus fullonum*	24	Eradicate
Oxeye daisy	*Chrysanthemum leucanthemum*	Unassigned	Prevent/Eradicate

The Forest Service developed the "Noxious Weeds Strategic Plan Working Guidelines Coconino, Kaibab and Prescott National Forests" in 1998 (USDA Forest Service 1998) to help address and mitigate effects to noxious or invasive weeds by management actions on the forests. In 2002, the Flagstaff Ranger District (known then as the Peaks and Mormon Lake Ranger Districts) completed the Flagstaff/Lake Mary Ecosystem Analysis (FLEA), a major landscape analysis. Among other issues, it addressed noxious or invasive weeds in certain management areas with the Flagstaff/Lake Mary ecosystem, incorporating the guidance provided by the strategic plan. In 2003, the southwestern region (Region 3) of the U.S. Forest Service completed the "Environmental Assessment for Management of Noxious Weeds and Hazardous Vegetation on Public Roads on National Forest System Lands in Arizona" (USDA Forest Service 2003), which allows treatment of noxious or invasive weeds along highway rights of ways in Region 3, including the Coconino National Forest. In 2005, the Forest completed the Final Environmental Impact Statement (FEIS) for Integrated Treatment of Noxious or Invasive Weeds, Coconino, Kaibab, and Prescott National Forests within Coconino, Gila, Mojave, and Yavapai Counties, Arizona. This document represented a major change in the management of noxious or invasive weed control on the forests by allowing the use of herbicides on forest lands, therefore providing a management tool not previously available to forest managers. The document and its provisions were incorporated into the Coconino forest plan by amendment 20 of the plan.

All of the above actions were beneficial management actions that supported management control objectives for noxious or invasive weeds on the forest. These management decisions are past cumulative actions for controlling noxious or invasive weeds on the Forest.

Management activities and disturbances prior to 1998 have contributed to the establishment and distribution of noxious or invasive weeds on the Forest. Past forest activities such as grazing, vegetation treatments, recreation uses, mining, infrastructure development and maintenance, road maintenance and travel along roadways, including paved roads and highways, affected the abundance and distribution of noxious or invasive weeds. However, without information on known distribution of noxious or invasive weed species, the past effects of management actions are unclear. Sources of introduction for noxious or invasive weeds are often unknown or difficult to verify.

Numerous management actions that could have affected the occurrence, distribution, and areal extent of noxious or invasive weeds have occurred in the past. Since 1997, noxious or invasive weed surveys were generally conducted on forest projects that would have management actions associated with soil disturbance. However, until the adoption of the 2005 FEIS, management actions for noxious or invasive weeds were generally limited to incorporation of best management practices or to manual control of certain weed populations.

Beginning in 2004, the Forest has released numerous biological control insects on Dalmatian toadflax, diffuse knapweed, and leafy spurge in certain areas of the forest. The success of these treatments is not fully known at this time. However, the objective is to decrease the density, areal extent, and reproductive capacity of the targeted weeds within the forest. These biological control agents will not completely eliminate the targeted noxious or invasive weed species from the Forest but will contribute to the management objectives established in the FEIS. Sheep grazing, a form of cultural control was used on leafy spurge at Brolliar Park in the past but has since been discontinued.

Since the finalization of the Noxious or Invasive Weeds FEIS, the Forest has treated certain infestations with herbicide, including some noxious or invasive weed infestations in wilderness areas, recent wildfires and leafy spurge infestations on the forest. Additionally, the Arizona Department of Transportation and Coconino County have used herbicide to treat noxious or invasive weeds along roadways under their jurisdiction. Other entities have treated some infestations within the City of Flagstaff. Collectively, these treatments have reduced infestations in some areas and reduced the risk of noxious weeds spreading into new areas.

Certain areas of the Forest are closed to vehicle travel. These include wilderness areas and closure areas for various purposes. Many of these closures restrict motorized vehicle travel in specific areas. Although these closures were done for various reasons, some are complementary to noxious or invasive weed control. The closures reduce motorized vehicle travel in certain areas and therefore reduce the risk of noxious or invasive weed dispersal in certain areas. One specific closure, order number 04-00-146, is specifically related to noxious or invasive weed control, restricting vehicle travel in an area containing leafy spurge.

Numerous projects have been initiated, analyzed, or implemented since 1995. Recent projects can be referenced on the Coconino National Forest NEPA website at http://www.fs.fed.us/r3/coconino/nepa/index.shtml. Projects analyzed since 2005 require consideration of the provisions of the 2005 FEIS; specifically, project survey and incorporation of

best management practices. Collectively, the incorporation of these provisions and planned noxious or invasive weed treatments associated provide noxious or invasive weed management and control within these project areas.

Despite all of these efforts, there is no evidence the magnitude or distribution of invasive weed species in decreasing on the Forest or surrounding lands. Rather, it is likely that weed populations are being maintained at approximately the same levels or are increasing as a result of establishment of new populations from unmanaged uses on private, state, county, municipal and federal lands. Motor vehicle use is one of the primary mechanisms for spread of these species.

Disturbance is a major factor in noxious weed invasions. Global climate change is expected to be a source of widespread disturbances. Higher temperatures will occur and precipitation cycles will be modified from current patterns over large areas. The warmer climate conditions may affect ecosystems by altering biotic and abiotic factors and increase the extent and severity of disturbances for some species (Bradley et al 2010, Hellmann et al 2008, Middleton 2006). Larger and more frequent fires are expected (Marlon et al. 2009). Climate may favor the spread of invasive exotic grasses into arid lands where the native vegetation is too sparse to carry a fire. When these areas burn, they typically convert to nonnative monocultures and the native vegetation is lost (USDA Forest Service 2010a).

