ADDITIONAL SPECIES OF GREATEST CONSERVATION NEED

As noted in the Approach chapter, association with key habitats was employed to identify Species of Greatest Conservation Need (SGCN). However, there were eight additional species of birds, mammals, amphibians and molluscs that lack an association with key habitats. These species have been designated as SGCN for reasons noted below. Although limited information precluded our use of the habitat association criterion for the arthropod taxonomic group, we have identified 154 of them as SGCN.

Bird, Mammal, Amphibian, and Mollusc SGCN

The tenuous status and limited New Mexico distribution and abundance of these eight indicative species (Table 5-19) warrant their designation as SGCN. We have therefore included them as SGCN and provide the requisite information on their distribution and abundance, identify relevant problems, information gaps, research, survey, and monitoring needs, desired outcomes, and conservation actions.

Table 5-19. Additional bird, mammal, amphibian, and mollusc SGCN in New Mexico.

Taxa Group	Common Name	State Status
Bird	Boreal Owl	Threatened
Mammal	Organ Mountains Colorado Chipmunk	Threatened
Mammal	Oscura Mountains Colorado Chipmunk	Threatened
Amphibian	Eastern Barking Frog	Not listed
Mollusc	Hacheta Grande Woodlandsnail	Threatened
Mollusc	Lilljeborg's Peaclam	Threatened
Mollusc	Peloncillo Mountains Talussnail	Species of Concern
Mollusc	Sangre de Cristo Peaclam	Threatened

Boreal Owl

Distribution and Abundance

Boreal owls (*Aegolius funereus*) occur in the boreal forests of both the Old and New Worlds. In Alaska and Canada, boreal owls inhabit forests of spruce (*Picea* spp.), aspen (*Populus tremuloides*), birch (*Betula* spp.), and balsam-fir (*Abies balsamea*). In the Rocky Mountains, they are found in forests of sub-alpine fir (*Abies* spp.) and Englemann spruce (*Picea englemanni*). In Colorado, boreal owls are found at 9,200 – 10,500 ft (2,800-3,200 m), with highest densities above 9,850 ft (3000 m), where mature spruce-fir forests are interspersed with sub-alpine meadows (Palmer 1986). SWReGAP associates boreal owls with Rocky Mountain Subalpine-Montane Limber-Bristlecone Pine Woodland, Rocky Mountain Sub-alpine Dry-Mesic Spruce-Fir Forest and Woodland, and Rocky Mountain Sub-alpine Mesic Spruce-fir Forest and Woodland.

The species reaches its southernmost limits in the mountains of northern New Mexico, where it was first detected in 1987 (Stahlecker and Rawinski 1990). Here the boreal owl has been documented as resident at 10 specific sites in eight general locales in the San Juan, Sangre de Cristo, and Jemez mountains. All were found on public lands in the Carson and Santa Fe National Forests located in Rio Arriba, Taos, Santa Fe, Mora, and San Miguel counties (Stahlecker and Duncan 1996, NMDGF 2004a). The average elevation where boreal owls are found in New Mexico is 10,345 ft (3,154 m), with only one locale below 10,000 ft (3,000 m).

The species is an obligate cavity nester, typically selecting old woodpecker holes in large trees, although natural cavities are also used. In the northern Rocky Mountains, nest sites are largely restricted to the older, multi-layered forest stands preferred by this owl. The diet of boreal owls is predominantly small mammals. Preferred foraging habitats are mature or older spruce-fir stands where prey populations are highest and an open lower story facilitates hunting. For roosting, this owl selects dense conifer stands with high canopy cover and high tree density (Hayward and Hayward 1993).

Abundance data are meager for boreal owls in New Mexico where numbers are believed to be small. Surveys conducted from 1987 through 1993 located only 23 individuals in the three northern mountain ranges and none in similar habitats farther south (Stahlecker and Duncan 1996). Conservation status codes (abundance estimates) for boreal owls are provided in Appendix H.

Problems Affecting Habitats or Species

Timber Harvest
New Mexico's small and highly fragmented boreal owl populations are vulnerable and would be adversely affected by losses to their specialized and limited sub-alpine habitats. In particular, timber harvest in such areas would eliminate nesting cavities, reduce prey populations, and remove forest structure necessary for nesting, foraging and roosting. The slowness of forest succession in high elevation stands suggests that disturbed habitats would remain unsuitable for one to two centuries (Hayward and Hayward 1993, Hayward and Verner 1994, Hayward 1997, NMDGF 2004a). Once lost, New Mexico's small, isolated populations are unlikely to be quickly replenished by birds dispersing down from the north.

Information Gaps

Information gaps that limit our ability to make informed conservation decisions regarding the boreal owl are outlined below.

- Abundance, distribution and trend data are absent or sparse for boreal owls in New Mexico.

- The location, timing, duration, frequency and intensity of factors influencing boreal owl habitats are unknown.

Research, Survey, and Monitoring Needs

Research and surveys that would enhance our ability to make informed conservation decisions are outlined below.

