

White-tailed Ptarmigan (*Lagopus leucura*) Recovery Plan

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NMDGF Staff Photo

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“No better proof could be found of the valuable diversity of climate of the Southwest than the presence of this purely Arctic bird on the high peaks of the Carson and Pecos ... The rarity and exceedingly restricted range of the ptarmigan in [New Mexico] makes it necessary to give them absolute and permanent protection.”

Aldo Leopold. 1915. Game and Fish Handbook for Officers of the National Forests of Arizona and New Mexico. Forest Service, U.S.D.A., District 3. Albuquerque, NM. Sept. 15, 1915.



1.0 Introduction

This Recovery Plan for white-tailed ptarmigan (*Lagopus leucura*) was developed under the authority of the New Mexico Wildlife Conservation Act (WCA). The New Mexico Department of Game and Fish (NMDGF) is directed under the WCA to develop recovery plans for species listed as threatened or endangered by the State [17-2-40.1 NMSA 1978]. To the extent practicable, each recovery plan should be developed to achieve the following objectives:

- restoration and maintenance of viable populations of the listed species and its habitat, to the extent that the species may eventually be down listed
- avoidance or mitigation of adverse social or economic impacts (if indicated)
- identification of social or economic benefits and opportunities (if indicated)
- use of existing resources and funding to implement the overall plan

As directed by the WCA, a public information meeting was held on 5 May 2016, at the Juan I. Gonzales Agricultural Center, Taos, New Mexico, at the initiation of the recovery planning process. An Advisory Committee was then formed. The Advisory Committee for this Plan is comprised of species experts from New Mexico, Colorado, and Oklahoma, representatives from the U.S. Forest Service (Carson and Santa Fe National Forests), Vermejo Park Ranch, and private individuals. Appendix 6.1 provides a list of committee members. A draft Recovery Plan, dated 4 November 2016, was available for public review and comment from 18 November through 20 December 2016. The final plan was approved by the State Game Commission at its 12 January 2017 meeting.

The organization of this Recovery Plan is based on Graves (2002). Section 1 provides an introduction, including the authority for the Plan. Section 2 includes background information on natural history, historical perspective, habitat assessment, and potential economic and social impacts of this Plan. Also included are an analysis of factors that led to listing the species, and existing and potential threats to the species persistence in the state. Section 3 contains the goal for recovery of the white-tailed ptarmigan, the accompanying objective, the issues affecting recovery of the species, and the strategies for addressing those issues, pending State Game Commission approval.

1.1 EXECUTIVE SUMMARY

This is a Recovery Plan for white-tailed ptarmigan (*Lagopus leucura*), developed under the authority of the New Mexico Wildlife Conservation Act (WCA). Recovery plans, which are mandated under the WCA, are long-term conservation and management strategies intended to restore and maintain viable populations of the species and its habitat. The white-tailed ptarmigan is the smallest member of the grouse family and is endemic to high alpine ecosystems of North America from Alaska to northern New Mexico. Populations in New Mexico are small and widely separated from one another, and suitable habitat is naturally limited in extent at the southern end of the continental range for this species. White-tailed ptarmigan typically occur in association with rocky alpine habitats that support a variety of sedges, forbs,



and shrub willows. Important habitat complexes that allow for year-round occupancy by this species occur primarily within the Pecos Wilderness, Wheeler Peak Wilderness vicinity, and the Culebra Range. White-tailed ptarmigan are listed as endangered under the WCA. Apart from potential negative effects of changing climate conditions, there presently appear to be no broadly operating anthropogenic threats significantly limiting population numbers, although localized stressors may be present. Strategies for conserving this species center on attaining a better understanding of habitat distribution and use, population dynamics, movements and conservation genetics, and in determining whether periodic strategic augmentation from outside source populations might be warranted.

1.2 RECOMMENDED CITATION

New Mexico Department of Game and Fish. 2016. White-tailed ptarmigan (*Lagopus leucura*) recovery plan. New Mexico Department of Game and Fish, Wildlife Management Division, Santa Fe, New Mexico. 32 p

1.3 ADDITIONAL COPIES

Additional copies of the Recovery Plan may be obtained from:

New Mexico Department of Game and Fish

P.O. Box 25112

Santa Fe, NM 87504

(505) 476-8000

<http://www.wildlife.state.nm.us/conservation/wildlife-species-information/birds/>

2.0 Background

Section 2 consists of background information on the distribution, status, habitat requirements, biology, and ecology of white-tailed ptarmigan. This information provides the basis for assessing current status, threats to persistence, and the most effective strategies for recovering the species. For the interested reader, key white-tailed ptarmigan literature contributions with respect to this recovery plan include the following:

- Braun, C.E., and S.O. Williams III. History and status of the white-tailed ptarmigan in New Mexico. *Western Birds* 46:233-243.
- Braun, C.E., K. Martin, and L.A. Robb. 1993. White-tailed ptarmigan. Number 68 in A. Poole and F. Gill, Editors. *The birds of North America*. The Academy of Natural Sciences, Philadelphia, Pennsylvania and The American Ornithologists' Union, Washington, D.C., USA.
- Center for Biological Diversity (Petitioner). August 24, 2010. Petition to list the white-tailed ptarmigan (*Lagopus leucura*) as threatened under the Endangered Species Act. Center for Biological Diversity, Portland, Oregon. Available: https://www.biologicaldiversity.org/species/birds/white-tailed_ptarmigan/pdfs/WTP_Petition.pdf



- Hoffman, R.W. 2006. White-tailed ptarmigan (*Lagopus leucura*): a technical conservation assessment. USDA Forest Service, Rocky Mountain Region. Available: <http://www.fs.fed.us/r2/projects/scp/assessments/whitetailedptarmigan.pdf>
- Wolfe, D.H., L.C. Larsson, J.R. Oldenettel, H.A. Walker, and M.A. Patten. 2011. Status of populations of the white-tailed ptarmigan at the southern edge of its range. Pages 247-258 in R.T. Watson, T.J. Cade, M. Fuller, G. Hunt, and E. Potapov (Eds.). Gyrfalcons and ptarmigan in a changing world, Volume 1. The Peregrine Fund, Boise, Idaho, USA.

2.1 NATURAL HISTORY

2.1.1 Taxonomy

The white-tailed ptarmigan (*Lagopus leucura*) is classified within the Order Galliformes, Family Phasianidae, and is a member of the grouse subfamily Tetraoninae. It is the southernmost species of ptarmigan. Congenerics include rock (*L. muta*) and willow ptarmigan (*L. lagopus*), neither of which occurs south of the Canadian arctic and high mountain cordillera of interior British Columbia. Five subspecies are commonly recognized, of which the southern white-tailed ptarmigan (*L. l. altipetens* Osgood, 1901) inhabits the Rocky Mountains from Wyoming south to New Mexico (Braun et al. 1993). In New Mexico, the most closely related sympatric species is the dusky grouse (*Dendragapus obscurus*), which typically resides in montane conifer forests at lower elevations than white-tailed ptarmigan. Hybridization between these two species has not been reported (Zwickel and Bendell 2005). White-tailed ptarmigan are believed to have been derived from ancestral rock ptarmigan progenitors that became isolated in the southern Rocky Mountains during the early Pleistocene (Johansen 1956). Fossilized ptarmigan bones dating to the late Pleistocene have been found in caves in New Mexico's Sandia Mountains, approximately 90 km southwest of the modern-day range of the species (Brasso and Emslie 2006).