The effects of global climate change on invasive species are expected to add to the effects of disturbance from motor vehicle use across the Forest under this alternative, which is expected to result in an increasing amount of invasive species populations. Also, the concentration of disturbance from motorized use and disturbance effects from climate change would cumulatively increase the ability of invasive species to persist and spread. These effects, however, may slightly be muted or partially contained through the many approved invasive weed treatment activities approved under the 2005 FEIS.

Alternative 1 – Direct, Indirect and Cumulative Effects

If the no action alternative is selected road mileages and densities would remain the same or continue to increase in the Forest as a result of off-road motorized use. The objective of reducing road densities would not be reached. Therefore, the risk of noxious or invasive weed dispersal would remain the same or increase as road densities continue to increase since roads and motorized use are one of the primary factors affecting the spread and establishment of invasive species (Mortensen et al. 2009, Flory and Clay 2009). The risk of dispersing noxious or invasive weeds into uninfested areas by motor vehicles will not be reduced.

The existing policy of allowing almost unrestricted motorized use on up to 1,496,246 acres of the Forest would remain the same. As a result, vehicles traveling off-road would continue to contribute to the spread of noxious or invasive weeds.

If the no action alternative is selected, there would be no restriction on motorized dispersed camping throughout the Forest except in those areas already restricted through the Forest Plan, official closures or existing NEPA decisions. Motorized dispersed camping may still occur in some areas where there are resource conflicts such as infestations of certain noxious or invasive weeds or in potential habitat or existing populations of threatened, endangered or sensitive plants.

Alternative 3 – Direct, Indirect and Cumulative Effects

Under alternative 3, the amount of road mileage with regular traffic would be reduced by about 58 percent. This reduction in road mileage and densities would help reduce the risk of present and future dispersal of noxious or invasive weeds along roadways (Rooney 2005). The reduction in risk would move toward the desired condition of reducing noxious or invasive weed dispersal along roadways and would be complementary to the management goals identified in the 2005 FEIS and amendment 20 of the forest plan. The density of noxious or invasive weeds tends to be greater along roadways than in interior areas with fewer disturbances (Fowler et al. 2008). Roads aid in dispersing noxious or invasive weeds in several ways such as altering habitat, stressing or reducing native vegetation, by providing avenues for conduction of weed infestations (Trombulak and Frissell 2000), by compaction of native vegetation (Gelbard and Belnap 2003), by dispersing seed carried in the mud on vehicles (Schmidt 1989), and by channeling or creating disturbance (Parendes and Jones 2000). Roads can be the entry points for many human influences that can affect the invasion process (Gelbard and Harrison 2003) and can provide avenues for long distance dispersal of seeds contributing to disjunct "founder populations" of noxious or invasive weeds along roadways (Von der Lippe and Kowarik 2007). Roads can contribute to forest fragmentation increasing the ratio of nonforested areas to forest and increasing the ratio of forest edge to interior habitats. These changes provide entry points for noxious or invasive weeds that are generally adapted to open, disturbed environments (Brothers and Spingarn 1992). Disturbances from such activities as road maintenance, construction and traffic may help overcome the biological barriers to invasion in healthy native plant communities (Parendes and Jones, 2000; Gelbard and Belnap, 2003). Disturbance along roadways is severe and episodic and can provide habitat for noxious or invasive weeds (Larson 2003). Though nondesignated roads may not disappear, reducing the regular use on approximately 58 percent of roads in the Forest would help reduce these risk factors and therefore reduce the risk of spreading noxious or invasive weed invasions on forest lands.

An indirect effect of alternative 3 would be increased disturbance from use and road maintenance on the remaining roads. By reducing the numbers of roads within the forest, use would more concentrated on remaining roads and would require more maintenance of existing roads. Gelbard and Belnap (2003) noted that increased levels of construction and maintenance increased the numbers of noxious or invasive weed species present along roadways as well as the density of weeds. These increases were attributed to increased disturbance from road maintenance and construction and tendency to introduce deeper layers of soil along roadways as road fill. Additionally, the levels of disturbance increased due to higher levels of use. Therefore, a potential negative effect of reducing the density of roads is concentrated use and maintenance along remaining roads. This would lead to higher levels of disturbance and more opportunities for dispersal of noxious or invasive weed propagules along remaining roads. These effects could be mitigated by focusing control efforts along roadways to control existing and introduced infestations along the remaining open road system.

By reducing off-road vehicular travel by over one million acres, the risk of spreading noxious or invasive weeds from existing infestations would be reduced. Motorized vehicles can disperse noxious or invasive weeds into new areas by transporting propagules on various parts of the vehicle (Schmidt 1989; Von der Lippe and Kowarik 2007). Additionally, reducing or eliminating off-road vehicular use would decrease the current levels of soil disturbance currently caused by vehicle travel. Disturbed areas tend to be more at risk for invasion by noxious or invasive weeds (Trombulak and Frissell, 2000; Parendes and Jones, 2000; Gelbard and Belnap, 2003).