- Research is needed to estimate boreal owl demographic parameters.

- The effects of natural and human-caused habitat fragmentation on boreal owls need to be determined.

Desired Future Outcomes

Desired future outcomes for boreal owls and their habitats include:

- Boreal owl habitats persist in the condition, connectivity, and quantity necessary to maintain viable and resilient populations of this species while sustaining diverse land uses with minimal resource use conflicts.

- Abundance, distribution, and population trend information and understanding of limiting factors are sufficient to make informed conservation decisions for this species.

Prioritized Conservation Actions

Prioritized conservation of the boreal owl in New Mexico depends on protection of high-elevation stands of mature spruce-fir forests in the San Juan, Sangre de Cristo, and Jemez Mountains. 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 the US Forest Service and affected publics to develop strategies for the protection of suitable boreal owl habitat. Actions should include the identification and setting aside areas of known occupancy.

2. Collaborate with state and federal agencies and private landowners to develop timber management practices that focus on maintaining the distribution and abundance of suitable boreal owl habitats in their natural states.

3. Work with the US Forest Service, timber companies, and affected publics to reduce and eliminate even-aged timber management on a broad scale in suitable boreal owl habitat.

4. Work with government and private land managers to eliminate or reduce forest management practices that are based simply on snag retention in clear cut areas, as the slowness of forest succession in high-elevation stands limits the utility of this management practice (Hayward and Hayward 1993, Hayward *et al.* 1993, Hayward and Verner 1994, Hayward 1997).

5. Work with federal and state agencies, private landowners, research institutions, and universities to design and implement projects that will provide information about boreal owls, their habitats, and limiting factors as outlined in the Research, Survey, and Monitoring Needs section.

Organ Mountains Colorado Chipmunk

Distribution and Abundance

The Organ Mountains Colorado chipmunk (*Neotamias quadrivittatus australis*) is confined to the Organ Mountains in Doña Ana County where it occurs on both the east and west slopes of the range. White Sands Missile Range, Fort Bliss Military Reservation, and the US Bureau of Land Management administer portions of the mountain range (Sullivan 1998). The distribution of this chipmunk is generally centered in the Aguirre Springs basin. This is an area bounded by Baylor, Baldy, and Sugarloaf peaks (Patterson 1979, 1980). All of its known range is included in a 4,480 ac (1,813 ha) area (Sullivan 1998).

This chipmunk is most abundant in the broad, dissected basin around Aguirre Springs on the north aspect of the Organ Mountains. They are associated with ponderosa pine (*Pinus ponderosa*) and deciduous oaks (*Quercu*s spp.) (Patterson 1979, 1980). However, they also occur locally in adjacent areas characterized by dominant stands of oak (*Quercus* spp.), juniper (*Juniperus* spp.), apache plume (*Fallugia paradoxa*) and sumac (*Rhus* spp.). More than 69 species of plants, most commonly mountain mahogany (*Cerocarpus montanus*), gray oak (*Q. grisea*), wavyleaf oak (*Q. undulata*), and unidentified oaks (*Quercus* sp.) are associated with the presence of this chipmunk (R. Sullivan, pers. comm.).

The chipmunk occupies the Upper Sonoran Zone or the oak-mountain mahogany community (R. Sullivan, pers. comm.) of the Organ Mountains. Specimens have been collected from 6,050-7,300 ft (1,845-2,225 m) (Patterson 1980). SWReGAP land cover types identified for this subspecies include Rocky Mountain Cliff and Canyon (S006), Inter-mountain Basins Cliff and Canyon Complex (S009), Rocky Mountain Piñon-Juniper Woodland (S038), and Mogollon Chaparral (S057).

There are no recent data on the abundance of this chipmunk. Patterson (1980) estimated that the Organ Mountains Colorado chipmunk numbered 1,000 to 2,000 individuals. Populations may be subject to wide fluctuations and the species is not abundant (Patterson 1979). Conservation status codes (abundance estimates) for the Organ Mountains Colorado chipmunk are provided in Appendix H.

Problems Affecting Habitats or Species

Habitat Conversion
Public access to the Organ Mountains is limited due to an absence of roads, although road development and facility construction associated with White Sands Missile Range (WSMR) on the east side of the mountains could cause habitat degradation and fragmentation. Particularly

susceptible components of chipmunk habitat include: 1) areas of mesic piñon-juniper-oak woodland in limestone or igneous rock outcrops or cliff habitats along north and east-facing escarpments, 2) old-growth piñon-juniper woodland associated with calcareous or igneous bedrock, red-granites or rhyolitic talus with interstices of igneous talus filled with soil and leaf litter, 3) ecotones between woodland, arroyo, and scrub vegetation in drainages and talus accumulations, and 4) slopes and bajadas with extensive, large boulders, fallen yucca stems, and woody bases of sotol (*Dasylirion wheeleri*) (R. Sullivan, pers. comm.).