2.1.2 Description

The white-tailed ptarmigan is the smallest grouse species. Adults typically measure 30 to 34 cm in length, and weigh 345 to 425 grams, with body mass varying by age class and season (Braun et al. 1993). White-tailed ptarmigan are distinguishable from other species of grouse by their completely white rectrices (tail feathers), in evidence throughout the year. The primaries also remain white year-round, although are often concealed by contour feathers on birds at rest. Like other ptarmigan species, the white-tailed ptarmigan's plumage changes from white in winter to grayish brown in summer, such that it is in an almost continual state of molt from April to November. Both plumage patterns offer camouflage that is seasonally appropriate to the alpine environments the species inhabits. Although males and females are similar in body size, males retain a white lower breast and abdomen throughout the year, and during the breeding season develop a conspicuous darker "necklace" and a prominent red eye comb (Braun et al. 1993). Ptarmigan feet are densely feathered to the toes -- an adaptation that functions as a snowshoe in their winter alpine environment (Höhn 1977). According to Hoffman (2006), the

genus name *Lagopus* is derived from the Latin words *lagos* and *pous*, meaning hare-footed, while *leucura* originates from the Latin words *leukos* meaning white and *oura*, meaning tail.

2.1.3 Distribution

Global: The white-tailed ptarmigan is endemic to alpine habitats in western North America and is the only species of ptarmigan whose range extends south of Canada. It occurs exclusively in North America, occupying alpine habitats from the central Yukon and southeast Alaska south through the mountain cordillera of British Columbia and western Alberta, and into northwestern Montana and the Cascade Range in Washington (Figure 1). It is distributed discontinuously through the U.S. Rocky Mountains south of Montana into New Mexico; no extant populations are currently known in Wyoming.



Figure 1. Global distribution of white-tailed ptarmigan. Southern subspecies (*Lagopus leucura altipetens*) distribution is shown in red. Black dots (California and Utah) denote extant introduced populations outside the historical range of the species. (Adapted from Martin et al, 2015; permission from Clait Braun).

Braun et al. (1993) speculate that the present distribution of white-tailed ptarmigan is probably similar to historical distribution; it has persisted throughout most of the current known range

from the first description of the various subspecies (1831 to 1939) until the present day. In addition, populations have been successfully introduced to areas outside of the historical range, including the Uinta Mountains in Utah (Braun et al. 1978), Pike’s Peak in Colorado (Hoffman and Giesen 1983), and the Sierra Nevada in California (Braun et al. 2011).

New Mexico: Within New Mexico, the species occurs at least seasonally on suitable peaks and ridgelines above treeline in the Sangre de Cristo Mountains (Figure 2). The present-day distributional range is essentially the same as the historical range, extending from the Colorado state line southward to the high peaks above the city of Santa Fe (Wolfe et al. 2011, Braun and Williams 2015). Suitable habitats for this species are naturally discontinuous and are often broadly separated by intervening forests and valleys. (Additional detail is given in Sections 2.2 and 2.3).

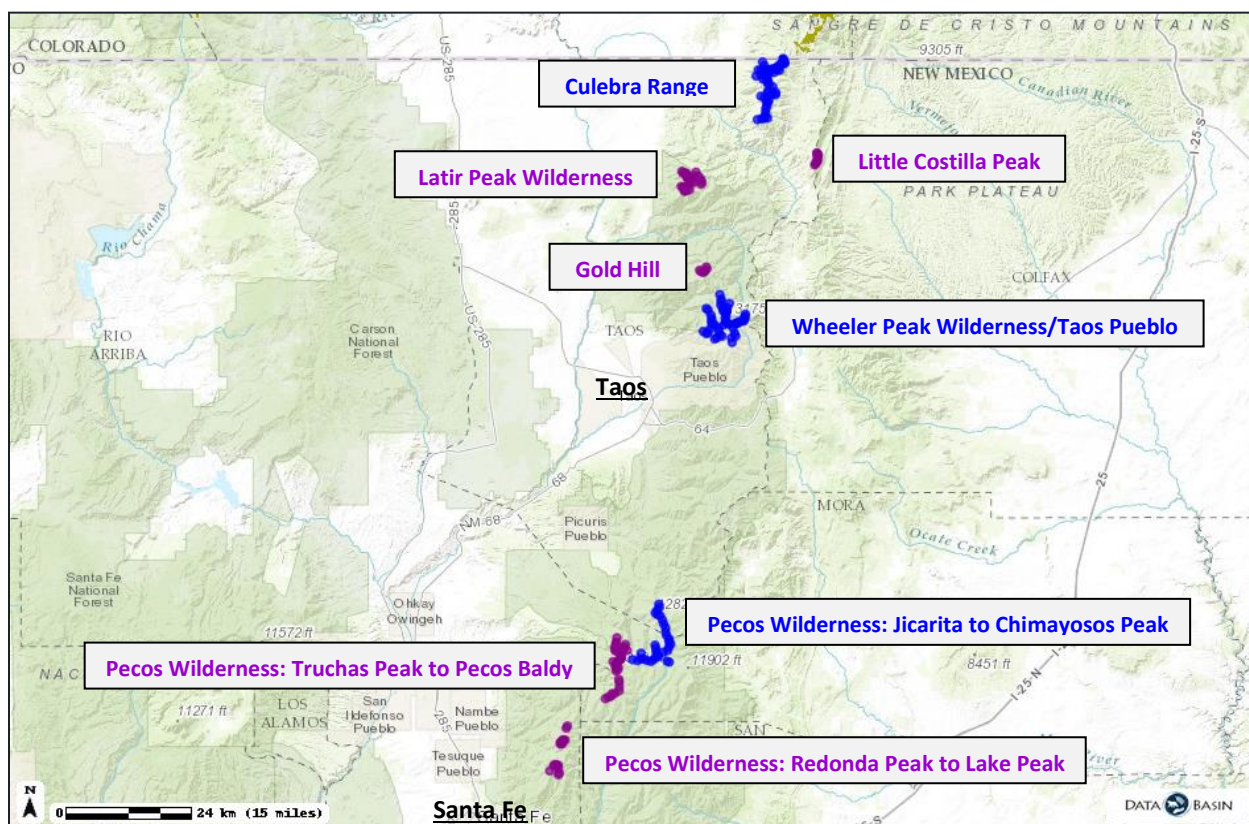


Figure 2. Distribution of white-tailed ptarmigan habitat in New Mexico (Sangre de Cristo Mountains). Sites shown in blue support breeding populations; sites shown in purple are sporadically occupied and are of lower suitability for breeding. Lower elevation, forested terrain separates occupied alpine habitat areas. The Culebra Range and Wheeler Peak are 35 km apart; Wheeler Peak and Pecos Wilderness are more than 50 km apart.