Elimination of off-road vehicular use would reduce this risk in most parts of the forest. Exceptions include the Cinder Hills OHV Area (Management Area 13), camping corridors, and legally permitted activities such as fuelwood collection. Off-road vehicular use would still occur in the Cinder Hills OHV Area. This area contains infestations of noxious or invasive weeds including diffuse knapweed (*Centaurea diffusa*). Under alternative 3, there would be no change in the current management in this area, which focuses on off-highway vehicle recreation opportunities. Therefore, the risk of noxious or invasive weed dispersal by motorized vehicles in this area will remain the same or increase over time as use in the area increases.

Areas for motorized dispersed camping corridors have been screened to reduce or eliminate resource conflicts, including noxious or invasive weeds. This could help control impacts to several resources including noxious or invasive weed infestations by allowing Forest Service personnel to eliminate motorized dispersed camping sites from areas where infestations or noxious or invasive weeds are problematic. By eliminating the current policy of allowing motorized cross-country travel to access campsites, the risk of noxious or invasive weed dispersal and introduction to new areas would be reduced.

Off-road motor vehicle use could occur in game management units 7W and 8 solely for the purpose of retrieving legally harvested cow and bull elk for all hunts. While these trips may cause some disturbance and increase the risk of noxious or invasive weed invasions, it is a considerable decrease from the current policy. Portions of 7W and 8 on the Forest include occasional areas with common noxious weeds such as Dalmatian toadflax and cheat grass, but these species are not widespread in units 7W and 8.

The action of prohibiting off-road travel for motorized big game retrieval in all other game management units would decrease the risk of spread of noxious weeds in areas with heavy infestations, such as in unit 11M around Flagstaff and in units 5A and 5B, which include grassland habitat susceptible to invasion from species such as cheatgrass. This action would contribute cumulatively to decreasing the spread of noxious or invasive weeds in areas such as around Flagstaff and adjacent to roadsides in units not included for motorized big game retrieval.

As part of alternative 3, permitted activities such as fuel wood cutting and livestock management would still be allowed. These actions are currently and would remain under the authority of the Forest Service. Therefore, access to areas with resource values at risk, including noxious or invasive weed infestations can be regulated through permit actions.

Alternative 4 – Direct, Indirect and Cumulative Effects

This alternative would also restrict off-road vehicle travel and thus would have similar effects to those for alternative 3. By restricting off-road vehicle travel, the risk of spreading infestations of noxious or invasive weeds would be reduced.

The exception to this would be the designation of off-road vehicle travel for the purpose of motorized big game retrieval on all designated routes. It is estimated that this alternative would result in approximately 2,922 off-road vehicle trips each year across the Forest. This would still result in a large decrease in off-road use from current use; however, it would remain a major source for the potential spread of existing invasive weed populations and facilitate the establishment of new invasive weed populations, especially in game management unit 11M, which is the area located around the City of Flagstaff and includes the highest density of known invasive weeds.

The effects of motorized camping corridors would be the same as for alternative 3.

The mileage and areal extent of open roads are higher in this alternative as compared to alternative 3. Road mileage available for regular public motorized use would be reduced by about 52 percent from the current condition. The effects of overall disturbance from road use and maintenance of roads would be slightly higher than in alternative 3, but localized disturbance would be slightly lower. However, this risk is not substantially lower compared to alternative 3.

Off-road vehicle travel for retrieval of downed elk may combine cumulatively with other sources of disturbance such as wildfire and climate change to establish new populations of invasive species and to allow for the spread of invasive species populations. This is particularly likely in areas with high invasive species populations, such as game management unit 11M, and in areas with a very high amount of elk hunting such as portions of game management units 5A, 6A, and 5B.

Threatened or Endangered Plants

The Forest provides habitat for two species protected under the Endangered Species Act: Arizona cliffrose (*Purshia subintegra*), an endangered species, and San Francisco Peaks groundsel (*Senecio franciscanus*), a threatened species. Detailed information about these two species can be found in the Botany specialist report, located in the Project Record.

Arizona Cliffrose (*Purshia subintegra*)

Arizona cliffrose occurs on the Forest in Management Areas (MAs) 11 and 17. Arizona cliffrose occupies only a small portion of MA11. MA 17 comprises areas of special emphasis including geological areas, botanical areas and research natural areas. The Verde Valley Botanical Area, which was created to manage Arizona cliffrose and several other sensitive and rare plants, is included in this designation.

Alternative 1 – Direct, Indirect and Cumulative Effects

Under the no action alternative, options for managing the Verde Valley Botanical Area, which provides habitat for the Arizona cliffrose, would remain the same. In addition, a limited number of roads in MA11 adjacent to the Verde Valley Botanical Area would remain listed as open roads on the Forest map. The estimated total mileage of these roads is 6.7 miles.

Based on this information, there would be no direct impacts to the Arizona cliffrose under this alternative since there are no roads located in areas where this species exist. It is possible this alternative could result in indirect effects as a result of the establishment of invasive species (such as cheatgrass) that could impact this species; however, there have been no observations of cheatgrass establishment or competition with Arizona cliffrose in the limited habitat types in which the species grows. Since there would be no direct or indirect effects, there would be no cumulative effects from this alternative.

Alternative 3 – Direct, Indirect and Cumulative Effects

Implementation of this alternative would provide beneficial effects to Arizona cliffrose. Under alternative 3, protective measures for such areas as the Verde Valley Botanical Area, which

provides habitat for the Arizona cliffrose, would be enhanced by strengthening restrictions for off-road travel through the incorporation of Executive Orders 11644 and 11989.

