SOUTHERN ROCKY MOUNTAINS ECOREGION

The Southern Rocky Mountains Ecoregion covers most of north central New Mexico extending from the state line southward to Santa Fe and Albuquerque and includes the southern San Juan Mountains, Sangre de Cristo Mountains, and Jemez Mountains. Important New Mexico rivers that flow through this ecoregion include the Rio Grande, San Juan River, Rio Chama, and the Vermejo River. Three key terrestrial habitat types, the Intermountain Basins Big Sagebrush Shrubland, Rocky Mountain Alpine-Montane Wet Meadow, and Rocky Mountain Montane Mixed-Conifer Forest and Woodland (Fig. 5-5) occur in this ecoregion. Neely *et al.* (2001) identified the Southern Rocky Mountains Ecoregion as one of the few areas that remains relatively intact and provides broad scale conservation opportunities. However, increasing residential and recreational development presents a potential source of change.

Species of Greatest Conservation Need

Fourty-nine Species of Greatest Conservation Need (SGCN), excluding arthropods other than crustaceans, are associated with the Southern Rocky Mountain Ecoregion (Table 5-7). The majority reside within the Rocky Mountain Montane Mixed-Conifer Forest and Woodland (31 species), which covers significantly more area within the ecoregion than the other two component key habitats. Of the 49 SGCN in the ecoregion, 16 species (33%) are considered vulnerable, imperiled, or critically imperiled both statewide and nationally. Approximately 17 species (35%) are nationally secure, but are considered vulnerable, imperiled, or critically imperiled in New Mexico, and 16 species (33%) are secure both statewide and nationally. Conservation status codes (abundance estimates) for each SGCN are provided in Appendix H. Some associated SGCN, such as mule deer (*Odocoileus hemionus*) and mourning dove (*Zenaida macroura*), are common throughout the region while others, such as the American marten (*Martes americana*) and Jemez Mountain salamander (*Plethodon neomexicanus*), are uncommon and localized. Additional conservation concerns for taxa associated with this ecoregion are addressed in 1) Statewide Distributed Ephemeral Habitats and Perennial Tanks, 2) Statewide Distributed Riparian Habitats, or 3) Watersheds with aquatic key habitats sections.

Intermountain Basins Big Sagebrush Shrubland

Habitat Condition

In the Southern Rocky Mountains Ecoregion, the Intermountain Basins Big Sagebrush Shrubland is found north and west of Taos and Questa, specifically in northwestern Rio Arriba, and western Taos counties. Within this ecoregion is a cold desert (Dick-Peddie 1993). The shrub layer consists of rubber rabbitbrush (*Chrysothamnus nauseousus*) and sagebrush (*Artemisia tridentata, and A. bigelovii*). Sage, with other brush species, comprises more than 70% of the vegetative cover and more than 90% of the plant biomass (West 1988). Sagebrush is dominant with little or no grass understory, even in late seral stages. Associated perennial grasses include Western wheatgrass (*Agropyron smithii*), needle and thread grass (*Stipa neomexicana*), ring muhly (*Muhlenbergia torreyi*), and alkali sacaton (*Sporobolus airoides*) in heavy clay sites.

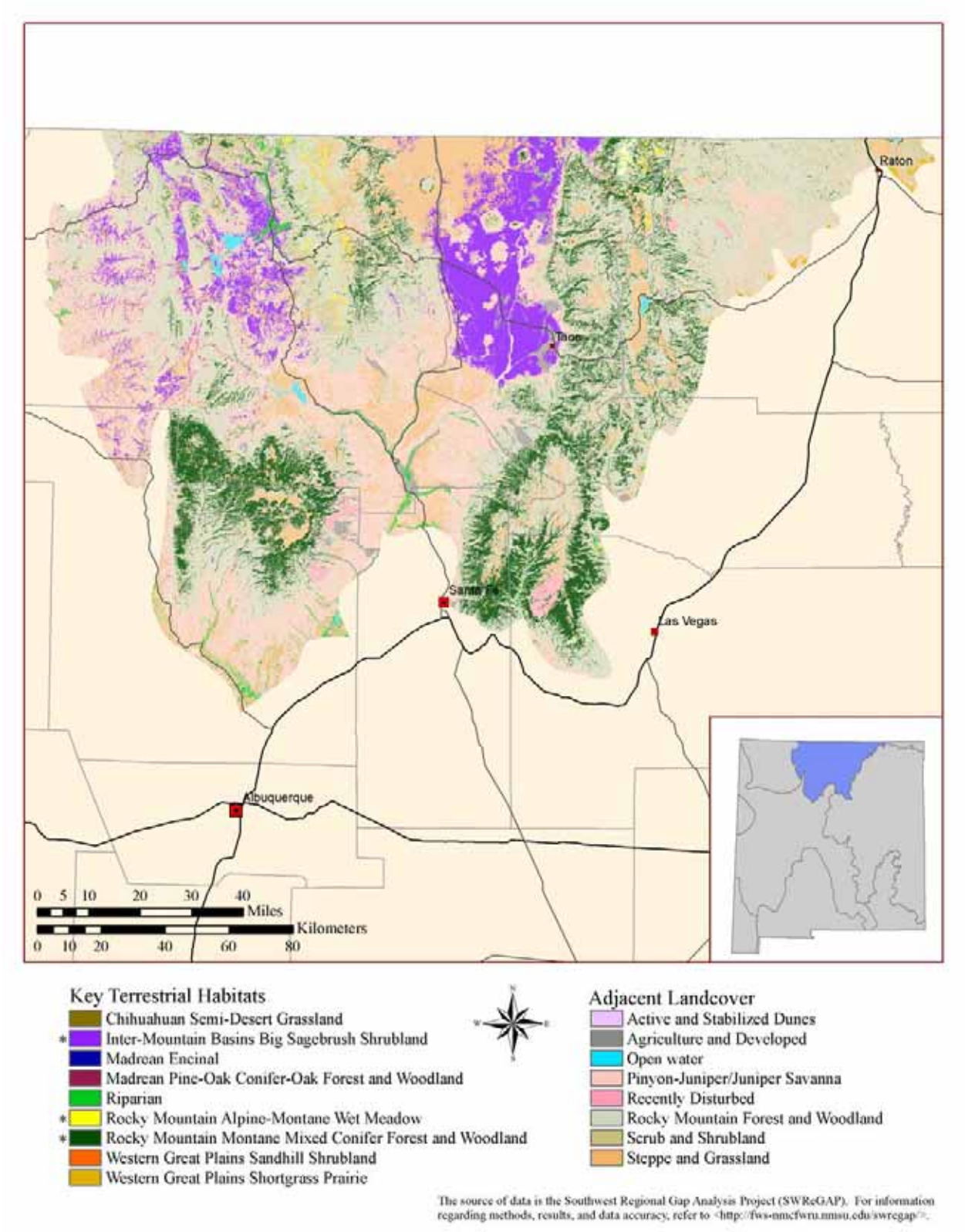

Figure 5-5. Key terrestrial habitats in the Southern Rocky Mountains Ecoregion in New Mexico. Adjacent land cover types are given to provide an indication of vegetation surrounding key habitats. Key habitats are designated with an asterisk (*).

Table 5-7. Species of Greatest Conservation Need in the Southern Rocky Mountains Ecoregion in New Mexico.