2.1.4 Habitat Requirements

White-tailed ptarmigan primarily inhabit alpine ecosystems at or above treeline throughout the year, though under some circumstances during winter they may forage and roost in riparian areas, meadows, or burns at lower elevations (Braun 1971, Braun et al. 1993, Hoffman 2006,). Alpine vegetation consists of low-growing perennial graminoids (grasses, sedges, rushes), forbs, mosses, lichens, and dwarf shrubs. Vegetation on wetter sites is dominated by graminoids and shrubs, whereas cushion plants and lichens predominate on drier sites. The alpine growing season in New Mexico is less than 90 days (June through August) in most years. Principal plant communities comprising alpine ecosystems in New Mexico include (Dick-Peddie 1993, Romme et al. 2009): (1) fellfield and rock field communities dominated by cushion plants on wind-swept sites with shallow, rocky soils; (2) *Kobresia bellardii*/*Geum rossii* turf meadows on more protected sites with moister and more well-developed soils; (3) a *Carex rupestris*/cushion plant vegetation type that is intermediate between fellfield and *Kobresia* communities; (4) dwarf willow communities associated with sites where snowpack persists into summer, and taller willows (*Salix spp.*) in more protected moist sites; (5) wetland vegetation types including most prominently *Deschampsia caespitosa* and *Juncus drummondii* communities; and (6) wind-sheared krummholz communities in the lower alpine zone, which typically are dominated by stunted Engelmann spruce (*Picea engelmannii*) and subalpine fir (*Abies lasiocarpa*), often intermixed with other woody plants including juniper (*Juniperus sp.*), shrubby cinquefoil (*Potentilla fruticosa*), willows, and whortleberry (*Vaccinium sp.*).

Most alpine plant communities are used by white-tailed ptarmigan at some time during the year. However, key habitat features are the presence of willows, alpine meadows, rocky areas (ca. >50% ground cover), and soft snow for roosting in winter. Willows are particularly critical from late fall through spring, when alternative food plants are scarce (Braun et al. 1976).

Breeding Habitat

Breeding typically begins in late April to early May, or as soon as there are areas free of snow adjacent to willows (prior to other food plants becoming available). Early in the season, breeding territories tend to be near treeline in snow-free areas where taller willows (>0.5 m) are available and protruding above the snow cover. As the breeding season progresses, territories expand upslope with advancing snow melt and greening vegetation. Upslope portions of territories tend to be rockier, with more herbaceous vegetation and less willow (Braun 1971).

Nesting Habitat

Nesting habitat in the southern Rockies occurs in alpine areas that are snow-free by mid-May. These tend to be rocky areas with willow-dominated plant communities or krummholz vegetation. Nest sites (n = 305) in Colorado range in elevation from 3,383 m (Giesen et al. 1980) to 4,161 m (Wiebe and Martin 1998b), with nesting elevations increasing as the season progresses. East-facing aspects appear to be favored (167 of 305 nests). White-tailed ptarmigan nest on the ground in areas of gentle to moderate slope, typically <40% (Wiebe and



Martin 1998b), usually immediately adjacent to some type of cover. Cover may be provided by rocks or vegetation, and is reported to be more for protection against wind and snow than for concealment. Broad habitats used for nesting include rock and boulder fields, various meadow types, evergreen krummholz, and willow krummholz (Giesen et al. 1980; Wiebe and Martin 1998b). Dense cover is avoided, and nests placed in krummholz or willow thickets tend to be at edges or adjacent to openings (Hoffman 2006).

Summer and Brood-Rearing Habitat

Most males and unsuccessful females move upslope to exposed rocky ridges after completing breeding activities in July, where they feed on succulent green vegetation, often adjacent to snowfields or other moist sites (Braun 1971, Hoffman 2006). Hens with chicks move to these areas as the chicks mature. Important mid-to late summer foraging habitat in Colorado includes *Trifolium*-cushion plant fellfields, *Carex* meadows, *Carex-Geum* rock meadows, and vegetation near snowfields and high elevation stream courses (Braun et al. 1993). Moist areas adjacent to late-lying snowfields are typically important foraging sites late in summer, although New Mexico usually lacks these by late July to mid-August. Hoffman (2006) states that traditional summering habitat areas may be abandoned during especially dry years for areas with more moisture, which often are found at lower elevations in willow or krummholz communities. Late summer habitat selection by white-tailed ptarmigan in New Mexico is uncertain.

Fall and Winter Habitat

White-tailed ptarmigan feed almost exclusively on willow during the winter months (late October through late April). White-tailed ptarmigan wintering habitat is characterized by presence of willows and soft snow to burrow into for roosting (Braun 1971, Braun et al. 1976, Giesen and Braun 1992). In New Mexico, alpine willow species include low-growing dwarf and mat forms [snow willow (*S. nivalis*), and alpine willow (*S. petrophilia*)], and taller forms growing on moister sites [grey-leaf willow (*S. glauca*) and plane-leaf willow (*S. plantifolia*)].

Wintering sites often are on northeast or southeast exposures, in the lee of prevailing winds. White-tailed ptarmigan typically feed above treeline on exposed ridges and slopes in early winter. Taller willow shrubs that protrude through the snow are important habitat components during heavy snowfall years or at sites where willows are lacking along windblown ridges and slopes. Thus, as winter progresses, birds tend to move downslope into drainage basins near treeline in the lower alpine and upper subalpine zones, where willows grow taller and are more prolific. Krummholz vegetation can be important at this time of year. In some circumstances, birds move well below treeline and winter along willow-dominated stream courses as low as 2450 m. Avalanche chutes on steep mountainsides, montane meadows, and logged or burned subalpine forest are at times also used at this season (Braun et al. 1976, Braun et al. 1993). Females generally winter in flocks at lower elevations than males and may move long distances (10-30 km) to reach suitable wintering sites (Hoffmann and Braun 1975, 1977; Martin et al.



2000). Suitable wintering habitat therefore may be limited at the landscape scale, particularly for females (Hoffman 2006).

2.1.5 Food Habits

Seasonal food habits as determined from crop analyses in Colorado vary (Table 1). New Mexico alpine habitats are structurally and floristically analogous to those in Colorado (Dick-Peddie 1993, Braun and Williams 2015). Hoffman (2006) reported that in any given area, approximately three dozen food plants are eaten by white-tailed ptarmigan, with about a dozen commonly so.

Table 1. Seasonal food plants of white-tailed ptarmigan in Colorado. Data from 286 crops of adult birds collected at 16 localities (May and Braun 1972; adapted from Hoffman 2006). Plants indicated with a boldface upper-case X comprised more 10% (dry weight) of the diet at that season. All but *Dryas octapetala* occur in New Mexico alpine ecosystems.