Motor vehicle travel is currently prohibited in the botanical area, but there are still occasional incursions from unauthorized use. Provisions to restrict off-road vehicle use would be part of alternative 3 would strengthen existing closures in this area and areas with potential habitat.

There are no motorized trails in the botanical area or in any nearby habitat, thus there would be no effects from designation of motorized trails, including Lower Smasher Canyon.

Under alternative 3, motorized big game retrieval would be allowed one mile from designated routes in game management units 7W and 8, which do not contain Arizona cliffrose habitat or potential habitat.

In the adjacent MA11, all roads under Forest Service jurisdiction would be officially closed in. Only two main passenger car roads that are outside of Forest Service jurisdiction, Yavapai County Road 70 (Mingus Avenue Bypass) and Rocking Chair Road (a paved street accessing private land) would remain open. The elimination of these roads and restriction of cross-country travel in MA 11 would benefit Arizona cliffrose by reducing potential impacts to existing Arizona cliffrose populations such as crushing of plants, soil compaction, and erosion. It would also reduce impacts to suitable habitat for Arizona cliffrose by reducing soil erosion and compaction in potential habitat on forest lands.

The cumulative effects boundary includes the known range of Arizona cliffrose, focusing on portions of the range controlled by the Forest.

Rangewide, multiple agencies have management responsibility for the four known population areas of Arizona cliffrose. The Burro Creek population is on Federal lands managed by the Bureau of Land Management, Kingman Resource Area. The Cottonwood population is on Federal, Arizona State, Yavapai County and private lands. The Federal lands are part of Coconino National Forest and the State lands are managed as Dead Horse Ranch State Park. The Horseshoe Lake population is on Federal land with management of lake operations under the Bureau of Reclamation and surface management under Tonto National Forest. The Bylas population is on the San Carlos Apache Indian Reservation (USDI Fish and Wildlife Service 1995a).

Major impacts to Arizona cliffrose include urbanization, recreation, road and utility line construction and maintenance, minerals exploration and mining, and livestock and wildlife browsing. The Cottonwood population is in a developing urban/suburban area. The most serious impacts are from land development, road construction, and motorized and nonmotorized recreation. The soils supporting Arizona cliffrose populations contain high quality bentonite, a type of clay with numerous commercial uses. Most mining and exploration has been in the Burro Creek and Horseshoe Lake populations. Livestock and/or wildlife browse all Arizona cliffrose populations. The greatest use occurs when both livestock and wildlife are present and when livestock are grazed yearlong (USDI Fish and Wildlife Service 1995a).

The Forest revised the Windmill Allotment Management Plan in 1992 to accommodate Arizona cliffrose recovery needs, excluding livestock from some pastures and monitoring use in others. The current allotment management plan requires monitoring for threatened and endangered species within the allotment (USDA Forest Service 2008). Managing livestock in the Windmill

Allotment using forest plan standards and guidelines is providing increased protection for plants and habitat through use of fences, monitoring, and grazing regimes.

Red Rock Ranger District initiated several actions since 1996 including trail rerouting and rock placement to protect Arizona cliffrose along several trails in the area of Dead Horse Ranch State Park, photo monitoring along trails, and maintenance of fences to exclude cattle and off-road vehicles from the Verde Valley Botanical Area. Other beneficial actions included maintenance and enhancement of vehicle closures along Rocking Chair Road. The District initiated emergency consultation on illegally placed signs, then coordinated placement of the signs to eliminate damage to Arizona cliffrose. The Forest Service closed and rehabilitated an unofficial target shooting range.

While climate change is not directly linked to the actions of the Travel Management Rule, the beneficial effects of alternatives 3 would slightly counteract the larger effects of global climate change, which may contribute to the decline in viability and distribution of Arizona cliffrose in the Verde Valley and whether the species continues to be extant throughout its range.

Other natural resource management agencies have considered Arizona cliffrose in their projects. These included future planned projects for nonmotorized trails in suitable habitat of Arizona cliffrose and mitigations for utility line reconstruction and improvement within the habitat of Arizona cliffrose. The proposed trails would consolidate nonmotorized trail routes to a given area and reduce random "wandering" by users such as hikers and horseback riders. The Forest Service worked with Arizona Public Service on the Phase II Maintenance in Utility Corridors on Arizona National Forests to assure that maintenance and improvements to utility lines within Arizona cliffrose habitat are mitigated, and existing plants are avoided (Phillips 2008). Additionally, the Red Rock Ranger District continues to monitor and reinforce closures where needed. All of these are considered positive actions.

The positive results anticipated from implementation of alternative 3 would be additive to the positive actions the Forest has taken to date for Arizona cliffrose. When this and other reasonably foreseeable actions are considered, implementation of alternative 3 on would result in a cumulative beneficial impact toward maintaining the viability and distribution of Arizona cliffrose in the Verde Valley.

Alternative 4 – Direct, Indirect and Cumulative Effects

Effects for this alternative are similar to alternative 3, though in alternative 4, off-road travel for elk retrieval would be allowed 1 mile from all designated routes. However, the likelihood of elk retrieval in nonriparian desert scrub habitat is extremely low and has near zero probability of impacting Arizona cliffrose.

San Francisco Peaks Groundsel (*Senecio franciscanus*)

There is a recovery plan (USDI Fish and Wildlife Service 1987) for San Francisco Peaks groundsel. Critical habitat includes the summits of Agassiz and Humphrey's Peaks and the surrounding slopes and alpine areas.