Fire Management
Fire may provide both a benefit and a detriment to this mammal. Prescribed fire in woodland habitats may serve to increase primary productivity and reduce the risk of catastrophic wildfire in the future (Rivieccio *et al.* 2003). Alternatively, catastrophic fires or full fire suppression may have adverse effects on habitats through fragmenting, simplifying or destroying habitats, or greatly modifying disturbance regimes.

Information Gaps

There is little information on the ecology of this species. Accordingly, information gaps that limit our ability to make informed conservation decisions are outlined below.

- The distribution of this species is poorly understood.
- The abundance and habitat use of this species is unclear.
- Environmental conditions that limit chipmunk populations are unknown.
- The intensity, scale, and extent of man-caused habitat fragmentation are unknown.

Research, Survey, and Monitoring Needs

Rivieccio (2000) and Rivieccio *et al.* (2003) developed survey methodologies involving GIS modeling and observational field surveys of this population. Visual/audible surveys may prove to be more effective than trapping surveys (Rivieccio *et al.* 2003). Research and surveys that would enhance our ability to make informed conservation decisions for this species are outlined below.

- Additional distribution and biological surveys should continue to document the population size, habitat requirements, and distribution of Organ Mountains Colorado chipmunk. Future surveys and development of a species management plan should be a multi-agency effort.
- Habitats considered essential for these chipmunks should be surveyed and evaluated prior to activities that may potentially fragment or disturb them.
- Monitoring of environmental factors associated with construction and testing activities and should include a component of environmental/habitat restoration as needed to assure functional ecosystems in the Organ Mountains.

- A formalized survey and monitoring methodology needs to be developed, possibly incorporating aspects of GIS habitat data and observational and/or trapping surveys. This effort should include coordination between NMDGF, US Bureau of Land Management, Fort Bliss Military Reservation, WSMR, and other entities with land management responsibilities in the Organ Mountains.

Desired Future Outcomes

Desired future outcomes for the Organ Mountains Colorado chipmunk and their habitats include:

- Organ Mountains Colorado chipmunk habitats persist in the condition, connectivity, and quantity necessary to maintain viable and resilient populations of this species while sustaining diverse land uses with minimal resource use conflicts.

- Abundance, distribution, and population trend information and understanding of limiting factors are sufficient to make informed conservation decisions for this species.

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 WSMR and Fort Bliss Military Reservation to develop and implement a survey protocol for systematically detecting Organ Mountains Colorado chipmunk and tracking its population trends.

2. Work with WSMR and Fort Bliss Military Reservation to develop and implement a habitat assessment and monitoring plan to determine changes in chipmunk habitat in the Organ Mountains.

3. Develop a cooperative agreement among entities with resource management responsibilities in the Organ Mountains to ensure that important habitat for this species is identified and maintained.

4. Work with federal and state agencies, private landowners, research institutions, and universities to design and implement projects that will provide information about the Organ Mountains Colorado chipmunk, its habitats and limiting factors as outlined in the Research, Survey, and Monitoring Needs section.

Oscura Mountains Colorado Chipmunk

Distribution and Abundance

The Oscura Mountains Colorado chipmunk (*Neotamias quadrivittatus oscuraensis*) is known only from the Oscura Mountains in Socorro and Lincoln counties. The chipmunk has been found from approximately 0.6 mi (1 km) north of North Oscura Peak to 3.7 mi (6 km) south of Oscura Peak (Sullivan 1996). The entire Oscura Mountains and its surrounding area are contained within WSMR. No information on abundance is available for this sub-species (Sullivan 1998). Conservation status codes (abundance estimates) for the Oscura Mountains Colorado chipmunk are provided in Appendix H.

The Oscura Mountains, located at the northern edge of the Tularosa Basin, are arid and characterized by steep and broken mountainous terrain with large outcrops of limestone, particularly along the west-facing escarpment. Areas of dense stands of mature piñon-juniper are present and interspersed with poorly vegetated areas of limestone bedrock (Sullivan 1996). Dominant trees are piñon (*Pinus edulis*) and one-seed juniper (*Juniperus monosperma*). Characteristic shrub species include mountain mahogany (*Cerocarpus montanus*), antelope brush (*Purshia tridentata*), four-wing salt bush (*Atriplex canescens*), and oaks (*Quercus* sp.). Open areas are variously covered with side-oats grama (*Bouteloua curtipendula*), black grama (*B. eriopoda*), blue grama (*B. gracilis*), Chihuahuan love-grass (*Eragrostis erosa*), and soaptree yucca (*Yucca elata*) (Sullivan 1996).