| Common Name | Latin Name | Winter (n = 58) | Spring (n = 26) | Summer (n = 45) | Fall (n = 165) |
|---------------------------|----------------------------------|--------------------|--------------------|--------------------|-------------------|
| willow | <i>Salix spp.</i> | 89% | 85% | 6% | 43% |
| mountain alder | <i>Alnus tenuifolia</i> | x | | | |
| mountain dryad | <i>Dryas octapetala</i> | X | X | | X |
| varileaf cinquefoil | <i>Potentilla diversifolia</i> | | x | x | x |
| buttercup | <i>Ranunculus spp.</i> | | x | x | |
| snowball saxifrage | <i>Saxifraga rhomboidea</i> | | x | x | x |
| alpine bistort | <i>Polygonum viviparum</i> | | | X | X |
| American bistort | <i>Polygonum bistortoides</i> | | | x | x |
| sedges | <i>Carex spp.</i> | | | X | x |
| clovers | <i>Trifolium spp.</i> | | | X | x |
| mouse-ear chickweed | <i>Cerastium spp.</i> | | | X | x |
| alpine avens | <i>Geum rossii</i> | | | x | |
| mountain sorrel | <i>Oxyria digyna</i> | | | x | x |
| creeping <i>Sibbaldia</i> | <i>Sibbaldia procumbens</i> | | | | x |
| alpine sandwort | <i>Arenaria obtusiloba</i> | | | | x |
| Fendler's sandwort | <i>Arenaria fendleri</i> | | | x | |
| pussytoes | <i>Antennaria spp.</i> | | | | x |
| whortleberry | <i>Vaccinium spp.</i> | | | | x |
| sage | <i>Artemisia spp.</i> | | | x | |
| lousewort | <i>Pedicularis spp.</i> | | | x | |
| littleleaf alumroot | <i>Heuchera parvifolia</i> | | | x | |
| common alplily | <i>Lloydia serotina</i> | | | x | |
| pygmy-flower rock-jasmine | <i>Androsace septentrionalis</i> | | | x | |
| mustards | Brassicaceae | | | x | x |
| grasses | Poaceae | | | x | x |



During the non-breeding season (September through April) white-tailed ptarmigan in the southern Rocky Mountains subsist almost exclusively on buds, twig tips and leaves of willow species. Dwarf and mat form willows are eaten when available in windblown areas during the winter. Taller, shrub willows that protrude above deep snow cover are important as winter progresses. Birch and alder are browsed when willow is absent. Forbs, graminoids, and berries are added to the diet during the breeding season (May through August), and insects are prominent in the diet of chicks during the first three weeks post-hatching (Braun et al. 1993, Hoffman 2006).

2.1.6 Behavior and Social Organization

Note: Unreferenced information in the sections below is from Schmidt 1988, Hoffman (2006), and Martin et al. (2015).

Territoriality: Both males and females defend territories against same-sex individuals during the breeding season. Nonterritorial males are usually also present in the breeding population, and extra-pair copulations have been documented (Schmidt 1988, Benson 2002). Territories are not defended in winter. Males arrive in breeding areas ahead of females in spring and begin advertising, using territorial calls and aerial flights. Males and females typically occupy the same territory in consecutive years if both members of the pair return. Breeding pairs have overlapping territories.

Pair Bond: White-tailed ptarmigan are typically monogamous, though polygyny occurs at low frequency (Schmidt 1988). Early in the breeding season males engage in a variety of courtship displays and in mate guarding. From the time of pair formation until the onset of incubation, males accompany females almost continuously. Males also are particularly vigilant during this time, a behavior that appears to enhance the female's foraging opportunities prior to nesting. Pair bonds last up to three months within a breeding season Schmidt (1988). Failed clutches may result in a female selecting a new mate for a second nesting attempt.

Sociality: Breeding territories are abandoned soon after chicks hatch, and loosely organized, temporary flocks of adults and juveniles may form as summer progresses. Winter flocks are well-documented, with adults frequently segregated by sex and utilizing different wintering areas. Juveniles of both sexes tend to winter with females.

2.1.7 Reproductive Phenology and Biology

Data presented in this section are from studies in Colorado cited in Martin et al. (2015), unless stated otherwise.

Phenology: Pair formation occurs from late April to mid-May (Schmidt 1988). Eggs are laid from late May to late June, although initiation of nesting may be delayed in years of late snowmelt (Clarke and Johnson 1992, Martin and Wiebe 2004). Hatching occurs from late June to late July. Chicks are precocial, and remain in the company of the hen until late September or October.



Females sometimes lay a replacement clutch if the initial nesting attempt fails, with second clutch laying dates ranging from mid-June to mid-July.

Breeding Biology: White-tailed ptarmigan typically are monogamous and begin breeding as yearlings. Nests are constructed by females. The nest is a shallow, bowl-shaped scrape on the ground, lined with nearby vegetation and body feathers (Giesen et al. 1980). Clutch size is 4-9 eggs (replacement clutches 2-7 eggs); females incubate clutches for 22-25 days, usually beginning after laying the penultimate egg. The precocial chicks leave the nest within 12 hours of hatching and are able to fly at age 10-12 days. Chicks are regularly brooded during the initial 2-3 weeks post-hatching, and remain in the company of the female for at least 8-10 weeks.

2.1.8 Population Ecology

Vital rates of well-studied Colorado populations (Wann et al. 2014) indicate that population growth is most influenced by juvenile survival, followed closely by ≥ 2 year-old adult female survival (Sandercock et al. 2005a, Wilson and Martin 2011). A generation time (assuming a closed population) has been calculated at 2.62 years for Colorado birds (Sandercock et al. 2005a).

Long-term records from Colorado and Vancouver Island show remarkable stability and persistence of populations (Braun and Rogers 1971; Martin and Wiebe 2004; Martin et al. 2004; Sandercock et al. 2005b; Hoffman 2006; Wilson and Martin 2011, 2012; Wann et al. 2014). In most white-tailed ptarmigan populations studied to date, recruitment of immigrants ('demographic rescue') from external populations is a major contributing factor to population stability and maintenance (Giesen and Braun 1993, Martin et al. 2000, Martin and Wilson 2011, Wilson and Martin 2011). Thus, it is possible for females to have low fecundity for an extended period but for the population to still exhibit positive growth. Studies of population genetics at Mt. Evans, Colorado, and on Vancouver Island, British Columbia, Canada, reported evidence of extensive gene flow among populations over large areas (Fedy et al. 2008. Oyler-McCance et al. 2011).

Radio-telemetry and banding studies indicate that dispersal distances typically are <10 km for males, and <30 km for females (Martin et al. 2000, 2015). Maximum movement distances reported for white-tailed ptarmigan for two males in Colorado that had been transplanted to a new site and returned 43 and 50 km, respectively, across primarily forested terrain to their territories (Martin et al. 2000).

2.1.9 Predators

Principal predators of adult and juvenile white-tailed ptarmigan include prairie falcon (*Falco mexicanus*), golden eagle (*Aquila chrysaetos*), weasels (*Mustela* spp.), coyotes (*Canis latrans*), and red foxes (*Vulpes vulpes*) (Martin et al. 2015). Eggs and chicks are known to be taken by common ravens (*Corvus corax*), weasels, red foxes, and coyotes. Compared to other grouse species, predation rates on well-studied populations of white-tailed ptarmigan are relatively low. Bergerud (1988) speculated that this was due to the comparative paucity of avian



predators in alpine areas, particularly during winter, in combination with the species' cryptic plumages, abundant cover provided by extensive rock fields, low population densities, and the patchy nature of suitable habitat.

2.1.10 Associated Species

Other bird species that routinely breed or forage in alpine habitats utilized by white-tailed ptarmigan include prairie falcon, golden eagle, common raven, horned lark (*Eremophila alpestris*), American pipit (*Anthus rubescens*), brown-capped rosy-finch (*Leucosticte australis*), and white-crowned sparrow (*Zonotrichia leucophrys*) (Braun 1980). White-tailed ptarmigan and dusky grouse occasionally are observed foraging in mixed flocks in late summer (Martin et al. 2015).