Environmental Consequences of All Alternatives to Threatened and Endangered Plants

Direct, Indirect, and Cumulative Effects – The San Francisco Peaks groundsel is limited to areas that are inaccessible by motor vehicles. All known locations and designated critical habitat for this species are within the Kachina Peaks Wilderness Area where motor vehicle travel is currently prohibited. Thus, there would be no effects to San Francisco Peaks groundsel under any alternative.

Southwestern Region (Region 3) Sensitive Plants

There are several sensitive species on the Forest that would not be affected by any alternative. These species have been placed at the beginning of this discussion. The rest of the discussion focuses on species that may be affected, first beneficially then not beneficially. Descriptions of plant species and their habitat can be found in the Botany specialist report.

- Crenulate moonwort (*Botrychium crenulatum*),
- Cochise sedge (*Carex ultra*),
- Arizona bugbane (*Cimicifuga arizonica*),
- Mogollon thistle (*Cirsium* parryi ssp. *mogollonicum*)
- Metcalf's tick trefoil (*Desmodium metcalfei*)
- Cliff fleabane (*Erigeron saxatilis*)
- Eastwood Alum root (*Heuchera eastwoodiae*)
- Lyngholm's brakefern (*Pellaea lyngholmii*)
- Alcove bog orchid (*Platanthera zothecina*)

Environmental Consequences of All Alternatives to Sensitive Species

Direct, Indirect, and Cumulative Effects

There would be no effect to crenulate moonwort, Cochise sedge, Arizona bugbane, Mogollon thistle, Metcalf's tick trefoil, cliff fleabane, Eastwood alum root, Lyngholm's brakefern, alcove bog orchid and Blumer's dock because these species occur in areas that are currently inaccessible to motorized travel. Those species that could be affected to changes in motorized use include:

- Tonto Basin agave (*Agave delamateri*)
- Phillips' agave (*Agave phillipsiana*)
- Mt. Dellenbaugh sandwort (*Arenaria aberrans*)
- Rusby's milkvetch (*Astragalus rusbyi*)
- Disturbed rabbitbrush (*Chrysothamnus molestus*)
- Arizona leatherflower (*Clematis hirsutissima* var. *hirsutissima*)
- Heathleaf wild buckwheat (*Eriogonum ericifolium* var. *ericifolium*)
- Ripley wild buckwheat (*Eriogonum ripleyi*)
- Flagstaff pennyroyal (*Hedeoma diffusum*)
- Arizona sunflower (*Helianthus arizonensis*)
- Arizona sneezeweed (*Helenium arizonicum*)
- Flagstaff beardtongue (*Penstemon nudiflorus*)

- Hualapai milkwort (*Polygala rusbyi*)
- Blumer's dock (*Rumex orthoneurus*)
- Bebb's willow (*Salix bebbiana*)
- Verde Valley sage (*Salvia dorrii* ssp. *mearnsii*)

Alternative 1 – Direct, Indirect, and Cumulative Effects

Under this alternative, impacts to these Region 3 Sensitive plants would continue at current levels or increase over time as general motorized use increases. Examples of these impacts include driving on plants, damage to potential habitat by reducing soil viability, fragmentation of habitat and introduction of noxious or invasive weeds into the habitats and/or populations of these species.

There would be few restrictions on motorized dispersed camping throughout the Forest except in those areas already restricted through the Forest Plan, official closures or existing NEPA decisions. Motorized dispersed camping would still occur and result in direct impacts such as where motorized use occurs infestations of certain noxious or invasive weeds (such as Brolliar Park) or in potential habitat or inhabited sites of Region 3 Sensitive plants (such as Lake Mary Meadows).

Cumulative effects to the listed plant species include past and ongoing management actions by the U.S. Forest Service such as grazing, timber sales, fuels reduction projects, prescribed burning, recreational activities (motorized and nonmotorized), construction, reconstruction and decommissioning of roads and trails, various land use projects including communications facilities, utility corridors and special use areas. Most of these actions have very little impact because their effects are mitigated according to the Forest Plan give the activity is under Forest Service jurisdiction.

More relevant are large-scale long-term changes in vegetation structure and composition such as caused by fire suppression and past alteration of the fire regime through suppression. This long-term trend has affected all vegetation including several of the Region 3 Sensitive plant species through changes in tree density and understory species composition and changes to hydrologic function. Elimination of fire in many areas of the Forest has allowed tree canopy and stand density to increase in some areas, reducing the abundance or eliminating of most understory species. Elimination of fire and subsequent increase in forest density have probably reduced the amount surface water and soil moisture in some areas, therefore negatively affecting the potential habitat of some species.

There have been many large wildfires in the potential habitat of several of these species. Severe wildfires can negatively alter the potential habitat for many species by destroying plants, stopping reproduction, and significantly altering the habitat on a long-term basis. The extent of the alteration of potential habitat by past wildfires over the Forest is unknown.

Cumulative effects not mitigated include non-Forest actions such as public travel, recreational visits by the public, wildfires and unmanaged grazing (wildlife and livestock). Activities on lands outside National Forest such as state and private lands have also contributed to cumulative effects on several species including timber harvest, fuels reduction projects, recreational uses and development. Land development on non-forest parcels has affected the amount of suitable habitat available on non-forest lands, reducing the amount of suitable habitat in these areas. Activities on

lands outside National Forest tend to have more adverse effects on populations and habitat because they are not subject to mitigation as similar actions on the Forest would be. The overall result is a possible reduction in the overall distribution and amount of suitable habitat for some species throughout their ranges.