Chipmunks in the Oscura Mountains have been observed on steep, northwest-facing slopes where extensive limestone cliffs and ledges are present. Most have been found within 20 ft (6 m) of mixed stands of piñon, one-seed juniper, and Gambel oak (*Quercus gambelii*). Accumulations of leaf litter are usually present. Other woody plants in these areas are barberry (*Berberis* spp.), mountain mahogany, beargrass (*Nolina* spp.), mockorange (*Philadelphus* spp.), currants (*Ribes* spp.), rose (*Rosa* spp.), and snowberry (*Symphoricarpos* spp.) (Sullivan 1996). SWReGAP land cover types associated with this subspecies include: Rocky Mountain Cliff and Canyon (S006), Inter-mountain Basins Cliff and Canyon Complex (S009), Rocky Mountain Piñon-Juniper Woodland (S038), and Mogollon Chaparral (S057).

Problems Affecting Habitats or Species

Habitat Conversion
As noted above, the geographic range of this subspecies is entirely contained within WSMR and is not accessible to the public. Road development and facility construction associated with the mission of WSMR poses the greatest potential threat to this species and could cause habitat degradation and fragmentation. Isolation of these patchy habitats may exceed distance thresholds beyond which these chipmunks are capable of searching for seasonally available foods and increase their vulnerability to starvation, exposure, and predation (Sullivan 1996). Species characterized in patchy distributions or those that use a variety of microhabitats are vulnerable to extinction in fragmented landscapes.

Fire Management
Fire may provide both a benefit and a detriment to this mammal. Prescribed fire in woodland habitats may serve to increase primary productivity and reduce the risk of catastrophic wildfire in the future (Rivieccio *et al.* 2003). Conversely, catastrophic fires or full fire suppression may have adverse effects on habitats through fragmenting, simplifying or destroying habitats, or greatly modifying disturbance regimes.

Information Gaps

There is little information on the ecology of this species. Information gaps that limit our ability to make informed conservation decisions are outlined below.

- The distribution of this species is poorly understood.
- The abundance and habitat use of this species are unclear.
- Environmental conditions that limit chipmunk populations are unknown.
- The intensity, scale, and extent of man-caused habitat fragmentation are unknown.

Research, Survey, and Monitoring Needs

Rivieccio (2000) and Rivieccio *et al.* (2003) developed survey methodologies involving GIS modeling and observational field surveys of this population. Visual and audible surveys may prove to be more effective than trapping surveys (Rivieccio *et al.* 2003). Research and surveys that would enhance our ability to make informed conservation decisions for this species are outlined below.

- Additional distribution and biological surveys should continue in order to document population size, habitat requirements, and distribution of the Oscura Mountains Colorado chipmunk. Future surveys and development of a species management plan will be a multi-agency effort.
- Habitats considered essential for these chipmunks should be surveyed and evaluated prior to activities that potentially further fragment or disturb them.
- Monitoring of environmental factors associated with construction and testing activities and should include a component of environmental/habitat restoration as needed to assure functional ecosystems in the Oscura Mountains.
- A formalized survey and monitoring methodology, possibly incorporating aspects of GIS habitat data and observational and/or trapping surveys, needs to be developed. This effort should include coordination between NMDGF and WSMR.

Desired Future Outcomes

Desired future outcomes for the Oscura Mountains Colorado chipmunk and its habitat includes:

- Habitat persists in the condition, connectivity, and quantity necessary to maintain viable and resilient populations of this species while sustaining diverse land uses with minimal resource use conflicts.

- Abundance, distribution, and population trend information and understanding of limiting factors are sufficient to make informed conservation decisions for this species.

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 WSMR to develop and implement a survey protocol for systematically detecting this chipmunk that will allow comparison among survey periods to determine population trends.

2. Work with WSMR to develop and implement a habitat assessment and monitoring plan to determine changes in chipmunk habitat in the Oscura Mountains.

3. Develop a cooperative agreement between NMDGF and WSMR to ensure that important habitat for this species is identified and maintained.

4. Work with WSMR to preserve habitat patches in their natural states where this recently described subspecies occurs. If habitat modifications are inevitable in the Oscura Mountains, Sullivan (1996) has suggested two approaches: 1) restrict future development to previously disturbed sites, or 2) restrict development in the mature piñon-juniper woodlands east of the escarpment. This would have fewer impacts than altering the piñon-juniper-oak woodlands and limestone ledges essential to this chipmunk.

5. Work with WSMR, research institutions, and universities to design and implement projects that will provide information about the Oscura Mountains Colorado chipmunk, its habitats, and limiting factors as outlined in the Research, Survey, and Monitoring Needs section.

Eastern Barking Frog

Distribution and Abundance

In New Mexico, the eastern barking frog (*Eleutherodactylus augusti latrans*) occurs only at scattered localities in specific habitats in Chaves, Eddy, and Otero counties. They are found from 2,950-3,950 ft (900-1,200 m) in elevation. Suitable habitats include barren creosote bush (*Larrea tridentata*) flats with numerous and extensive rodent burrows on gypsum soils in and near limestone and gypsum outcrops. SWReGAP land cover types associated with the barking frog include the Chihuahuan Mixed Desert and Thorn Scrub.