Resident alpine mammals include yellow-bellied marmot (*Marmota flaviventris*), American pika (*Ochotona princeps*), least chipmunk (*Tamias minimus*), golden-mantled ground squirrel (*Callospermophilus lateralis*), weasels, and bighorn sheep (*Ovis canadensis*). Elk (*Cervus canadensis*), coyote, and red fox also frequently use alpine habitats, but are not usually year-round residents

2.1.11 Threats

Historical and current threats to white-tailed ptarmigan populations and habitat in New Mexico are speculative and based primarily on casual observations and anecdotes.

Domestic Livestock Grazing: Domestic sheep were intensively grazed throughout New Mexico's alpine habitats during the late 1800s and early 1900s. Photographs from as early as the 1920s indicate that alpine meadows of what is now the Pecos Wilderness were severely overgrazed (USFS 2011). Early ornithologists cataloguing the state's avifauna also noted the poor condition of alpine habitats, which they attributed to domestic sheep grazing practices of the time (Bailey 1904, 1905; Ligon 1927). [See Section 2.2.1 below for more on sheep grazing]. Domestic sheep are no longer grazed in alpine habitats on either the Santa Fe or Carson National Forests, nor on the private ranches of the Culebra Range. Domestic cattle are grazed sparingly above treeline, and have not been reported to be broadly detrimental to alpine habitats used by white-tailed ptarmigan (Hoffman 2006, USFWS 2015). However, based on extensive field investigations in Colorado, Braun et al. (1976 p. 8) cautioned that: "... localized overgrazing caused by improper herding practices and early fall storms can have major impact on the amount of (willow) buds and twig tips available to ptarmigan. Any grazing of willow-dominated areas by domestic livestock after 1 September is probably detrimental in terms of the amount of forage remaining for populations of ptarmigan." Ideally, proactive measures for the conservation of white-tailed ptarmigan foraging habitats should be factored into grazing plans on a site-specific basis by resource managers.

Native Ungulate Browsing: Following a site visit in June 2006, Braun (2006) commented on having observed excessive browsing of willow bushes in a portion of the Pecos Wilderness, and, judging from sign, attributed this to elk. It has been hypothesized that over-browsing of willows



at Rocky Mountain National Park by elk during winter and especially early spring may have depressed white-tailed ptarmigan numbers by reducing ptarmigan food availability at these times (Braun et al. 1991, Zeigenfuss 2006). Although the hypothesis remains valid, at present there is no evidence to directly link declines in white-tailed ptarmigan populations to forage competition and depletion by elk (Wang et al. 2002a, USFWS 2015). Impacts of browsing on willows, and the growth responses of willows to browsing, are complex and situational, involving a large set of variables that can be difficult predict, measure, and appropriately evaluate (e.g., Braun et al. 1991; Singer et al. 1994, 1998; Zeigenfuss 2006; Johnston et al. 2007; Bilyeu et al. 2008; Zeigenfuss et al. 2011). In New Mexico, most elk in the Sangre de Cristo Mountains migrate to lower elevations for the winter after the first frosts create dormancy in alpine plants, and remain there until snowmelt in spring allows access to alpine grasses and sedges (NMDGF records). However, small numbers of elk winter in the alpine environment when grazing sites remain available on windblown ridges. Ptarmigan nesting areas in New Mexico will be visually evaluated by NMDGF biologists for evidence of heavy ungulate browsing in the course of other field work.

Public Recreation: By comparison to many sites in Colorado, recreational use of white-tailed ptarmigan habitats in New Mexico is relatively light and is largely restricted to the snow-free summer and fall months. Most use is confined to hiking trails, and foraging ptarmigan typically appear to be little disturbed by people at close range unless actively harassed. However, Wolfe (2011) expressed concern about the potential for unleashed dogs accompanying hikers to harass or kill ptarmigan at Wheeler Peak, by far the most heavily visited portion of the New Mexico white-tailed ptarmigan range. Wolfe et al. (2011) posited that the frequent threat of predation from dogs could result in ptarmigan avoiding otherwise suitable habitat in the vicinity of heavily traveled trails.

Climate Change: Undoubtedly the greatest threat to persistence of white-tailed ptarmigan populations in New Mexico is climate change (Hoffman 2006, Marten et al. 2015, Braun and Williams 2015). Indeed, the projected impacts of climate change were the primary impetus behind a recent petition to list the southern white-tailed ptarmigan as threatened under the federal Endangered Species Act (Center for Biological Diversity 2010). The listing petition and the U.S. Fish and Wildlife Service's 90-day finding (USFWS 2015) discuss and analyze the supporting scientific literature, and readers are encouraged to reference those documents for further details (additional recent literature includes Benson and Cummins 2011; Wilson and Martin 2012; Jackson et al. 2015; Wann et al. 2014, 2016). The principal concerns with respect to changing climate and southern white-tailed ptarmigan include:

- significant alteration of alpine plant community species composition, potentially affecting ptarmigan food availability and dietary breadth
- warming temperatures may shift treelines upslope to higher elevations, reducing available ptarmigan habitat



- a higher percentage of precipitation may fall as rain, rather than snow, leading to drier alpine meadow and fellfield conditions earlier in summer, and to potentially poor winter roosting conditions and low accumulation of snowfields
- being highly susceptible to heat stress, ptarmigan are physiologically ill-equipped to tolerate or adapt to rising summer temperatures

NMDGF acknowledges that climate change manifestations may significantly impact white-tailed ptarmigan and their habitats in New Mexico. While we encourage research efforts in relation to climate effects on alpine ecosystems, because the drivers for climate change are globally distributed, there are few (if any) management or conservation actions that can be taken at the scale of a state Recovery Plan to forestall, ameliorate, or reverse their potentially detrimental effects. However, NMDGF will keep abreast of developments in this regard. It may, for example, be possible to use strategically placed snow fences to create large snowfields in sheltered areas to provide late summer foraging habitat for white-tailed ptarmigan (Martinelli 1975; Clait Braun, pers. comm.).

2.2 HISTORICAL PERSPECTIVE

2.2.1 Habitat Trends

Intensive domestic sheep grazing during the late 1800s and early 1900s degraded alpine habitats to an unknown extent throughout New Mexico's white-tailed ptarmigan range. Sheep were moved into the alpine zone during the summer, and were grazed in tight bands and bedded in the same location for multiple nights. Romme et al. (2009) note that: "These practices resulted in large losses of forage through trampling and in soil damage from excessive trailing to and from bedding ground to water. . . . We speculate that general vegetation structure and distribution resembled what we see today, but that species composition was different in places that have received heavy sheep grazing; range conditions have improved greatly in many places, but legacies of uncontrolled grazing that occurred before that time are still with us." In some cases the loss is permanent. For example, Fletcher and Robbie (2004) state that old soil level marks on rocks near Santa Fe Baldy reveal near complete loss of the sedge community in that area. Hubbard (1979) further speculated that it is possible that domestic sheep eliminated or severely reduced subalpine willow thickets in some areas.