Global climate change could affect the distribution of vegetation in general by affecting biotic and abiotic factors and by increasing the extent and severity of disturbances (USDA Forest Service 2010a). Rare and sensitive species may be especially vulnerable because they often need specific habitat components such as specialized soil types, which are not widely available. This could negatively affect their abilities to migrate to suitable areas as environmental conditions change. Water availability may decrease in some areas while temperatures generally increase. Alpine habitats may disappear entirely as elevational vegetation shifts occur (USDA Forest Service 2010a). Future plant distributions in general may be governed by several factors including human influences, abilities of plants to disperse, and the presence of suitable habitat components including such factors as suitable soil types and presence of pollinators (McKenney et al. 2007). Large changes in ecosystem structure and species composition of plant communities are expected due to increasing temperatures and altered precipitation cycles (USDA Forest Service 2010a). The specific effects of these factors on local plant communities and Region 3 sensitive plants growing in them are not known.

The no action alternative would continue to result in direct impact (driving on plants) and indirect impacts (habitat destruction, habitat degradation, and impacts to plant reproductive capacity) and would contribute cumulatively with the aforementioned effects to affect sensitive plant species on the Coconino National Forest. Though it is unclear to what extent these cumulative impacts would have on individual or populations of sensitive plants, but it is expected that based on expected increase of motorized use over the next several decades the cumulative impacts would result in decreasing populations for one or several of these plant species over time.

Alternative 3 – Direct, Indirect, and Cumulative Effects

Effects from motorized vehicles to plant communities in general include soil compaction, erosion or loss of top soil, crushing of above ground portions, crushing of roots, up-rooting of plants (Wilshire et al, 1978), compaction of native vegetation (Gelbard and Belnap, 2003) and altering habitats, stressing or reducing native vegetation, by providing avenues for conduction of weed infestations (Trombulak and Frissell , 2000) and by channeling or creating disturbance (Parendes and Jones, 2000). Roads can contribute to forest fragmentation increasing the ratio of nonforested areas to forest and increasing the ratio of forest edge to interior habitats (Brothers and Spingarn 1992; Fowler et al. 2008). These changes create open, disturbed environments, which in turn can provide habitat for noxious or invasive weeds (Brothers and Spingarn 1992). Interior habitats can provide important refugia with fewer human generated disturbances for native plant species (Gelbard and Harrison 2003).

Under alternative 3, impacts from motor vehicle use including crushing of plants, damage to soils, fragmentation of habitat, and introduction of noxious or invasive weeds would be reduced.

The reduction of road miles designated for motorized use may not have a direct impact on any sensitive plant species, over time some of these roads would rehabilitate to the extent that they could support sensitive plant species. This would result in an indirect effect of increasing potential habitat and reducing impacts from fragmentation.

Under this alternative, the Lower Smasher Trail would be incorporated into the off-road vehicle system. There are no sensitive plant locations or habitat along the route.

Proposed motorized camping corridors have been reviewed and screened using the most recent data available to help reduce impacts from motorized camping to sensitive plant species in these areas. This would help control impacts by allowing Forest Service personnel to minimize motorized dispersed camping sites from areas where plants are known to occur. However, corridors may increase use and disturbance in some areas containing potential habitat.

Indirect effects resulting from the reduction in mileage and density of roads and regulation of dispersed motorized camping is the potential reduction of the numbers of people conveyed into some sensitive areas. Currently approximately 93 percent of the Forest is within ½ mile of a road outside of wilderness areas. Roads facilitate motorized and nonmotorized uses into remote areas containing Region 3 sensitive plants and/or potential habitat that would otherwise be remote locations. For example, two remote monitoring points for Flagstaff pennyroyal were impacted by camping when users left an established road and set up campsites in areas away from roads (Crisp 2005). Campers built fires directly on top of the monitoring plots and plant populations. Reduction in the numbers of roads and elimination of roads in certain sensitive areas may reduce potential impacts by restricting access in the most sensitive areas of the forest.

This alternative would also designate 30 miles of unauthorized routes. Portions of these routes intersect several areas of the forest that contain potential habitat for Region 3 sensitive plants; however none of these routes are located in areas with known sensitive species populations.

This alternative would designate motorized big game retrieval corridors of one mile off both sides of 74 miles of designated routes within game management units 7W and 8. While these trips may cause some disturbance and result in some impacts to Region 3 sensitive plant habitats and possibly individual plants, it is expected it would limit almost all potential impacts to a number of species including Flagstaff beardtongue, Hualapai milkwort, Blumer's dock, Bebb's willow, Verde Valley sage, Tonto Basin agave, Phillip's agave, disturbed rabbitbrush, Arizona leatherflower, Arizona sneezeweed, heathleaf wild buckwheat, and Ripley wild buckwheat. Other species where there is potential habitat by reducing the number of trips in this area, the impacts to these species would be reduced.

Past, present and reasonably foreseeable future activities are the same as the no action alternative. Overall, alternative 3 would result in a cumulative beneficial impact by focusing motorized uses on the Forest and reducing disturbance and loss of habitat from motorized impacts on over 1 million acres within the Forest.