The species is uncommon within its limited range in New Mexico. During a 5-year intensive study of barking frogs, only 33 individuals were observed at Bitter Lakes Wildlife Refuge where a "dense population" is known to exist (Radke 2001). At other sites known to harbor populations of barking frogs, it is unusual to locate more than 2-3 frogs per night during optimal weather conditions (C.W. Painter, pers. observ.). Abundance is therefore difficult to determine. The recent specimen reported from near Aguirre Springs (Murray and Painter 2003) represents a disjunct and questionable record. Conservation status codes (abundance estimates) for the barking frog are provided in Appendix H.

Problems Affecting Habitats or Species

Habitat Conversion
Factors that adversely affect barking frogs include herbicide control of creosote bush, shrub land conversion to agriculture, and soft-rock mining. Little is known about the intensity, scale, and extent of the effects on barking frog populations.

Collecting
Commercial exploitation is also a concern for the barking frog. Little is known about the extent of this market or its effects on barking frog populations.

Information Gaps

There is little information on the ecology of this species. Information gaps that limit our ability to make informed conservation decisions are outlined below.

- Information is lacking on population density, distribution, abundance, habitat use, activity periods, and reproduction.
- The natural history of this species in New Mexico is little known.
- Little is known about the intensity, scale, and extent of the effects of chemical creosote bush control on barking frog populations, shrub land conversion to agriculture, soft-rock mining, or commercial exploitation.

Research, Survey, and Monitoring Needs

Currently there are isolated reports and anecdotal observations on the natural history of eastern barking frogs in New Mexico. Research and surveys that would enhance our ability to make informed conservation decisions for this species are outlined below.

- Research is needed to determine the distribution, abundance, and habitat use of eastern barking frogs.

- Research or survey work is needed to determine the extent and effects of commercial exploitation.

- Research is needed to identify and evaluate factors limiting eastern barking frog populations.

- Research is needed to quantify the intensity, scale, extent, and effects of man-caused habitat conversion on eastern barking frog populations.

Desired Future Outcomes

Desired future outcomes for the eastern barking frog and its habitats include:

- Eastern barking frog habitats persist in the condition, connectivity, and quantity necessary to maintain viable and resilient populations of this species while sustaining diverse land uses with minimal resource use conflicts.

- Abundance, distribution, and population trend information and understanding of limiting factors are sufficient to make informed conservation decisions for this species.

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 federal and state agencies, private landowners, research institutions, and universities to design and implement projects that will provide information on eastern barking frog distribution and habitat use in New Mexico.

2. Work with federal and state agencies and affected publics to protect limestone and gypsum outcroppings within the range of the species.

3. Work with federal and state agencies and affected publics to develop strategies to reduce or eliminate incidental take of the species.

4. Collaborate with interested agencies and publics to develop a research and monitoring plan for this species.

Hacheta Grande Woodlandsnail

Distribution and Abundance

The endemic Hacheta Grande woodlandsnail (*Ashmunella hebardi*) is narrowly restricted to the south wall of Chaney Canyon on the west-central flank of the Big Hatchet Mountains. The canyon is west of Big Hatchet Peak in Hidalgo County (Metcalf and Smartt 1997, Lang 2005a). They are found at elevations of 6,600-7,300 ft (2,000-2,200 m). The Hacheta Grande woodlandsnail occupies densely forested habitats at the base of limestone outcrops, living beneath large rock fragments and in rubble piles where soil mold collects (Lang 2005a). No information is available regarding the abundance of this species. Conservation status codes (abundance estimates) for the Hacheta Grande woodlandsnail are provided in Appendix H.

Problems Affecting Habitats or Species

Biotic/Abiotic Resource Use
Any form of soil disturbance (mineral mining) or vegetative removal (logging, fire, or grazing) in areas where this species is known to occur could result in adverse affects upon edaphic conditions and cause direct habitat loss.

Fire Management
The prospects of a 2005 prescribed burn in the north-central range of the Big Hatchet Mountains could adversely affect the persistence of this woodlandsnail in Chaney Canyon.

Information Gaps

There is little information on the ecology of this species. Information gaps that limit our ability to make informed conservation decisions are outlined below.

- The distribution and abundance of this species is poorly understood.

- The short and long-term effects of fire on forest ecosystem dynamics are poorly understood, especially with respect to mollusc recovery periods (Lang 2005a).

Research, Survey, and Monitoring Needs

Distribution surveys for this species have been conducted from the early 1970s to 2004 (Metcalf and Smartt 1997, Lang 2001, 2005a). Based on morphologic and genetic studies, Lang (2005a) recommended that the currently accepted taxonomy of *Ashmunellas* in the Big Hatchet

Mountains (Metcalf and Smartt 1997) recognize two species, *A. mearnsii* and *A. hebardi*, and their hybrids (*A. mearnsii* x *A. hebardi*).

The Department has worked closely with the BLM Las Cruces Field Resources Office to consider alternative prescribed fire strategies to prevent the burning of forested habitat. This habitat is currently occupied by Hacheta Grande woodlandsnail, and five additional species of land snails endemic to the Big Hatchet Mountains and outlying ranges. Pre and post-fire studies are ongoing. Additional research and survey work that would enhance our ability to make informed conservation decisions are outlined below.