A recent U.S. Forest Service (USFS 2015) assessment report maintains that the alpine ecosystems of Carson National Forest have been damaged in some areas by past sheep grazing, and to a lesser extent by recreational activities. Vegetative groundcover on average is estimated to be 33 percent less than an unmodified reference condition, although vegetation structure and distribution are likely similar to historical conditions.

That domestic sheep are no longer grazed in New Mexico's white-tailed ptarmigan habitats suggests that that this environment may be recovering from past abuses. Clait Braun (Colorado



Division of Wildlife, retired) visually evaluated habitat conditions of selected white-tailed ptarmigan sites in Carson National Forest on several occasions and reported notable improvements in alpine turf communities over time (Braun 1969, 1979, 2006).

2.2.2 Population Trends

White-tailed ptarmigan population trends in New Mexico are entirely unknown. Systematic surveys designed to provide population estimates have never been conducted in any portion of the New Mexico ptarmigan range. Well-studied ptarmigan populations in Colorado and on Vancouver Island have persisted for decades, despite experiencing periods of low survival and fecundity (Wann et al. 2014, Martin et al. 2015). In New Mexico, there are indications that at least the northern portion of the species' range has been continuously occupied since the time of Bailey's (1904, 1905) initial reports (Braun and Williams 2015).

2.2.3 Use and Demand Trends

At present there are no consumptive uses or demands for the white-tailed ptarmigan in New Mexico. Although they are a game animal, there is no hunting season. A small number of amateur birders search for the species each year, primarily in the Jicarita Peak/Santa Barbara Ridge area of the Pecos Wilderness (Braun and Williams 2015).

2.2.4 Past Management

There has been little past management aimed specifically at white-tailed ptarmigan in New Mexico.

Regulatory Actions: The white-tailed ptarmigan was listed as endangered under the WCA in New Mexico in 1975 (NMDGF 2016). It is listed as a Species of Conservation Concern and a Sensitive Species in the Rocky Mountains by the U.S. Forest Service (Regions 2 and 3). U.S. Forest Service objectives for sensitive species are to (1) develop and implement conservation strategies for the species and their habitats, and (2) coordinate management and conservation objectives with state and federal agencies, tribes, and other cooperators (USFS 2013). The southern (Rocky Mountain) white-tailed ptarmigan has been petitioned for listing as threatened under the federal ESA (Center for Biological Diversity 2010), to which the U.S. Fish & Wildlife Service responded with a positive 90-day finding and a recommendation for a status review (USFWS 2015). Colorado, in its recent State Wildlife Action Plan, has listed the white-tailed ptarmigan as a Tier 1 Species of Greatest Conservation Need (Colorado Parks and Wildlife 2015).

Management Actions: Past management actions for white-tailed ptarmigan in New Mexico include most prominently the translocation of 43 individuals from Colorado to the Pecos Wilderness in 1981 to augment the native population (see Braun and Williams 2015). It was suspected at the time that either Pecos Wilderness had never supported a well-established population or that the population had declined (for unknown reasons) to a very low level. Although the Pecos population was not subsequently monitored in any systematic fashion, the translocation appears to have been successful in that individuals are still present and breeding in the release area 35 years later. A study comparing the allelic diversity of the Pecos population



with that of other New Mexico populations and with the donor populations in Colorado would be useful in elucidating its source composition. It is noteworthy that the 1981 translocation constitutes a major step toward white-tailed ptarmigan recovery in the state.

U.S. Forest Service Draft Grazing Guideline: In its forest plan revision, Carson National Forest has drafted the following cattle grazing guideline for allotments that overlap white-tailed ptarmigan habitat:

- *To assist white-tailed ptarmigan nesting success, adaptive seasonal use or percent utilizations for livestock grazing should be considered and based on the best available information, as well as on site-specific factors (e.g., topography and available habitat) within alpine/tundra and subalpine.* [Alyssa Radcliffe, pers. comm.].

2.3 HABITAT AND POPULATION ASSESSMENT

In New Mexico, white-tailed ptarmigan occur only in the Sangre de Cristo Mountains in the northcentral portion of the state. Historically and currently occupied habitat extends from the Lake/Deception Peak area in the south to State Line Peak on the Colorado border (Figure 2 on page 7). Braun and Williams (2015) calculated the area above treeline (3505 m) in this range at about 285 km², of which no more than half (140 km²) might be suitable for occupation during the nesting and brood rearing seasons (May – October). The extent and distribution of winter habitat is unknown. Additionally, based on multiple survey trips during the summer months to most portions of the species' range in New Mexico, Wolfe et al. (2011, 2014) report that more than 95% of their observations of white-tailed ptarmigan and ptarmigan sign (scat, feathers) were from above 3,750 m in elevation. They estimated that only about 25 km² of the alpine habitat in New Mexico is above 3,750 m. These figures are rough estimates, but clearly indicate that white-tailed ptarmigan numbers in New Mexico are constrained by the relatively small area of total habitat available to them. Ptarmigan densities have been determined for several locations in Colorado, and range from <1 to 13.5 individuals per square kilometer (Martin et al. 2015).

Verifiable historical records exist from all major alpine areas of the Sangre de Cristo Mountains prior to the WCA listing in 1975. These include the Culebra Range (State Line Peak south to Big Costilla Peak); the Cabresto Range (Latir Peak Wilderness), Little Costilla Peak (Valle Vidal Unit of Carson NF), Gold Hill (Carson NF), Wheeler Peak Wilderness and vicinity (including Taos Pueblo), and Pecos Wilderness (records summarized by Wolfe et al. 2011, Braun and Williams 2015). Historical records from any portion of the range are sparse, however, due principally to the remoteness of the terrain, the cryptic nature of the species, and little focused effort to find it.

Most of what is known about current distribution is due to presence/not-detected surveys conducted by Don Wolfe and his colleagues from 2006-2013 (summarized in Wolf 2006; Wolfe et al. 2011, 2014), and visual habitat assessments and surveys conducted by Clait Braun in 1969, 1979, and 2006 (summarized in USFS 2011, Braun and Williams 2015). As a result of this work, it



is reasonably certain that there are three core areas where established populations persist year to year: the Culebra Range, the Wheeler Peak Wilderness vicinity, and Pecos Wilderness primarily from Jicarita Peak south and west to Chimayosos Peak (Figure 2). Latir Peaks Wilderness, Little Costilla Peak, Gold Hill, and large portions of Pecos Wilderness are used by dispersing individuals, are used seasonally, or are perhaps occupied in years when core populations are thriving, but by all accounts do not contain sufficient areas of suitable breeding and winter habitat to support self-sustaining populations (Wolfe et al. 2011, Braun and Williams 2015). In particular, willow vegetation is depauperate or lacking from these sites, and rock fields are in short supply at many. Based on data from temperature loggers, Wolfe et al. (2011) further suggest that Latir Peak Wilderness is perhaps too warm and dry during the summer to continuously support the species. Braun and Williams (2015) contend that the limited availability of taller willow in winter and spring and the routine lack of late summer snowfields suggest that these periods may be limiting white-tailed ptarmigan populations in New Mexico. It is conceivable, however, that birds are using lower elevation sites during winter.