Alternative 3 is expected to slightly counteract the effect of loss and degradation of habitat from public travel, recreational visits, wildfires, and unmanaged grazing (wildlife and livestock) by reducing the potential for habitat loss and degradation for existing and potential sensitive plant habitat within the Forest.

The specific effects of climate change on local plant communities and Region 3 sensitive plants are not known; however, the beneficial effects of alternatives 3 would slightly counteract the larger effects of global climate change by reducing the vulnerability of sensitive plant populations to additional disturbance from motorized use.

Alternative 4 – Direct, Indirect, and Cumulative Effects

The effects of restrictions on off-road vehicle use are similar to alternative 3, though motorized big game retrieval would be permitted one mile off of all designated routes. It is estimated this would result in 2,922 off-road vehicle trips for elk retrieval, which would largely reduce impacts to sensitive species from direct and indirect impacts.

In addition, alternative 4 would add 51.8 miles of unauthorized motorized trail to the motorized trail system (Challenger Trail and Lower Smasher Canyon Trail). This would result in a system with approximately 89 miles of motorized trails. The Challenger Trail is a unauthorized trail that goes completely around the San Francisco Peaks. The trail uses roads in some areas but generally transverses the Peaks using segments of unauthorized trails. No surveys have been done on these areas but there are no GIS-documented locations of Region 3 sensitive plants along the routes. Several areas of the trail are within potential habitat for Rusby milkvetch. Impacts include crushing of individual plants in unrecorded locations and soil erosion and compaction.

This alternative would also designate 36 miles of unauthorized routes. Portions of these routes intersect several areas of the forest that contain potential habitat for Region 3 sensitive plants; however none of these routes are located in areas with known sensitive species populations.

Road mileage would be reduced by about 52 percent from the current condition. The effects of overall disturbance from road use and maintenance of roads would be slightly higher than in alternative 3.

The cumulative effects for this alternative are the same as those for alternative 3, except that due to increased off-road travel from motorized big game retrieval alternative 4 would be less effective at counteracting the negative effects of habitat loss and degradation to rare plant species and potential habitat occurring from lack of wildlife, development of private lands, and global climate change.

Sunset Crater Beardtongue (*Penstemon clutei*)

The range of this species is limited to the Sunset Crater volcanic field near Flagstaff (MA13), which includes the Cinder Hills OHV Area.

Alternative 1 – Direct, Indirect, and Cumulative Effects

If the no action alternative is selected, current management and recreational use within Sunset Crater beardtongue habitat would remain the same. Most of this species occurs in MA13, which would remain open to cross-country vehicle travel. Some populations occur outside of MA 13 and use by motor vehicles would remain the same or increase over time.

Under this alternative, there would be no restriction on motorized dispersed camping throughout the Forest except in those areas already restricted through the forest plan, official closures or existing NEPA decisions. Motorized dispersed camping would still occur in MA 13 and other areas occupied by Sunset crater beardtongue resulting in regular but low-level impact to individuals as well as potential habitat.

The cumulative effects discussed in the Alternative 1 section above for Tonto Basin Agave, Phillips' Agave, Mt. Dellenbaugh sandwort, Rusby's milkvetch, Disturbed rabbitbrush, Arizona leatherflower, Heathleaf wild buckwheat, Ripley wild buckwheat, Flagstaff pennyroyal, Arizona

sunflower, Arizona sneezeweed Flagstaff beardtongue, Hualapai milkwort, Bebb's willow, Blumer's dock and Verde Valley sage, apply to Sunset Crater beardtongue.

Alternatives 3 – Direct, Indirect, and Cumulative Effects

Under this alternative, cross-country travel would not change within the Cinder Hills OHV area, but would be restricted in other areas containing Sunset Crater beardtongue. There would be some open roads and motorized camping corridors in these areas; however, the Forest botanist reviewed the most recent data in NRIS TESP/INPA database and determined that there are no documented locations in areas with designated dispersed camping areas.

The direct, indirect and cumulative effects discussed in the section above for Tonto Basin agave, Phillips' Agave, Mt. Dellenbaugh sandwort, Rusby's milkvetch, disturbed rabbitbrush, Arizona leatherflower, Heathleaf wild buckwheat, Ripley wild buckwheat, Flagstaff pennyroyal, Arizona sunflower, Arizona sneezeweed, Flagstaff beardtongue, Hualapai milkwort, Bebb's willow, Blumer's dock, and Verde Valley sage, apply to Sunset Crater beardtongue. Additional effects to the species are discussed below.

Exceptions to the anticipated positive effects for Region 3 sensitive plants include the Cinder Hills OHV area, which includes much of the known range of this species. Impacts such as crushing and destruction of individual plants and degradation of habitat would continue in that area. The populations of Sunset Crater beardtongue that occur outside this area would benefit from the proposed management actions in alternative 3.

Alternative 3 would designate 1.8 miles of motorized trails (Lower Smasher Canyon Trail) and 30 miles of unauthorized routes across the Forest. Less than 10 percent of these routes occur in potential habitat for the Sunset Crater beardtongue. Where these unauthorized routes are designated, it is primarily to designate existing level 2 spur roads that provide access to one or more camping spots. None of these routes is located in areas with known beardtongue populations.