Common Name	Intermountain Basins Big Sagebrush Shrublands	Rocky Mountain Alpine-Montane Wet Meadow	Rocky Mountain Montane Mixed-Conifer Forest and Woodland
Birds			
American Bittern		X	
White-Faced Ibis		X	
Northern Pintail		X	
White-Tailed Ptarmigan		X	
Ferruginous Hawk	X		
Mourning Dove	X		
Loggerhead Shrike	X		
Sage Thrasher	X		
Bendire's Thrasher	X		
Sage Sparrow	X		
Osprey			X
Bald Eagle			X
Northern Goshawk			X
Golden Eagle		X	X
Peregrine Falcon			X
Blue Grouse		X	X
Band-Tailed Pigeon		X	X
Mexican Spotted Owl			X
Black Swift			X
Williamson's Sapsucker			X
Olive-Sided Flycatcher			X
Pinyon Jay			X
Yellow Warbler		X	X
Grace's Warbler			X
Red-Faced Warbler			X
Mammals			
Goat Peak Pika		X	
Arizona Myotis Bat	X		
White-Tailed Jack Rabbit	X		
Gunnison's Prairie Dog	X		
New Mexico Shrew			X
Spotted Bat			X
Allen's Big-Eared Bat			X
Snowshoe Hare			X
Abert's Squirrel			X
American Beaver		X	X
Black Bear	X	X	X
Rocky Mountain Bighorn Sheep		X	
American Marten			X
Mule Deer	X		X

Table 5-7 Cont.

Common Name	Intermountain Basins Big Sagebrush Shrublands	Rocky Mountain Alpine-Montane Wet Meadow	Rocky Mountain Montane Mixed-Conifer Forest and Woodland
Amphibians			
Tiger Salamander	X	X	X
Jemez Mountains Salamander			X
Reptile			
Collared Lizard	X		
Molluscs			
Crestless Column Snail		X	
Western Glass Snail		X	
Rocky Mountainsnail			X
Amber Glass Snail			X
Sangre de Cristo Woodlandsnail			X
Jemez Mountains Woodlandsnail			X
Spruce Snail			X

Much of this habitat type occurs on erosive sandy clay loams where wind and water erosion plays a major role in the degradation. In some sites west of Taos and north of Questa soils have in fact been removed through wind erosion, leaving a desert pavement of pebbles and rocks.

The current condition of the habitat is attributed to a long history of improper livestock grazing. Hull (1976) noted that by the late nineteenth century, the grazing capacity had been exceeded, resulting in a significant loss of native perennial grasses and an expansion of sagebrush and other shrubs within 10 to 15 years. Historic grazing use has also reduced the diversity of the forb component, which currently includes fleabanes (*Erigeron* spp.), buckwheats (*Eriogonum* spp.), and cheeseweeds (*Sphaeralcea* spp.). Many sites no longer have a soil seed bank sufficient to produce the native perennial grass component and now are invaded by non-native species including leafy spurge (*Euphorbia eusula*), cheatgrass (*Bromus tectorum*), and knapweeds (*Acroptilon* and *Centaurea* spp.). These species further reduce the productivity, diversity, and cover of the type, and in the case of cheatgrass, influence the intensity and frequency of fires (West 1988, Kurdila 1995, Vitousek *et al*. 1997).

It is likely that bird and small mammal assemblages have been affected by this change in the structure and composition of the vegetative community. Greater sage grouse (*Centrocercus urophasianus*) are obligate residents of the sagebrush ecosystem, usually inhabiting sagebrush-grassland or juniper sagebrush-grassland communities. Efforts to re-introduce this species, extirpated in 1919, probably failed because habitat conditions were no longer suitable. The effects of livestock grazing, invasion of noxious plants and a changing fire regime have also affected the prey base of top-level predators in the system, such as raptors, carnivores, and rattlesnakes (Jenkins *et al*. 2004).

Problems Affecting Habitat or Species

The primary disturbance factor within the Intermountain Basins Big Sagebrush Shrubland has been historical grazing with subsequent habitat conversion. This land cover type has also been affected by habitat fragmentation and conversion due to urban, residential, commercial, and recreational development. The future effects of these developmental factors may increase as human populations in the area continue to grow.

Grazing Practices
Livestock grazing has occurred in this habitat type for decades, with the greatest numbers of animals and associated disturbance occurring in the second half of the nineteenth century. Since then, grazing pressure in these sagebrush communities has declined. There are currently few remaining examples of intact sagebrush steppe in New Mexico. These are found as relict stands in the foothills of the Sangre de Cristo Mountains of Taos County. In this habitat type, even moderate levels of livestock grazing can remove the herbaceous understory that in turn, releases sagebrush seedlings from competition with herbaceous and graminaceous plants. This process results in excessively dense sagebrush stands with a sparse understory of annuals and unpalatable perennials (Havstad and Vavra 2004). However, studies in northern New Mexico have indicated that the total elimination of grazing for 22 years did not improve range condition on upland or lowland sites when compared with adjacent moderately grazed areas (Holechek and Stephenson 1985).

Urban/Residential, Commercial/Industrial, and Recreational Development
The continued encroachment of subdivisions and roads into previously undisturbed areas is a significant factor in the fragmentation of this habitat type. Between 1930 and 2000, the population of Taos County more than doubled (Williams 1986, US Census Bureau 2001). Related development is most evident near the communities of Taos and Questa where the proliferation of roads, pipelines, power line corridors, traffic, and human activity is clearly visible. Such development reduces landscape connectivity (Kiett *et al*. 1997) and affects the ability of wildlife to use habitats.

For example, changes in landscape patterns affect the energy balance, foraging behavior, and use of winter ranges by mule deer. In a study of two mule deer winter ranges in Taos County, Dunn and Milne (In Prep.) found that roads and home sites alter connectivity and act as barriers to animal movements. They also found that, between 1935 and 1996, total available habitat greater than 200 m from all roads and home sites decreased 83% in the El Rito and 46% in the Lama areas of Taos County. Exploration for natural gas in the Sunshine Valley area of northwestern Taos County is also ongoing and may presage future energy development and related impacts to this important mule deer winter range.

Non-Native Species
As noted in the above assessment of habitat condition, invasion of non-native plants is ongoing and likely to reduce the productivity, diversity, and cover of this habitat type and alter the intensity and frequency of fire.

Fire Management
Prior to European settlement, wildfires probably occurred less than once every 100 years in this and other arid sagebrush habitats. However, in the last century, fire frequency has increased in sagebrush communities throughout the West. Today, frequent wildfires in the Intermountain Basins Big Sagebrush Shrubland promote the decline of native grasses in favor of non-native annual grasses (Whisenant 1990). Control of these fires and reduction of livestock grazing will not result in a return to historic conditions because much of the soil seed bank has been lost (Anderson and Holte 1981).

Disease and Toxins
Most the avian and mammal SGCN are potentially affected by diseases and toxins (See the Statewide Assessment and Strategies chapter). The growing wildland urban interface, particularly in the vicinities of the communities of Taos and Questa, may expose wildlife to domestic pets and feral animals and contribute to the spread of these diseases. Increased exposure to refuse, pesticides, and parasites may also affect wildlife at this interface.

Information Gaps

Although there is a large body of literature on the sagebrush communities in the West, particularly in reference to sage grouse, remaining information gaps that constrain our ability to make informed conservation decisions include:

- Data are lacking regarding SGCN distribution, life history, spatial needs, and seasonal use patterns in the Intermountain Basins Big Sagebrush Shrubland.

- Important migration corridors, areas of habitat fragmentation, and area-sensitive species needs requirements have yet to be identified in the Intermountain Basins Big Sagebrush Shrubland.

- Little is currently known about the extent and distribution of invasive species in the Intermountain Basins Big Sagebrush Shrubland and effective interventions.