- Investigate alternative prescribed fire strategies to prevent burning of forested habitat currently occupied by woodlandsnail populations.

- Research is needed to further define habitat use, abundance, and distribution of woodlandsnails.

- Investigate environmental conditions that limit woodlandsnail populations.

- Research the effects of man-caused habitat alteration and degradation factors on woodlandsnails.

Desired Future Outcomes

Desired future outcomes for the woodlandsnail and its habitats include:

- Woodlandsnail habitats persist in the condition, connectivity, and quantity necessary to maintain viable and resilient populations of this species while sustaining diverse land uses with minimal resource use conflicts.

- Abundance, distribution, and population trend information and understanding of limiting factors are sufficient to make informed conservation decisions for this species.

Prioritized Conservation Actions

This species is listed as state threatened (NMDGF 2004a) and as a federal species of concern (Federal Register 1994). 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 state and federal agencies charged with protection of Hacheta Grande woodlandsnail to develop a plan to conserve this species.

2. Work with federal and state agencies, private landowners, research institutions, and universities to design and implement projects that will provide information on the woodlandsnail and its habitat that is outlined in the Problems Affecting Species and Habitats, and Research, Survey, and Monitoring Needs sections.

3. Work with federal land managers to adopt and implement fire management strategies that avoid destruction of woodlandsnail habitats.

Lilljeborg's Peaclam

Distribution and Abundance

This circum-boreal species occurs in lakes and rivers from the Arctic south across the northern United States (Herrington 1962, Burch 1975). In the western United States, Lilljeborg's peaclam (*Pisidium lilljeborgi*) is found in high-elevation lakes of California (Trinity Alps), Utah (Uinta Mountains), and New Mexico (Sangre de Cristo Mountains) (Taylor 1983). In New Mexico, Lilljeborg's peaclam is known only from Nambe Lake, a remote glacial cirque located in the Santa Fe National Forest. Nambe Lake has been modified to serve as a water supply for the city of Santa Fe. This population represents the most southern and highest known elevation occurrence in either North America or Eurasia (Taylor 1983, NMDGF 2004a). Lilljeborg's peaclam is not abundant in New Mexico where it is listed as a state threatened species (NMDGF 2004a). Conservation status codes (abundance estimates) for the Lilljeborg's peaclam are provided in Appendix H.

Problems Affecting Habitats or Species

Pollution and Modification of Natural Processes
Due to its restricted distribution, the Nambe Lake population of Lilljeborg's peaclam is vulnerable to contaminants from fire suppressant chemicals and natural stochastic events such as fire, sedimentation, and drought (Taylor 1983, NMDGF 2004a, McDonald and Hamilton 1995).

Information Gaps

There is little information on the ecology of this species. Information gaps that limit our ability to make informed conservation decisions are outlined below.

- The distribution and abundance of this species is poorly understood.

- Environmental conditions that limit the species populations are unknown.

- The intensity, scale, and extent of man-caused habitat degradation are unknown.

Research, Survey, and Monitoring Needs

Research, survey, and monitoring needs that would enhance our ability to make informed conservation decisions are outlined below.

- The Department should continue surveys of high-elevation aquatic habitats to determine the statewide distribution and abundance of this species.

- Investigate environmental conditions that limit Lilljeborg's peaclam populations.

- Research is needed on the effects of human-caused habitat alteration and degradation factors.

Desired Future Outcomes

Desired future outcomes for Lilljeborg's peaclam and its habitat includes:

- Lilljeborg's peaclam habitats persist in the condition, connectivity, and quantity necessary to maintain viable and resilient populations of this species while sustaining diverse land uses with minimal resource use conflicts.

- Abundance, distribution, and population trend information and understanding of limiting factors are sufficient to make informed conservation decisions for this species.

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 federal and state agencies, private landowners, research institutions, and universities to design and implement projects that will provide information on the statewide distribution and abundance for this species, including information regarding basic biology and habitat requirements.

2. Work with interested agencies and publics to develop a conservation and recovery plan for the Lilljegborg's peaclam.

Peloncillo Mountains Talussnail

Distribution and Abundance

Pilsbry and Ferris (1915) described the Peloncillo Mountains talussnail (*S. h. peloncillensis*) from a single collection in Skull Canyon, Peloncillo Mountains, in Hidalgo County. It occurred in igneous talus sprawls at higher elevations. A single living specimen and several fresh shells of this talussnail were collected from Skull Canyon in March 2004 (Lang 2005a). This talussnail is considered a species of concern by the NMDGF (NMDGF 2005c) and in a habitat conservation plan for the Peloncillo Mountains of New Mexico and Texas (Lehman 2003). This species is included on the Interagency Interstate Sensitive Species List adopted by the US Bureau of Land Management, US Fish and Wildlife Service, US Forest Service, NMDGF, and Arizona Game and Fish. Little is known of its abundance. Conservation status codes (abundance estimates) for the Peloncillo Mountains talussnail are provided in Appendix H.