Historically, there have been several large wildfires in the habitat of Sunset Crater beardtongue including the Burnt Fire in 1973. After the fire, Goodwin (1979) stated that Sunset Crater beardtongue was a pioneering species in the fire. However, Fule et al. (2000) found that Sunset Crater beardtongue numbers were lower on burned plots three years after treatment when compared to pre-treatment numbers. In 1992, a tornado occurred in the area near Sunset Crater, within the habitat of the Sunset Crater beardtongue. The storm damaged large numbers of trees on National Forest System land and within Sunset Crater National Monument. The Forest Service conducted a salvage sale and removed storm damaged trees from its land. A monitoring project conducted by the Peaks District (Crisp 1996) found no adverse effects from the storm or the salvage sale. The cinder hills area that contains most of the habitat for Sunset Crater beardtongue is heavily used for recreation. Other activities that have occurred in the habitat include fuel wood removal, utility corridors and grazing. Sunset Crater has been collected as an ornamental on a limited basis but this practice is strongly discouraged. This limited collection has not affected the viability of the species. Past activities within the habitat include recreational uses, fuelwood removal, utility corridors and grazing

Nonforest actions include a rapidly growing population in the Doney Park, Timberline and similar neighborhoods that are within the range of Sunset Crater beardtongue. Post-fire flooding from the 2010 Schultz Fire may also have impacted Sunset Crater beardtongue individuals or potential

habitat. Effects of this increasing human population include increases of human impacts to surrounding Forest lands and possibly a decrease in suitable habitat available on non-forest lands through alteration of habitat by human activities such as development. Implementation of the Travel Management Rule under alternatives 3 or 4 would not combine cumulatively to habitat loss or degradation to the Sunset Crater beardtongue, but would counteract this affect by limiting the amount of off-road motorized use and removing regular motorized use on a number of roads that currently result in direct and direct impact to the species' habitat.

The effects of climate change on Sunset Crater beardtongue are similar those for other Region 3 sensitive plants discussed above.

Alternative 4 – Direct, Indirect, and Cumulative Effects

Effects from this alternative are similar to alternative 3, though alternative 4 also includes the addition of the 50-mile Challenger Trail. No surveys have been done on these areas but there are no GIS-documented locations of Sunset Crater beardtongue. An additional 36 miles of unauthorized road would also be added to the National Forest road system.

Cumulative effects are the same as those described under alternative 3.

Short-term Uses and Long-term Productivity

The change in driving on National Forest System roads and trails created by any of the action alternatives does not jeopardize the long-term productivity of the Coconino National Forest. As described throughout chapter 3, implementing any of the action alternatives would improve resources such as wildlife habitat, cultural resource sites, and others.

Unavoidable Adverse Effects

Designating unauthorized routes in either action alternative could spread invasive plants to new locations and cause an unavoidable impact in these localized areas. Both action alternatives may result in more bare ground and thus loss of soil productivity in some portion of the designated dispersed camping corridors.

Irreversible and Irretrievable Commitments of Resources

An irreversible commitment of a resource is one that cannot be regained, such as the extinction of a species. An irretrievable commitment is one where the value of the resource is lost for a period of time, such as the loss of soil productivity from the existence of a road.

Alternative 1 could result in the irreversible loss of cultural resource sites. By definition, cultural resource sites and traditional cultural properties are not renewable and damage to them cannot be reversed. Alternatives 3 and 4 would have no irreversible commitments of resources.

All the alternatives would result in the irretrievable commitment of some of the forest's soil productivity. This commitment, however, would be negligible when considered at the scale of the forest. All alternatives designate unauthorized routes, which commits the soil to use as a route rather than for growing plants. All alternatives continue to allow camping, which also tends to commit soil to that use. Alternatives 3 and 4, which are expected to result in more bare ground

from motorized dispersed camping, could irretrievably reduce visual quality in some places. This would also be negligible at the scale of the forest.

Other Required Disclosures

Environmental Justice

Environmental justice is an executive order (EO 12898) that requires each Federal agency to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies and activities on minority and low income populations.

Environmental justice is the fair treatment and involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment means that no group of people, including racial, ethnic, or socioeconomic groups, should bear a disproportionate share of the negative environmental consequences resulting from industrial, municipal, and commercial operations or the execution of federal, state, local, or tribal programs and policies.

In 2000, Native Americans were the largest minority group in Coconino County (28.51 percent) while Hispanics represented the predominant minority group in Gila and Yavapai Counties (16.65 and 9.78 percent, respectively; de Steiguer et al. 2005). Only Native Americans represent a greater proportion of the population than the state average, and thus only this group is considered a minority population to be considered for environmental justice impacts in this analysis.

None of the alternatives would have a disproportionate health or environmental risk on any minority or low income communities as route closures primarily focus on restricting off-road travel and closure of high-clearance dirt roads and not those most important for vehicular access.

None of the alternatives would have a disproportionate economic effect on any community or minority or low-income population. The effects to jobs and income from all alternatives studied are a very small portion (less than 1 percent) of the overall jobs and income (see page 94 and Economics specialist report). There is no evidence that any loss of jobs or income would disproportionately affect Native American or Hispanic populations in or adjacent to the Coconino National Forest. Any losses in motorized use are likely to be made up for in continued increases expected for total recreation use on the Coconino National Forest.

We have consulted with potentially affected tribes and effects on their rights and concerns have been considered within the analysis of alternatives. American Indian populations would not be disproportionately impacted under any alternative with avoidance of heritage resources, consideration of traditional values, and reasonable access and forest product collection allowed through agreements, permits, and recognition of their sovereignty and legal rights.