- The implementation and effectiveness of energy development mitigation in conserving habitats and species within the northern portions of the Intermountain Basins Big Sagebrush is unknown. This precludes evaluation of industry impacts and subsequent improvement of land management agency energy development policies.

- Information is needed on grazing management practices that produce sustainable levels, composition, and structure of native vegetation.

- The extent to which off-road vehicle use is impacting big sagebrush shrubland SGCN populations is unknown.

- Our understanding of the role of fire in sustaining the big sagebrush shrubland and appropriate fire management protocols is poor.

Research, Survey, and Monitoring Needs

The processes that have affected the Intermountain Basins Big Sagebrush Shrubland in the past and the anticipated levels of future development hasten the need for additional information. Research and Survey efforts that would inform conservation decisions are outlined below.

- Studies are needed to define current habitat use by SGCN of the Intermountain Basins Big Sagebrush Shrubland so that important areas of big sagebrush habitat may be identified and conserved, habitat fragmentation prevented, and migration corridors retained or restored. This information is also important in understanding how fragmentation and patch dynamics affect small mammal species, avifauna, and herpetofauna and how wildlife diseases and parasites are contracted at the wildland urban interface and transmitted through wildlife populations.

- Collection of basic life history information is needed to develop effective monitoring and conservation actions for SGCN whose basic biology is poorly understood.

- Studies are needed on how the invasion of cheatgrass has affected SGCN habitat structure, foraging behaviors, nutrition, and reproduction to develop effective habitat manipulations.

Desired Future Outcomes

Desired future outcomes for the Intermountain Basins Big Sagebrush Shrubland include:

- The Intermountain Basins Big Sagebrush Shrublands persist in the condition, connectivity, and quantity necessary to sustain viable and resilient populations of SGCN and host a variety of land uses with reduced resource use conflicts.

- Modified grazing management results in improved ecological conditions for Intermountain Basins Big Sagebrush Shrubland habitats and improved economic viability for the ranching community of northern New Mexico.

- A fully funded, comprehensive, statewide noxious weed program is established and implemented. Colonization of noxious weed species is stopped and extant weed populations are controlled or eliminated.

- Protected areas have been established as wildlife corridors to reduce habitat fragmentation and provide SGCN access to necessary habitat.

- Local communities are involved in and support decisions related to conserving to the SGCN and biodiversity of the Intermountain Basins Big Sagebrush Shrubland.

- Consistent reclamation standards that ensure future habitat integrity and functionality for Intermountain Basins Big Sagebrush Shrubland are jointly established and adopted by

private landowners, counties, municipalities, federal land management agencies and the State Land Office.

- Working groups comprised of local, state, and federal government agencies, landowners and the public have been established to address conservation issues at the wildland urban interface.

Prioritized Conservation Actions

Approaches for conserving New Mexico's biological diversity at the species or site-specific level are inadequate for long-term conservation of SGCN. Conservation strategies should be ecosystem-based and include public input and support (Galeano-Popp 1996). Monitoring of species and habitat will be employed to evaluate the effectiveness of the conservation actions described below. Those found to be ineffective will be modified in accordance with the principles of adaptive management. Conservation actions, in order of priority, which assist in achieving desired future outcomes, are outlined below.

1. Work with land management agencies and the agriculture industry to define and implement prescribed grazing systems that ensure long-term ecological sustainability and integrity and are cost effective for livestock interests.

2. Work with local, state, and federal government agencies and land owners to establish wildlife corridors, to reduce habitat fragmentation, and provide necessary habitat for SGCN. Approaches may include protecting sagebrush habitat west of Taos and Questa and management of road development and off-road vehicle use.

3. Work with federal and state agencies, private landowners, research institutions, and universities to design and implement projects that will provide information about SGCN and the Intermountain Basins Big Sagebrush Shrubland habitats outlined in the Research, Survey, and Monitoring Needs section above.

4. Work with private landowners, counties, municipalities, federal land management agencies and the State Land Office to mitigate and reduce impacts related to urbanization and develop consistent reclamation standards that ensure future habitat integrity and functionality for Intermountain Basins Big Sagebrush Shrubland.

5. Encourage comprehensive and vigorous noxious weed control efforts throughout the Intermountain Basins Big Sagebrush Shrubland and the strengthening of the state's invasive weed control capacity through applied science and promotion.

6. Promote establishment of nationally standardized indicators that would be used for the inventory, survey, and monitoring of the condition and health of this and other rangeland habitat types. Such indicators, along with standardizing methods of measuring site health and condition have previously been advocated by the National Research Council (1994), but have not been uniformly adopted.

7. Promote community based support and involvement in decisions related to ecological sustainability and integrity of the Intermountain Basins Big Sagebrush Shrubland and SGCN viability.

8. Develop an education program that imparts an understanding of the fragility of this habitat type and its importance to a wide array of species.

Rocky Mountain Alpine-Montane Wet Meadow

Habitat Condition

Alpine-montane wet meadows cover a relatively small area of land in the Southern Rocky Mountains Ecoregion. They occur in the high mountain valleys of the northern Sangre de Cristo Mountains (Latir, Pecos, and Wheeler Peak wilderness areas) at elevations of 9,000 ft (2,743 m) or greater. The extent of this land cover type is determined by the amount of annual snow accumulation, solar radiation, freeze-thaw cycles, and tree encroachment. In the Southern Rocky Mountains Ecoregion, these wet meadows are distinguished from classic tundra by the absence of permafrost and of deep organic mature soils (Rosiere 2000). While the soils in these alpine meadows are typically deeper and richer in organic matter than those found on fellfields and steep slopes, coarse rock fragments are found throughout soil profiles. Burrows built by pocket gophers (*Thomomys botteri*) result in a significant amount of soil mixing that facilitates soil aeration, nutrient cycling, water infiltration, and new sites for vegetation establishment.

Much of the variation in surface topography in this habitat type is caused by alternate freezing, thawing, and flow of water saturated soil over less permeable layers of rock and frozen ground (solifluction). Freeze-thaw processes produce a landscape of mounds and depressions at elevations above 12,000 ft (3,657 m). These depressions and the larger cirque lakes and marshes support micro-habitats and conditions supporting willow (*Salix* spp.). These meadows are also dominated by a thick turf composed of graminoids including sedges (Cyperaceae), rushes (Juncaceae), and grasses (Poaceae), especially tufted hairgrass (*Deschampsia caespitosa*). The forb species common to this type are more abundant on sites in earlier seral stages. Similarly, in rockier sites, vegetation is dominated by forbs including yellow stonecrop (*Sedum lanceolatum*) rose crown (*S. rhodanthum*), king's crown (S. *ingegrifolium*), stonecrop (*S. etenopetalum*), saxifrages (*Saxifrage* spp.), American bistort (*Polygonum bistortoides*), whiproot clover (*Trifolium dasyphyllum*), and dwarf clover (*T. nanum*). One of the most diagnostic indicator species of the alpine meadow is bogsedge (*Elyna bellardii* or *Kobresia myosuroids*). Weber and Wittmann (2001) described this species as the "climax dominant on mature soils of relatively dry but peaty alpine tundra." Beidleman *et al.* (2000) declared *Kobresia* "the dominant plant on mature, snow-free areas of tundra that have deep soils" while Kershaw *et al.* (1998) described it's habitat as "dry, open, wind-blown sites".