Problems Affecting Habitats or Species

Biotic/Abiotic Resource Use
Any form of soil disturbance (mineral mining) or vegetative removal (logging, fire, or grazing) in areas where this species is known to occur could result in adverse effects upon edaphic conditions and cause direct habitat loss.

Information Gaps

There is little information on the ecology of this species. Information gaps that limit our ability to make informed conservation decisions are outlined below.

- The distribution and abundance of this species is poorly understood.
- Factors that limit species populations are unknown.
- The intensity, scale, and extent of man-caused habitat degradation are unknown.

Research, Survey, and Monitoring Needs

Research and survey work that would enhance our ability to make informed conservation decisions regarding this species are outlined below.

- Surveys should be conducted in the Peloncillo and Guadalupe Mountains of New Mexico to further define the abundance, habitat use, and distribution of the Peloncillo Mountains talussnails.
- Research is needed on the effects of man-caused habitat alteration and degradation factors.

Desired Future Outcomes

Desired future outcomes for the Peloncillo Mountains talussnail and its habitats include:

- Peloncillo Mountains talussnail habitats persist in the condition, connectivity, and quantity necessary to maintain viable and resilient populations of this species while sustaining diverse land uses with minimal resource use conflicts.

- Abundance, distribution, and population trend information and understanding of limiting factors are sufficient to make informed conservation decisions for this species.

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 federal and state agencies, private landowners, research institutions, and universities to design and implement projects that will provide information on the statewide distribution and abundance for this species, including information regarding basic biology and habitat requirements.

2. Work with interested agencies and publics to develop a conservation plan for the Peloncillo Mountains talussnail.

Sangre de Cristo Peaclam

Distribution and Abundance

The narrowly distributed Sangre de Cristo peaclam (*Pisidium sanguinichristi*) is endemic to Middle Fork Lake. This lake is found in a single, high-elevation glacial cirque at 10,485 ft (3,195 m.) elevation at the base of Wheeler Peak, Taos County. The peaclam colonizes muddy shallows along the lake perimeter and a narrow stretch of the lake outflow (Taylor 1983, 1987; NMDGF 2004a). This peaclam can be considered the most narrowly restricted of all known North American, and perhaps worldwide, Pisidia (Lang 2002). Little is known of its abundance and it is listed as a state threatened species (NMDGF 2004a) and a federal species of concern (Federal Register 1994). Conservation status codes (abundance estimates) for the Sangre de Cristo peaclam are provided in Appendix H.

Problems Affecting Habitats or Species

Recreational Use
The remoteness and management of Middle Fork Lake within the Carson National Forest affords some measure of protection. However, this site experiences intense periods of recreational use (USFS 1996). Associated problems include shoreline destabilization, erosion, and sedimentation due to foot and vehicular traffic (Taylor 1983, NMDGF 2004a, McDonald and Hamilton 1995, USFS 1996).

Pollution and Modification of Natural Processes
Middle Fork Lake receives contamination from forest fire suppressants, placer mining runoff, and natural stochastic events such as fire, drought (Taylor 1983, NMDGF 2004a, McDonald and Hamilton 1995, USFS 1996).

Non-Native/Invasive Species
In the western United States, passive dispersal of non-native molluscs commonly occurs by human activities, such as contaminated fishing equipment, aquatic sampling gear, and aquatic shipments (Western Regional Panel on Aquatic Nuisance Species 2001).

In 2004, the non-native New Zealand mudsnail (*Potamopyrgus antipodarum*) was reported from a stream in the Rocky Mountains of Colorado. Potential adverse effects posed by non-native molluscs may include direct or indirect competition with native species for food and space, alteration of species composition and structure of primary producers, and disruption of energy transfer from macroinvertebrates to fish (Shannon *et al.* 2004). Aquatic conditions of Middle Fork Lake could possibly support an introduced population of the New Zealand mudsnail. This potential is particularly germane considering recreational use of Middle Fork Lake.

Information Gaps

There is little information on the ecology of this species. Information gaps that limit our ability to make informed conservation decisions are outlined below.

- The distribution and abundance of this species is poorly understood.
- Environmental conditions that limit species populations are unknown.
- The intensity, scale, and extent of man-caused habitat degradation are unknown.

Research, Survey, and Monitoring Needs

Annual population monitoring of Sangre de Cristo peaclam began in July 1995 under a multi-agency conservation effort initiated by the US Forest Service (US Forest Service 1996). Only six specimens collected from Middle Fork Lake (1995-1999) remotely resembled paratype (*P. sanguinchristi*) specimens (Lang 1996). No *Pisidia* collected from any other statewide surveys (1995-2005) are referable to Sangre de Cristo peaclam. A mitochondrial DNA study comparing

the nominal species with Held's peaclam (*Pisidium milium*) yielded inconclusive results since the biochemical analysis was restricted to a comparison of DNA extracted from shell proteins (Wilson *et al.* 1998). Although a study comparing shell characteristics of these species may help resolve outstanding taxonomic questions, significant ecophenotypic variation in valve morphology and hinge dentition of sphaeriid clams, as manifested by local environmental influences, could prove inconclusive (Herrington 1962). Additional research, survey, and monitoring needs that would enhance our understanding of this species and inform conservation decisions are outlined below.