White-tailed ptarmigan population sizes in New Mexico are unknown. Braun and Williams (2015) noted that “alpine areas used by ptarmigan in New Mexico are small, disjunct, frequently linear, and contain unsuitable habitats. Thus large numbers of individuals should not be expected.” Based on his experience with Colorado ptarmigan habitats and populations, Braun (1979) suggested that the Wheeler Peak area might support 15-20 breeding pairs (and probably never more than 50 individuals), and that the occupied portion of Pecos Wilderness was likely capable of supporting on the order of 10-15 breeding pairs per square mile (or approximately 50-75 breeding pairs). Wolfe et al. (2011) provided comparable estimates based on their survey work. No population estimate is available for the Culebra Range, although Don Wolfe has observed white-tailed ptarmigan and their sign at multiple locations there, which may indicate a population closer in size to that of Pecos Wilderness than to the Wheeler Peak area (Wolfe et al. 2011, 2014). In all cases, it must be stressed that these estimates are based on perceived habitat quality and ptarmigan presence, rather than from systematic census work.

2.3.1 Current Status Summary

The following is a bullet point summary of the current state of our knowledge with respect to white-tailed ptarmigan in New Mexico (from Braun 1969, 1979, 2006; Braun and Williams 2015; Wolf et al. 2011 and pers. comm.). These points form the fundamental basis for the development of the Recovery and Management Strategy outlined in Section 3.0.

- The historically occupied white-tailed ptarmigan range in New Mexico is currently occupied by unknown numbers of individuals, and, with the possible exception of Pecos Wilderness, has remained occupied in the absence of population augmentation or active management.
- Historically occupied habitat is largely intact at the macro-scale; while there may be local degradation from historical sheep grazing practices, there does not appear to have been wholesale loss of entire sites.



- Persistent core breeding populations occur in the most highly suitable habitat areas. Areas that offer only seasonal habitat or low quality habitat seem, predictably, to support only transient individuals.
- Winter and early breeding season habitat (willows) may be limiting, although it is possible that alternative lower elevation wintering sites are utilized in some areas. This needs investigation.
- Similarly, late summer and fall foraging habitat may be limiting in the chronic absence of remnant snowfields and the paucity of wet seeps. Habitat use and selection at this season needs investigation.
- At present there appear to be no significant *in situ* anthropogenic threats operating broadly on core populations or on habitats of those populations.
- Most of the white-tailed ptarmigan habitat in New Mexico is within designated (Wilderness Act of 1964) wilderness areas (Pecos, Wheeler Peak, Columbine-Hondo, Latir Peak), which provides some level of assurance against significant loss or degradation from a variety of human activities.
- The comparatively great distances separating sites occupied by the three core populations imply that there may not be regular dispersal between them. Particularly in the case of the Pecos Wilderness population, persistence may depend largely on internal recruitment and the ability of the population to weather stochastic processes.
- Population augmentation (translocation) appears to have been successful in the Pecos Wilderness, and could potentially be used to ensure the persistence of established core populations in New Mexico, if warranted. Protocols for successful white-tailed ptarmigan translocation are well established (Braun et al. 2011).

2.4 ECONOMIC AND SOCIAL IMPACTS

Because this species is confined to the high alpine zone, no adverse economic or social impacts related to conservation or management are anticipated in association with recovery planning. Habitat occupied by white-tailed ptarmigan does not overlap with areas inhabited by people or their economic activities, with the exception of limited cattle grazing.

The majority of white-tailed ptarmigan habitat in New Mexico occurs on U.S. Forest Service land (Pecos Wilderness, Wheeler Peak Wilderness, Gold Hill, Latir Peak Wilderness, and Little Costilla Peak). Non-federal lands include approximately 6-8 km² above treeline on Taos Pueblos, and the Culebra Range, owned by the Rio Costilla Cooperative Livestock Association and Vermejo Park Ranch (approximately 30 km² above treeline). Taos Ski Valley, Pattison Trust lands, and Ski Santa Fe also contain small amounts of potentially suitable summer habitat for ptarmigan.

Under the provisions of the Wildlife Conservation Act, the NMDGF does not have authority to prevent habitat-altering activities that might have an adverse effect on state-listed species, or to require activities that would benefit the species. Actions proposed to achieve recovery of white-tailed ptarmigan would have to be coordinated with all stakeholders, including federal land



management agencies, and any actions that would be conducted on private lands would require the voluntary cooperation of the landowner.

2.4.1 Economic Use of Habitat

The primary uses of white-tailed ptarmigan habitat in New Mexico are for recreation, including:

- Hiking/backpacking
- Birding – often with a goal of finding ptarmigan
- Limited fishing (alpine lakes)
- Hunting – elk, bighorn sheep, limited dusky grouse
- Skiing – downhill (Ski Santa Fe and Taos Ski Valley) and back country (limited in alpine)

No jobs are directly tied to white-tailed ptarmigan habitat areas. Cattle are grazed seasonally on U.S. Forest Service allotments and on the private ranches in the Culebra Range. The Recovery Plan contains no explicit guidelines or recommendations for alpine grazing practices.

2.4.2 Sociological Factors

There may be Native American cultural and spiritual values attached to particular features or areas within the alpine zone that is inhabited by white-tailed ptarmigan. NMDGF sent letters soliciting comments from the pertinent tribes. These included the Jicarilla Apache Nation and the Pueblos of Taos, Picuris, Jemez, Pojoaque, Tesuque, and Nambe.



3.0 Recovery and Management Strategy

In envisioning what might constitute “recovery” for white-tailed ptarmigan in New Mexico it is important to reiterate that prior to the 1975 state-listing as endangered there were no data on population sizes or density estimates from anywhere within the species’ New Mexico range. In consequence, we do not know whether numbers had declined significantly during the decades preceding the listing. Given that the present-day distribution of occupied habitat within the state is roughly equivalent to that historically documented, we consider that “recovery” will be indicated when we have learned enough about population sizes, population ecology and dynamics, habitat use, and genetics, that it is possible to be reasonably confident that we can ensure either natural or assisted maintenance and persistence of core populations in the Culebra Range, Wheeler Peak area, and Pecos Wilderness.

Ideally this Recovery Plan would identify minimum numeric population sizes that would need to be maintained to ensure persistence. We are unable to do so at this stage in the recovery process due to a lack of basic data that would allow us to set defensible targets. At the very least, we require information on (1) the extent and distribution of seasonally limiting habitats, (2) the extent to which core populations are demographically and genetically connected, and (3) estimates of current population sizes and vital rates. These are identified in the Issues and Strategies detailed below.

Goal:

Ensure long-term persistence of white-tailed ptarmigan within its historical range in New Mexico, thereby contributing to the maintenance of the southern (Rocky Mountains) white-tailed ptarmigan population and to the maintenance of biological diversity within the state.

Objective:

That habitat availability, seasonal habitat use, conservation genetics, and key attributes of population ecology and dynamics are sufficiently well understood to ensure the maintenance of three core populations of white-tailed ptarmigan in New Mexico, whether through natural processes alone or in combination with strategic augmentation via periodic translocation from other sites.