Despite the perception that water availability is high in these meadows, they are actually harsh environments with short growing seasons, high solar incidence, cold temperatures, and strong winds. The most important factor controlling the distribution and growth of alpine plants is soil moisture (Billings and Mooney 1968). Wind speeds of 25 to 30 mph (40 to 50 kmph) are common and may exceed 100 mph (60 kmph), particularly during the winter (Thilenius 1975).

Fuel loads in the sub-alpine and montane forests surrounding these meadows are unnaturally high and present a risk of catastrophic fire. Montane wet meadows are also strongly influenced by the encroachment of trees, which may increase with global warming. It is estimated that roughly one-third to one-half of this habitat type has been lost to human development (Southern Rockies Ecosystem Project 2003). Historical manipulation of the meadow habitats through root plowing and reseeding with non-native tame pasture species has significantly altered the composition and hydrology of the montane meadows in the northern Jemez Mountains. Many of these wet meadows were converted to more xeric grazing lands and no longer maintain the necessary hydrology to support the characteristic vegetation of this type. Throughout the ecoregion, wetlands have been intentionally drained to make the area more conducive for planting crops. Poorly placed and constructed roadways have also led to the drainage of wetland areas. Alpine meadows are particularly important to those species that are obligates within these habitats, such as ptarmigan (*Lagopus leucurus*) and Goat Peak pika (*Ochotona pinceps*). Rocky Mountain bighorn sheep (*Ovis canadensis canadensi*s) also use the alpine meadow habitat year-round and, in winter, become obligates to windswept slopes above timberline. The loss of alpine meadow habitats would result in the extirpation of ptarmigan and Goat Peak pika statewide and the extirpation of bighorn sheep from the Pecos, Latir, and Wheeler Peak sites.

Problems Affecting Habitats or Species

Fire Management
The accumulation of fuels in sub-alpine and montane forests adjacent to these meadows is the most serious factor potentially affecting these meadows. Fuel loads in the sub-alpine and montane forests surrounding these meadows are unnaturally high and, in combination with global warming induced encroachment of trees, may result in catastrophic stand-changing fire.

Drainage of Wetlands
Manipulation of wet meadows to replace native vegetation with pasture species and poor placement and construction of roadways remain land-use factors with the potential to drain the wetlands of Rocky Mountain Alpine-Wet Meadow habitats.

Grazing Practices
The wet meadows of the Southern Rocky Mountains Ecoregion provide some of the most attractive vegetation areas for grazing animals. Unconstrained access to the wet meadows may lead to loss of cover, mortality of plant species, increased erosion, and wetland drainage.

Recreational Use
The presence of roads and trails in and near alpine-montane wet meadows may result in reduced water quality, increased erosion, and eventual drainage of the wetlands.

Information Gaps

Information gaps are outlined below that impair our ability to make informed conservation decisions regarding alpine-montane wet meadow habitats and SGCN.

- Data are lacking pertaining to SGCN use and dependence upon Rocky Mountain Alpine-Montane Wet Meadow habitat.

- There are no accurate maps depicting long term historical changes in the location and extent of montane wet meadows that might be used to prioritize management actions.

- There is limited information on prescriptions for restoration of montane wet meadows.

- Information is needed on grazing management practices that produce sustainable levels, composition, and structure of native vegetation.

- The extent to which recreational use is impacting montane wet meadows SGCN populations is unknown.

- Our understanding of the role of fire in sustaining the montane wet meadows and appropriate fire management protocols is poor.

Research, Survey, and Monitoring Needs

The processes that have affected the Rocky Mountain Alpine-Montane Wet Meadow habitats in the past and the anticipated levels of future development provide the context for defining current research, survey, and monitoring needs:

- Research is needed to determine how forest encroachment and water use affect Rocky Mountain Alpine-Montane Wet Meadow habitats and how global warming induced tree encroachment has changed the spatial dynamics and persistence of this type in New Mexico.

- Research is needed to compile a comprehensive review of all known records and management actions affecting New Mexico's Rocky Mountain Alpine-Montane Wet Meadow habitats so as to better understand the effects of conversion to xeric grazing lands, conifer encroachment, and competition for water with dense conifer stands.

Desired Future Outcomes

Desired future outcomes for the Rocky Mountain Alpine-Montane Wet Meadow include:

- The Rocky Mountain Alpine-Montane Wet Meadows persist in the condition, connectivity, and quantity necessary to sustain viable and resilient populations of SGCN and host a variety of land uses with reduced resource use conflicts.

- Wetlands and meadows are restored to conditions approximating those that occurred before significant human impacts altered species composition, function, structure and morphology.

- Existing grazing practices ensure the sustainability and integrity of Rocky Mountain Alpine-Montane Wet Meadows and preserve cost effectiveness for private interests.

Prioritized Conservation Actions

Because of the importance and limited acreage of Rocky Mountain Alpine-Montane Wet Meadows, planning efforts should make the maintenance and restoration of these habitats a priority. Monitoring of species and habitat will be employed to evaluate the effectiveness of the conservation actions described below. Those found to be ineffective will be modified in accordance with the principles of adaptive management. Conservation actions, in order of priority, which assist in achieving desired future outcomes, are outlined below.

1. Work with federal and state agencies to liberalize burn policies in the wilderness areas surrounding montane and alpine meadow habitats to allow future fires to burn up to a meadow's edge rather than being suppressed.

2. Collaborate with federal and state agencies to mechanically remove (in the absence of fire) encroaching conifer stands to the extent necessary to retain the functionality of Rocky Mountain Alpine-Montane Wet Meadows. Pursue enabling legislative actions where wilderness status presents an obstacle.

3. Work with federal, state, and private land managers to adopt prescribed grazing practices that ensure the sustainability and integrity of Rocky Mountain Alpine-Montane Wet Meadows and preserve cost effectiveness for private interests.

4. Promote community based support and involvement in decisions related to ecological sustainability and integrity of Rocky Mountain Alpine-Montane Wet Meadow habitats and SGCN viability.

5. Work with federal and state agencies, private landowners, research institutions, and universities to design and implement projects that will provide the information about SGCN and the Rocky Mountain Alpine-Montane Wet Meadow habitats outlined in the Research, Survey, and Monitoring Needs section above.

6. Work with federal, state, and private land managers to reduce replacement of natural vegetation with pasture species and discontinue poor placement and construction of roadways within Rocky Mountain Alpine-Montane Wet Meadow habitats.

7. Develop and implement an information and education project to gain public acceptance for managed fire, wildfires, and mechanical cutting of trees in designated wilderness areas where these are needed to sustain or restore Rocky Mountain Alpine-Montane Wet Meadows.

Rocky Mountain Montane Mixed-Conifer Forest and Woodland

Habitat Condition

Rocky Mountain Montane Mixed-Conifer Forests and Woodlands form an indiscrete vegetation band dominated by Douglas fir (*Pseudotsuga menziesii*) that blends with true firs and spruces in the sub-alpine coniferous forest between elevations from 8,000 to 10,000 ft (2,438 to 3,048 m). The montane mixed-conifer forests and woodlands blends into ponderosa pine (*Pinus ponderosa*) forests at lower elevations. However, within the montane mixed-conifer forest Douglas fir seldom grows in pure stands, but mixes with blue spruce (*Picea pungens*) and white fir (*Abies concolor*). Blue spruce is often associated with frost pockets and is found along stream sides and on lower slopes where cold air drainage occurs. Following disturbances, Gambel oak (*Quercus gambelii*) and aspen (*Populus tremuloides*) are often prominent. Dick-Peddie (1993) described the montane mixed-conifer forest as being among the most widespread and productive vegetative types in New Mexico. Ample precipitation maintains well-watered soils for most of the long growing season when temperatures are favorable for tree growth.