- Conduct a taxonomic assessment of Sangre de Cristo peaclam to confirm this as a valid species. The taxonomic status of this species merits further study prior to adopting a conservation strategy (Lang 2004).

- Additional surveys should be conducted in New Mexico to further define the abundance, habitat use, and distribution of Sangre de Cristo peaclam.

- Research is needed on the effects upon Sangre de Cristo peaclam of man-caused habitat alteration and degradation factors.

Desired Future Outcomes

Desired future outcomes for the Sangre de Cristo peaclam and its habitats include:

- Sangre de Cristo peaclam habitats persist in the condition, connectivity, and quantity necessary to maintain viable and resilient populations of this species while sustaining diverse land uses with minimal resource use conflicts.

- Abundance, distribution, and population trend information and understanding of limiting factors are sufficient to make informed conservation decisions for this species.

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 interested agencies and effected publics to continue sphaeriid clam surveys in high-elevation, wetland habitats throughout the Sangre de Cristo Mountains. Expand this effort to include the Jemez Mountains. In the event live peaclams referable to *P. sanguinichrisiti* are located, genetic studies comparing *P. sanguinichristi* with *P. milium* would be in order.

2. Work with federal and state agencies, private landowners, research institutions, and universities to design and implement projects that will provide information on the statewide distribution and abundance for this species. These studies should gather information regarding basic biology and habitat requirements.

Arthropod (Insecta, Arachnida, Chilopoda, Diplopoda, and Entognatha) SGCN

An extensive inventory of New Mexico arthropods (other than crustaceans) has not been completed and our current list of arthropod SGCN (Appendix H) is biased toward those taxonomic groups for which we have some information. We anticipate future discoveries of undescribed arthropod taxa in New Mexico. We also anticipate new geographic distribution and ecological information for those already described arthropods. We therefore present only summary information about the 154 arthropod SGCN in the classes of Insecta, Arachnida, Chilopoda, Diplopoda, and Entognatha.

Distribution and Abundance

Little is known about arthropod distribution and abundance in New Mexico. Federal and state conservation status ranks are only known for about half of the arthropod SGCN. Of those, 85% of the species are not ranked in New Mexico, and 25% of the species are not federally ranked. Only four species are known to be critically imperiled at the state level, while 25 are known to be imperiled or critically imperiled at the national level. Conservation status codes (abundance estimates) for arthropod SGCN in the classes of Insecta, Arachnida, Chilopoda, Diplopoda, and Entognatha are provided in Appendix H.

Information on the distribution of arthropods in New Mexico is even more scant, and is limited to general observations about habitats or ecoregions. Habitats for arthropods in New Mexico appear to be quite diverse. They are known to inhabit desert grasslands and shrublands, mountain ranges, riparian habitats, rocky canyons, ponderosa pine and juniper savannas, gypsum sand dunes, caves, aquatic habitats, and sub-terrestrial habitats. The Chihuahuan Desert and the Arizona-New Mexico Mountains Ecoregions appear to host the majority of arthropod SGCN. However, there is uncertainly associated with the extent of these distributions (Appendix Q).

Problems Affecting Habitats or Species

Problems affecting the persistence of arthropod SGCN include improper grazing practices, forest and fire management, and over-collecting. However, the most prevalent threat to arthropods is the lack of good information on the problems that may affect species or their habitats (Appendix I). Many SGCN species are local endemics about which there is only little information regarding problems that may influence their habitats or populations.

Information Gaps

Information gaps that limit our ability to make informed conservation decisions regarding arthropods are outlined below.

- Arthropod species in New Mexico are relatively poorly known. We are aware of close to 50 undescribed arthropods, most of which are narrow endemics that have been recently discovered in New Mexico as a result of local biological inventory studies and collecting by taxonomic researchers.

- There is little information about arthropod abundance, distribution, or factors that limit or pose problems for species populations.

- Basic ecological data on arthropod species is lacking.

- The actual extent of undescribed arthropod taxa is unknown.

Research, Survey, and Monitoring Needs

Research and survey work that would inform conservation decisions applicable to arthropods are outlined below.

- An extensive inventory of arthropods is needed before NMDGF can address arthropod taxa with confidence.

- Basic research is needed to determine arthropod abundance, distribution, habitat requirements, and factors that limit or pose problems for species populations.

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 federal and state agencies, private landowners, research institutions, and universities to design and implement projects that will provide information on the statewide distribution and abundance of arthropod SGCN, including information regarding basic biology and habitat requirements that will inform future conservation decisions.