Objective Parameters:

Objective parameters are performance measures that are designed to assist in achieving the objectives of the recovery plan. Recovery objectives are likely to have been met when:

- All existing suitable habitat is identified and adequately characterized (including at sporadically-occupied sites, which may be important to metapopulation function).
- Core populations and their seasonally use habitats are identified and adequately characterized to ensure viability and persistence.
- Population census and monitoring methods and protocols have been developed and implemented, and a system for survey and monitoring data management is in place.
- Genetic relationships of the southern Rocky Mountains white-tailed ptarmigan population are sufficiently well-characterized to understand levels of connectivity among populations and to appropriately assess the risks and benefits of future



augmentations (if otherwise warranted). Augmentation decision processes and contingencies should be clearly spelled out.

- Current *in situ* threats are identified and managed to minimize negative impacts to habitat and population viability.
- Potential for habitat (vegetation) enhancement has been investigated and implemented, if feasible and warranted.

Issue 1- Knowledge of Core Population Sizes

Core populations inhabit the Culebra Range, Wheeler Peak Wilderness vicinity, and Santa Barbara Ridge within the Pecos Wilderness. It is imperative to gain an understanding of current population sizes and to monitor population trends over time.

Strategy 1. Develop and implement robust population census and monitoring methods and protocols.

Issue 2- Habitat Identification, Maintenance, and Protection

Suitable habitat for occupation by white-tailed ptarmigan is highly limited in New Mexico. Identification, maintenance, and protection of high-quality alpine habitat areas is of utmost importance in the conservation of this species within the state. In particular, taller shrub willows may be limiting in winter and early spring at many locations; willow habitat should be identified throughout the white-tailed ptarmigan range in New Mexico and prioritized for active conservation planning.

Strategy 1. Encourage and support willow vegetation mapping in alpine and upper subalpine zones throughout the alpine area within New Mexico, from Tesuque Peak northward to State Line Peak in the Sangre de Cristo Mountains, including the Cabresto Range (Latir Peak) and Little Costilla Peak.

Strategy 2. As basic information becomes available from field studies of white-tailed ptarmigan and their habitat in New Mexico, develop guidelines in cooperation with land managers for maintaining and protecting important ptarmigan habitats. Additionally, if indicated, consider establishing a monitoring program to track the health and structure (e.g., growth, mortality, reproduction, patch size) of willow communities.

Strategy 3. If site-specific information indicates that a dearth of willow vegetation is limiting the ptarmigan population, investigate possibilities for establishing willow patches at that site through planting of cuttings in appropriate soil types. An initial pilot study would be useful.

Issue 3- Need for Population-Specific Information on Ecology and Natural History

Many aspects of the ecology and natural history of the white-tailed ptarmigan are sufficiently well understood for purposes of conservation and recovery planning. In particular, there exists a large body of literature from research conducted for many decades in analogous ecosystems in Colorado. For the core New Mexico populations, however, it would be useful to have more information on: (1) habitat use/selection and seasonal movements (particularly during fall, winter, and early spring), (2) genetic structure and relationships among New Mexico populations and populations in Colorado, and (3) basic population ecology parameters.



Strategy 1. Encourage and support radio-telemetry studies to investigate seasonal habitat use, resource selection, and movements. [It is particularly important that critical wintering areas be identified so that NMDGF can work with land managers to prevent habitat alteration and conserve their important life history function for white-tailed ptarmigan. Suitable wintering areas, especially for females, are often limited].

Strategy 2. Encourage and collaborate with ongoing research into the genetic structure, levels of connectivity among populations, and levels of heterozygosity among individual white-tailed ptarmigan throughout its range in the southern Rocky Mountains (Colorado and New Mexico). Evaluate potential for and risks of future transplants to augment New Mexico populations, if warranted.

Strategy 3. Encourage and support research into the basic ecology and natural history of New Mexico white-tailed ptarmigan, particularly as it relates to population ecology and dynamics, including but not limited to:

- Estimates of seasonal and annual survival and recruitment
- Estimates of reproductive rates, age specific fecundity and survival (population growth rates), if sample sizes are adequate
- Diet (seasonal food plants)
- Estimates of phenology/timing of breeding activities

Strategy 4. As feasible, coordinate with Colorado Parks and Wildlife to investigate population sizes and connectivity between white-tailed ptarmigan populations on both sides of the Colorado/New Mexico state line in the Culebra Range. This ideally would include population surveys, genetic sample collection, color banding, and (if warranted) radio-telemetry studies.

Issue 4- Need for Information on Current Threats to New Mexico Populations

At the present time, NMDGF believes that habitat availability during the fall, winter, and early spring months (October-April), in combination with presumably low migration rates associated with widely-separated extant populations, are the most critical factors limiting white-tailed ptarmigan distribution and abundance in the state. Apart from the potential for climate change to lead eventually to broadly deteriorating habitat conditions, current potential threats to New Mexico ptarmigan populations appear to be highly localized and therefore are not a priority for focused investigation early in the recovery process. More critically, our understanding of current in situ anthropogenic threats operating on the species in New Mexico is at best speculative and is based entirely on casual observations. For purposes of recovery planning, we therefore choose to focus on Issues 1-3 and their associated strategies. We believe that elucidation of any currently operating stressors that might need amelioration on a site-specific basis will emerge with greater clarity from maintaining this focus.

Issue 5- Future Localized Threats to Ptarmigan Habitat

In his technical conservation assessment, Hoffman (2006) emphasized that: "The best management practice for alpine ecosystems is to leave them alone. Alpine ecosystems are among the most difficult to restore following disturbance." A high proportion of the white-tailed ptarmigan range in New Mexico is reasonably secure against future developments due to its



statutory designation as wilderness. However, it is likely that permitting agencies will receive proposals in the future for activities that may alter habitats used by ptarmigan outside of wilderness areas. These might include proposals for expansion of ski areas, construction of powerline corridors, microwave towers, mines, water developments, or other infrastructure projects.

Strategy 1. Ensure that NMDGF biologists review and comment on all project proposals that affect alpine and subalpine habitats in the Sangre de Cristo Mountains.

Issue 6- Management issues

Occupied and potentially occupied habitat of white-tailed ptarmigan in New Mexico occurs on Federal (U.S. Forest Service), Tribal (Taos Pueblo), and private lands. Additionally, it is likely that ptarmigan move between New Mexico and Colorado; suitable habitat (with minor disjunctions) extends northward from New Mexico for approximately 40 km through the southern Colorado portion of the southern Sangre de Cristo Mountains. Coordination of research and conservation efforts will allow management entities and other stakeholders to pursue their own goals while maintaining a path forward to long-term conservation assurances (recovery) of white-tailed ptarmigan.

Strategy 1. Collaborate with stakeholders, researchers, managers, tribal governments, and agencies to (1) coordinate conservation efforts, (2) coordinate sharing information and data, and (3) facilitate cooperative recovery efforts.

Strategy 2. Identify and secure funding to promote the objectives of this Recovery Plan.

Strategy 3. As feasible, coordinate recovery efforts in New Mexico with white-tailed ptarmigan research and conservation planning in Colorado, particularly as it relates to the Culebra Range (southern Sangre de Cristo Mountains).

Strategy 4. As feasible, coordinate management objectives of this Recovery Plan with other wildlife management activities conducted by NMDGF in the alpine and subalpine zones of the Sangre de Cristo Mountains.

Strategy 5. Develop a public information and outreach program to inform the public about white-tailed ptarmigan and alpine ecosystems.



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5.0 Approvals

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6.0 Appendices

6.1 ADVISORY COMMITTEE MEMBERS

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