Fire and logging are the primary disturbances within the mixed-conifer woodland. Natural fires historically occurred about every 10 years up until the late 1800s when fire suppression policies were implemented (Mac *et al.* 1998). Dick-Peddie (1993) speculated that erratic fire behavior created a patchy mosaic of stands in various successional stages. These fires might flare up into crown fires in some areas and miss other areas completely. Aspen is often present at sites where high intensity fires have occurred and subsequent open meadow succession processes seem to take one of two paths. Observations in the Pecos Wilderness indicate meadow replacement by aspen suckering while in areas of the Valle Vidal and Cruces Basin former aspen stands have died out and been replaced by montane and sub-alpine grasses. The elimination of fire in southwestern mixed-conifer forests has caused a major change in species composition and structure in the past century (Samson *et al.* 1994).

Historically, lower elevation mixed-conifer forests in the Southwest with more open stand structures had ponderosa pine as a co-dominant species. However, dense sapling understories developed in the mixed-conifer forest as a result of fire suppression and subsequent tree regeneration by the more fire-sensitive Douglas-fir and white-fir species. Forest stand inventory data from Arizona and New Mexico show an 81% increase in the area of mixed-conifer forests between 1962 and 1986, which is explained by this trend toward more fire-sensitive tree species (US Forest Service 1993). Fire suppression has also contributed to reduced aspen stands and the habitat they provide for a variety of wildlife species. Logging in mixed-conifer habitats has created extensive road networks, furthered habitat fragmentation, and replaced fire as a determinant of stand succession.

Improper grazing practices (those that reduce the ability of the land to sustain long-term plant and animal production) in mixed-conifer habitats have created competition with wildlife for water, forage, and space. These practices have altered vegetation composition and structure, increased siltation, affected stream hydrology and water quality, and reduced soil permeability and soil compaction.

Problems Affecting Habitats or Species

Analyses based on the scientific literature and NMDGF staff opinion indicates that the associated effects of climate change, drought, man-caused changes to natural fire regimes, and insect attacks are the factors most adversely affecting Rocky Mountain Montane Mixed-Conifer Forest and Woodland habitats in the Southern Rocky Mountain Ecoregion. High biological productivity within Rocky Mountain montane mixed-conifer forests explains why extractive resource uses, such as logging and grazing, have been an important economic consideration in this habitat type. Sustained or increased intensities of these activities may reduce biodiversity and productivity (Dick-Peddie 1993).

The synergistic effects of factors that influence habitats make it difficult, and perhaps impossible, to separate out individual causal factors that influence habitats or the SGCN. Multiple factors are closely linked in cause and effect relationships across spatial and temporal scales. Adverse consequences from multiple ecosystem stressors can have cumulative effects that are more than additive effects. One or more stressors may predispose biotic organisms to additional stressors (Paine *et al.* 1998). A greater discussion of the synergistic effects is provided in Statewide Assessment and Strategies (Chapter 4).

Climatic Change and Drought
The effects of climatic change on the Rocky Mountain Montane Mixed-Conifer Forest and Woodland are difficult to predict, largely due to the complexity of interactive relationships between global, regional and local biotic and abiotic factors (Weltsin and McPherson 1995). However, the effects of climatic change on habitat types in New Mexico are significant and are presented in detail in Chapter 4.

Drought (an extended period of abnormally dry weather) is considered to be one of the most significant factors affecting Rocky Mountain Montane Mixed-Conifer Forest and Woodland because it alters landscape and atmospheric conditions and leads to habitat conversion. Drought can limit seedling establishment and forest productivity by altering soil moisture gradients (Osmond *et al*. 1987, Schulze *et al*. 1987). Further, drought alters fire frequency, intensity, and timing in forest habitats by changing the amount and accumulation of fine fuels (Clark 1990, Haworth and McPherson 1994).

Fire Suppression
The disruption of natural fire cycles caused by fire suppression can significantly alter Rocky Mountain Montane Mixed-Conifer Forest and Woodland habitats in New Mexico (see Chapter 4). Mac *et al.* (1998) estimated the mean fire occurrence interval in the montane mixed-conifer forest at about every 10 years up until the late 1800s when fire suppression policies were implemented. Prior to that time, frequent, naturally occurring, low-intensity ground fires helped maintain stands of older trees with open, park-like structure within ponderosa pine and lower Rocky Mountain Montane Mixed-Conifer Forest and Woodland (Moir and Dieterich 1988). Within higher elevation mixed-conifer and spruce-fir forests, wildfires were less frequent and of the generally higher-intensity, stand-replacing type. An historic and relevant example is the Aspen Basin fire of 1891, above Santa Fe in the Santa Fe National Forest, which created thousands of acres of aspen that still exist (Dick-Peddie 1993).

Insects and Disease
Native insects and diseases are an integral part of forest ecosystems. They help recycle forests by decomposing trees and thereby releasing nutrients necessary for forest growth. However, insect and disease outbreaks can seriously impede conifer regeneration and affect resources valued by society, such as aesthetics, recreation, water, and wildlife (see Chapter 4 for more details).

Many different species of bark beetles affect southwestern mixed-conifer forests. Most bark beetle species are relatively host-specific, limiting their activities to primarily one tree species. Some of the more important species for mixed-conifer forests that attack ponderosa pine trees in New Mexico include the mountain pine beetle (*Dendroctomus ponderosae*), western pine beetle (*D. brevicomis*), roundheaded pine beetle (*D. adjunctus*), and pine engraver (*Ips pini*). The Douglas fir beetle (*D. pseudotsugae*), and the fir engraver (*Scolytus ventralis*) prefer white fir, while the spruce beetle (*Dendroctomus rufipennis*) attacks Engelmann spruce (*Picea englemannii*) (Wilson and Tkaz 1994). The direct effects of bark beetle infestation on trees include tree mortality and top-killing (Stark 1982). The US Forest Service, in 2003, mapped conifer mortality attributed to bark beetles on about 2,700,000 ac (1,092,653 ha) in Region 3 alone (US Forest Service 2004).

White fir and Douglas fir are also the preferred host species for western spruce budworms (*Choristoneura occidentalis*). When fire is suppressed, the density of these tree species increases and they are more susceptible to intense and synchronous outbreaks of spruce budworm. Between the 1920s and 1993 there were five major outbreaks of western spruce budworm in New Mexico. The most recent outbreak covered approximately 700,000 ac (283,280 ha) at its peak (Fellin *et al.* 1990).

Aspen is subject to fungus including white tree rot (*Phellinus* spp.), sooty-bark cankers (*Encoelia pruinosa*), and several root rots. Sooty-bark canker is the most lethal canker on aspen in the West and tends to occur on the larger trees (Johnson *et al.* 1995). A study conducted in Colorado and New Mexico indicated that trunk cankers (developed from infected logging injuries) were the major cause of aspen death (Johnson *et al.* 1995). Approximately 20% of residual trees in partially cut stands died five years after the stand was harvested. Two years later, 40% of the remaining residual trees were infected with various cankers, indicating that tree mortality would increase. Insects that attack aspen include tortrix (*Choristoneura conflictana*) and western tent caterpillar (*Malacosoma californicum*).

Several SGCN of the Rocky Mountain Montane Mixed-Conifer Forest and Woodland are likely to benefit from the occurrence of native insects and diseases or their effects on the habitat. These include: Williamson's sapsucker (*Sphyrapicus thyroideus*), olive-sided flycatcher (*Contopus cooperi*), yellow warbler (*Dendroica petechia*), red-faced warbler (*Cardellina rubrifrons*), Grace's warblers (*Dendroica graciae*), Mexican spotted owl (*Strix occidentalis lucida*), Jemez Mountains salamander, black bear (*Ursus americanus amblyceps*), and Allen's big-eared bat (*Idionycteris phyllotis*).

Extractive Resource Uses
The high productivity of the montane mixed-conifer forest creates a place where extractive resource use, such as grazing and logging, is relatively common. Further, this habitat type is open for increased oil and gas exploration. Sustained uses for these activities may reduce biodiversity and productivity.

Livestock grazing has economic and cultural values that are important to individuals, communities, and to the state. Improper grazing practices are considered practices that reduce long-term plant and animal productivity (Wilson and MacLeod 1991), and include domestic livestock and wildlife. Improper grazing practices have influenced vegetation communities and fish and wildlife habitat in New Mexico for more than a century (See Chapter 4 for greater details). Improper grazing has reduced vegetative cover, increased soil erosion, and aggravated local flooding (Felger and Wilson 1995). Impacts of improper grazing practices in Rocky Mountain Montane Mixed-Conifer Forests and Woodlands include: 1) competition with wildlife for water, forage, and space; 2) degradation of forage and cover by the altering of vegetative composition and structure; 3) alteration of stream hydrology and water quality; 4) increased siltation; 5) and reduced soil permeability and the potential to support plants due to soil compaction. Further, excessive domestic livestock and native ungulate browsing may damage aspen suckers and weaken aspen clones, in turn making trees more susceptible to invasion from disease and insects.

Logging has been one of the primary disturbance factors in Rocky Mountain Montane Mixed-Conifer Forest and Woodlands in the Southwest. Conifer forest and woodlands in New Mexico now generally occur in early and middle successional stages. Stand succession that would have occurred due to fires has been replaced through the silvicultural practices of logging. However, the patchy mosaic that erratic fire behavior would create is usually not successfully duplicated through logging. The natural processes associated with fire are not fully understood and it is not clear what effects may result from replacing fire with logging (Dick-Peddie 1993). Logging has created extensive road networks furthering habitat fragmentation in the Rocky Mountain Montane Mixed-Conifer Forest and Woodlands and other New Mexico forests.

Fuel-wood collection is not recognized as a factor significantly affecting the mixed-conifer habitat type. However, woodcutters sometimes remove standing snags and downed logs that are important for wildlife habitat and ecosystem function. Roads developed for fuel-wood collection fragment habitat and may function as artificial firebreaks. The Carson National Forest had approximately 3,587 mi (5,772 km) of open road and the Santa Fe National Forest had approximately 3,750 mi (6,035 km) of existing road in the late 1980s.

Currently, the amount of oil and gas exploration that occurs in this habitat type in the Southern Rocky Mountain Ecoregion is limited to coal-bed methane drilling on the Vermejo Park Ranch. Coal-bed methane exploration is under consideration for the US Forest Service Valle Vidal Unit located adjacent to Vermejo Park. There are a variety of impacts that could be associated with coal bed methane exploration on the Valle Vidal, including increased mileage of roads, increased disturbance, and potential impacts to water quality, big game, and other wildlife habitat. Similar impacts to the adjacent privately owned Vermejo Park have been mitigated through costly methods. Mitigation on the Valle Vidal may not be cost effective and therefore not be employed.

Recreational Use
Current recreational uses of the mixed-conifer habitat type include skiing, hiking, mountain biking, snowmobiling, off-road vehicles, rock climbing, and camping. The overall effect of these activities is not fully understood, nor is there a full comprehension of how much recreational use can be tolerated before wildlife or wildlife habitats are adversely affected. Commercial ski areas are usually located within this habitat type and clearly result in habitat conversion.

Non-Native Species
As of 1998, non-native or invasive species have been implicated in the decline of 42% of species federally listed under the Endangered Species Act (Center for Wildlife Law 1999). Once established, non-native species have the ability to displace native plant and animal species, disrupt nutrient and fire cycles, and alter the character of the community by enhancing additional invasions (Cox 1999, Deloach *et al.* 2000, Zavaleta *et al.* 2001, Osborn *et al.* 2002). The occurrence or rate of spread of non-native or invasive species within Rocky Mountain Montane Mixed-Conifer Forest and Woodland is unknown.

Information Gaps

Information gaps are outlined below that impair our ability to make informed conservation decisions regarding mixed-conifer forest and woodland habitats and SGCN.

- Abundance, distribution, and trend information is absent or sparse for many SGCN. There is no central clearinghouse for biological information and no one agency has ready access to all available information. In addition, the requirements for area-sensitive species have not been clearly defined.

- While many aspects of fire are understood, the role that natural fire plays, particularly differing intensities of fire within the entire ecosystem is not well understood. Site-specific fire histories and methods to initiate more natural fire regimes within the Rocky Mountain Montane Conifer Forest and Woodland are unknown.

- There is little known about aspen succession (Dick-Peddie 1993). In aspen stands that have predominantly changed to conifers, information is lacking on how many aspen should remain in order to provide adequate regeneration after a fire removes conifers. The occurrence of aspen succession resulting in montane and sub-alpine grasslands is not well understood.

- The location, timing, duration, frequency, and intensity of all the factors influencing Rocky Mountain Montane Conifer Forest and Woodland and associated SGCN are unknown. For example, information on the location, timing, intensity, and duration of prescribed fire and fuel reduction/logging activities is needed for conservation of SGCN, such as the Jemez Mountain salamander. Further, there is a long history of grazing by domestic livestock and native ungulates in this habitat type. Perceived effects include subsequent soil erosion and altered fire cycles. However, there is little understanding of the mechanisms by which these effects occur.

- The intensity, scale, extent, and causes of forest fragmentation in the Rocky Mountain Montane Mixed-Conifer Forests and Woodlands and the effects of forest fragmentation on associated SGCN have not been determined.

- Community structure and many life history attributes of SGCN that use Rocky Mountain Montane Mixed-Conifer Forests and Woodlands are unknown.

- Environmental conditions that limit populations of SGCN associated with Rocky Mountain Montane Mixed-Conifer Forests and Woodlands are unknown.

- The intensity, scale, extent, and causes of human-caused habitat fragmentation are unknown in the Rocky Mountain Montane Mixed-Conifer Forests and Woodlands.

- Information on requirements of area-sensitive species is needed, including the location of key migration corridors, degree of habitat fragmentation, and spatial locations of fragmented areas.

- It is not clear how the Healthy Forest Initiative and Healthy Forest Restoration Act will affect SGCN including Northern goshawks (*Accipiter gentilis*), Mexican spotted owls, Jemez Mountain salamanders, and American martens that rely on old growth, mixed-conifer forests.

- It is unknown the extent to which invasive species alter disturbance regimes and population viability of SGCN within Rocky Mountain Montane Mixed-Conifer Forests and Woodlands.

Research, Survey, and Monitoring Needs

Ruggiero (1991) defined how species and their habitats should be viewed when considering research needs: "Because requirements can change over time, the focus of research should not only be on the features of the environment that are required for a population to exist, under a given set of conditions, but also on the requirements necessary for the population to persist over time under varying environmental conditions. The profound difference between existence and persistence must be clearly recognized." Current research, survey, and monitoring needs that would inform conservation decisions are outlined below.

- Abundance, distribution, and trend information needs to be determined for many SGCN. The requirements for area-sensitive species need to be determined.

- Research is needed to assess the attributes of Rocky Mountain Montane Mixed-Conifer Forest and Woodland habitats that are required for the persistence of associated SGCN so that viable populations may persist.

- Basic research is needed to enhance currently incomplete information of SGCN vertebrate and invertebrate community structures, natural history, and ecological relationships in Rocky Mountain Montane Mixed-Conifer Forest and Woodland habitats.

- Determine how SGCN of Rocky Mountain Montane Mixed-Conifer Forest and Woodlands respond to prescribed livestock grazing practices, fuel wood harvesting, increased recreational use, exotic species invasions and increased human population growth (DeBano and Ffolliott 1995).

- Determine the necessary habitat size and forest age-class structure needed to support SGCN of the Rocky Mountain Montane Mixed-Conifer Forests and Woodlands that migrate vertically during daily and seasonal movements to fulfill their ecological needs for food, shelter, water and space.

- Environmental conditions that limit populations of SGCN within Rocky Mountain Montane Mixed-Conifer Forest and Woodlands need to be determined.

- Much work is needed to understand the relationships between climate change, drought, fire and fire suppression activities, phytophagous insect attacks, and habitat fragmentation resulting from roads and increased human developments.

- Determine how global and regional climate change will affect vegetation and community and ecosystem-level dynamics in mixed-conifer forests and woodlands.

- Mountain Montane Mixed-Conifer Forests and Woodlands are disturbance forests with predominant seral communities (Dick-Peddie 1993). To adequately restore fire as a management tool, there must be a clear understanding of historic fire regimes at regional- to site-specific scales.

- There is a continuing need to increase our understanding of the effects of post-fire treatments within the context of ecological and societal goals for forested public lands of the western US (Beschta *et al.* 2004).

- Research is needed to evaluate the effectiveness of prescribed fire in reducing the potential for catastrophic stand-replacing fires in the Rocky Mountain Montane Mixed-Conifer Forest and Woodlands.

- Work is needed to determine the effects of natural and prescribed fire on the structure of vegetative communities in the Rocky Mountain Montane Mixed-Conifer Forest and Woodlands and the subsequent effects upon vertebrate and invertebrate populations.

- Research is needed regarding the ecological effects of logging as compared with fire in the Rocky Mountain Montane Mixed-Conifer Forest and Woodlands. The natural processes associated with fire are not fully understood and it is not clear what effects may result from replacing fire with logging (Dick-Peddie 1993).

- Research is needed to explore the best methods of mimicking natural disturbance regimes within the historic natural range of variability. Ecological forestry assumes that native species evolved under natural conditions and management within this natural range of variability should ensure that these species persist (Seymour and Hunter 1999).

- Research is needed to determine how SGCN respond short-term and long-term to phytophagous insect outbreaks in Rocky Mountain Montane Mixed-Conifer Forest and Woodlands and the potential habitat fragmentation caused by these attacks at the community, species, population and individual levels.

- Studies are needed to identify wildlife travel corridors that connect the Rocky Mountain Montane Mixed-Conifer Forest and Woodlands to different mountain ranges of the Southern Rocky Mountain Ecoregion. The information needed for understanding and managing for habitat connectivity includes population-level information of dispersal behavior, daily and seasonal movements of SGCN through this habitat type, how different types of habitat fragmentation affect movements, and how climate change may ultimately affect species distributions.

- Research is needed to determine the intensity, scale, extent, and causes of forest fragmentation in Rocky Mountain Montane Mixed-Conifer Forest and Woodlands and how SGCN respond to habitat fragmentation at the community, species, population and individual levels.

- The species-specific effects of natural and human-caused habitat fragmentation on SGCN within the Rocky Mountain Montane Mixed-Conifer Forests and Woodlands need to be determined.

- Research is needed to assess the impacts of prescribed livestock grazing on the structure of Rocky Mountain Montane Mixed-Conifer Forest and Woodlands.

- Research is needed to determine how grazing timing, intensity, and duration affect SGCN life history attributes in Rocky Mountain Montane Mixed-Conifer Forest and Woodlands.

- Determine how prescribed grazing ultimately affects natural disturbance regimes (McPherson 1992) in Rocky Mountain Montane Mixed-Conifer Forest and Woodlands.

- Research is needed to better understand aspen succession in Rocky Mountain Montane Mixed-Conifer Forest and Woodlands and the effects of prescribed grazing by domestic sheep, cattle, and native ungulates.

- Determine the areal extent, age class, structural characteristics, and regeneration rates of the Rocky Mountain Montane Mixed-Conifer Forest and Woodlands so as to provide predictive power and inform an ecosystem management approach.

- The extent to which invasive species may alter disturbance regimes and population viability of SGCN within Rocky Mountain Montane Mixed-Conifer Forest and Woodlands needs to be determined.

- There is a need for additional investigations of hydrologic relationships in the mixed-conifer forest and woodlands that will provide a better understanding of infiltration, interception, and transpiration processes, and how disturbances such as drought and fire affect these processes. This information is necessary for determining effective and sustainable conservation practices (Ffolliott *et al*. 1993).

Desired Future Outcomes

Desired future outcomes for the Rocky Mountain Montane Mixed-Conifer Forest and Woodland include:

- Rocky Mountain Montane Mixed-Conifer Forest and Woodland habitats persist in the condition, connectivity, and quantity necessary to sustain viable and resilient populations of SGCN and host a variety of land uses with reduced resource use conflicts.

- Partnerships have been established among state and federal government agencies, non-governmental organizations and private landowners for the implementation of collaborative and coordinated initiatives to conserve SGCN and the functionality of the Rocky Mountain Montane Mixed-Conifer Forest and Woodland habitats upon which they depend.

- Long-term conservation strategies to restore native species to viable populations within Rocky Mountain Montane Mixed-Conifer Forest and Woodlands garner wide public support.

- Stand-replacing wildfires have become less common in the Rocky Mountain Montane Mixed-Conifer Forests and Woodlands and no longer alter existing habitats beyond the range of natural variability under which SGCN evolved.

- Post-fire management activities that are detrimental to SGCN and/or ecosystem function and recovery are no longer practiced in Rocky Mountain Montane Mixed-Conifer Forest and Woodlands.

- Prescriptions have been developed for the Rocky Mountain Montane Mixed-Conifer Forest and Woodlands that allow adequate and sustainable levels of human harvest of fuel wood and other wood products, are compatible with the tenets of ecological forestry, and replicate natural disturbance patterns.

- Decisions to implement control measures for phytophagous insect outbreaks in Rocky Mountain Montane Mixed-Conifer Forest and Woodlands are informed and balanced by considerations of the role of these events in maintaining forest health and ecosystem function (Schowalter 1994).

- Consistent development standards that ensure future habitat integrity and functionality for the wildland urban interface of Rocky Mountain Montane Mixed-Conifer Forest and Woodlands are jointly established and adopted by private landowners, counties, municipalities, federal land management agencies and the State Land Office.

- Local zoning regulations are in place to help reduce wildfire threats to private residences at the wildland urban interface in Rocky Mountain Montane Mixed-Conifer Forest and Woodlands and funds that are currently directed toward these threats have been redirected to re-establishing naturally functioning ecosystems in forest interiors.

- Major migration/movement corridors of Rocky Mountain Montane Mixed-Conifer Forest and Woodlands are intact and maintain connectivity and availability of SGCN habitats.

- Oil and gas extraction activities have not compromised the condition, connectivity, and quantity of Rocky Mountain Montane Mixed-Conifer Forest and Woodlands on the Valle Vidal or the capacity of this property to sustain viable and resilient populations of SGCN.

- Livestock and large ungulate grazing levels are maintained at levels that sustain the full range of ecosystem functions and persistence of SGCN.

- Aspen stands within Rocky Mountain Montane Mixed-Conifer Forest and Woodlands are maintained at a sufficient level to sustain obligate SGCN and associated plant and wildlife species.

- Special habitats within the Rocky Mountain Montane Mixed-Conifer Forest and Woodlands such as cienegas, limestone outcrops, talus slopes, caves, and perennial streams are protected and are being monitored on a long-term basis to ensure conservation for SGCN that rely on these habitats.

- Scientific ecosystem management has been established and implemented in the Rocky Mountain Montane Mixed-Conifer Forest and Woodlands and is evidenced in forest management plans.

- Colonization by exotic species in Rocky Mountain Montane Mixed-Conifer Forest and Woodlands is stopped and existing populations of exotic species are controlled or eliminated.

- Activities implemented in Rocky Mountain Montane Mixed-Conifer Forest and Woodlands under the Healthy Forest Initiative and Healthy Forest Restoration Act are focused on removing ladder fuels and smaller diameter thickets and protecting human structures and neighborhoods in the wildland urban interface and avoid unnecessary removal of large old-growth trees and snags important as wildlife habitat.

Prioritized Conservation Actions

Approaches for conserving New Mexico's biological diversity at the species or site-specific level are inadequate for long-term conservation of SGCN. Conservation strategies should be ecosystem-based and include public input and support (Galeano-Popp 1996). Monitoring of species and habitat will be employed to evaluate the effectiveness of the conservation actions described below. Those found to be ineffective will be modified in accordance with the principles of adaptive management. Conservation actions, in order of priority, which assist in achieving desired future outcomes, are outlined below.

1. Work with land management agencies and private landowners in Rocky Mountain Montane Mixed-Conifer Forest and Woodlands to develop a fire management regime that promotes restoration of vegetative communities more nearly approximating those that historically supported SGCN. Approaches might include encouraging the US Forest Service to supplement lightning-caused fires with prescribed burning.

2. Collaborate with state and federal agencies, the New Mexico Legislature, NGOs, and private landowners to conserve riparian and other important wildlife habitat corridors linking Rocky Mountain Montane Mixed-Conifer Forest and Woodlands within and between other ecoregions. Approaches might include conservation easements and/or fee-simple purchases from willing sellers.

3. Collaborate with state and federal agencies and private landowners to reduce habitat fragmentation within Rocky Mountain Montane Mixed-Conifer Forest and Woodlands. Approaches might include closure of unnecessary interior and adjacent roads and minimizing new road building on associated national forests.

4. Work with the US Forest Service to promote compliance with the tenets of ecological forestry for any land management activities conducted within Rocky Mountain Montane Mixed-Conifer Forest and Woodlands.

5. Work with federal and state agencies, private landowners, research institutions, and universities to design and implement projects that will provide the information about SGCN and the Rocky Mountain Montane Mixed-Conifer Forests and Woodlands outlined in the Research, Survey, and Monitoring Needs section above.

6. Work with the US Forest Service and affected publics to develop strategies for the sustainable harvest of wood products in Rocky Mountain Montane Mixed-Conifer Forest and Woodlands that will retain old-growth trees and large diameter snags needed by SGCN and the communities that support them.

7. Encourage thinning and fuel-reducing initiatives in Rocky Mountain Montane Mixed-Conifer Forest and Woodlands where necessary to open dense stands that have become susceptible to insects, diseases, or stand-replacing wildfires that may alter conditions to which SGCN are adapted.

8. Work with the US Forest Service to ensure that fuel reduction treatments in Rocky Mountain Montane Mixed-Conifer Forest and Woodlands are focused on removing smaller diameter ladder fuels and dog-hair thickets and protecting human structures and neighborhoods in the wildland urban interface and that these interventions avoid unnecessary removal of large old-growth trees and snags important as wildlife habitat.

9. Encourage government and private land managers to protect and restore watersheds, wetlands, and wet meadows of the Rocky Mountain Montane Mixed-Conifer Forest and Woodlands through management practices that maintain native biodiversity and reduce erosion, gully formation, and soil loss.

10. Work with the US Forest Service and affected livestock and hunting interests to ensure that livestock and large ungulate grazing occur at levels compatible with sustaining viable populations of SGCN.

11. Monitor the introduction and spread of exotic plants and animals into Rocky Mountain Montane Mixed-Conifer Forest and Woodlands and encourage control or eradication where necessary to maintain or restore native biodiversity.

12. Work with the US Forest Service in conducting prescribed burning in Rocky Mountain Montane Mixed-Conifer Forest and Woodlands to protect breeding birds, avoid riparian areas, and otherwise conserve SGCN.

13. Work with land management agencies, private land managers, and the agriculture industry to identify and promote grazing systems on rangelands that ensure long-term ecological sustainability and integrity and are cost effective for livestock interests.

14. Collaborate with US Forest Service to designate areas for off-road vehicle use that avoid disturbance to SGCN or their habitats and to discover ways to mitigate such disturbance where it currently occurs.

15. Work in partnership with private landowners, counties, municipalities, federal land management agencies and the State Land Office to mitigate and reduce impacts related to urbanization of Rocky Mountain Montane Mixed-Conifer Forest and Woodlands habitats. Approaches might include establishment of development standards that ensure continued habitat integrity and functionality.

16. Work with counties and municipalities in Rocky Mountain Montane Mixed-Conifer Forest and Woodlands to create local zoning regulations that help reduce wildfire threats to private residences in areas of wildland urban interface and to direct financial resources to re-establishing naturally functioning ecosystems in forest interiors.

17. Work with the US Forest Service and oil and gas companies to minimize oil and gas development and associated effects in the Rocky Mountain Montane Mixed-Conifer Forest and Woodland, especially the Valle Vidal.

18. Encourage the US Forest Service to conserve the biological diversity of the Rocky Mountain Montane Mixed-Conifer Forest and Woodland through development and implementation of an ecosystem management approach.

19. Work with the US Forest Service to employ prescribed burns and let-burn policies that will promote return of aspen groves to their historic distributions and abundances within the Rocky Mountain Montane Mixed-Conifer Forest and Woodlands.

20. Collaborate with state and federal agencies to minimize installation of developed recreation sites in aspen stands so as to reduce exposure of aspens to injury and fungal infections.

21. Develop projects and partnerships to assess SGCN distribution, abundance, population trends, basic life history attributes, population biology, community ecology, and responses to anthropogenic and natural habitat disturbances within Rocky Mountain Montane Mixed-Conifer Forest and Woodlands.

22. Partner with US Forest Service, NGOs, and private landowners to identify, protect, and monitor special SGCN habitats such as cienegas, limestone outcrops, talus slopes, caves, and perennial streams within the Rocky Mountain Montane Mixed-Conifer Forest and Woodlands.

23. Create public awareness and understanding of ecosystem function, values, and products and the scope and scale of human impacts on the condition of Rocky Mountain Montane Mixed-Conifer Forest and Woodland important to SGCN.

24. Collaborate with land management agencies, conservation organizations, and educational groups to inform the public about the potential adverse effects of continued climate change on SGCN and their habitats.

25. Work with the US Forest Service and NM State Forestry Division to inform land managers and affected publics of the ecology of phytophagous insects and their role in sustaining ecosystem function.

26. Work with the US Forest Service, NM State Forestry Division, and private landowners to prevent conducting post-fire management activities that are detrimental to SGCN and/or ecosystem function.