U.S. FISH AND WILDLIFE SERVICE
SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM

SCIENTIFIC NAME: *Lagopus leucura altipetens*

COMMON NAME: Southern white-tailed ptarmigan

LEAD REGION: Interior Regions 5 and 7 (FWS Legacy Region 6)

DATE INFORMATION CURRENT AS OF: May 2020 (The date of the current Species Status Assessment report for the southern white-tailed ptarmigan; we have received no new information since that time.)

STATUS/ACTION

_X_ Species assessment - determined either we do not have sufficient information on threats or the information on the threats does not support a proposal to list the species and, therefore, it was not elevated to Candidate status

___ Listed species petitioned for uplisting for which we have made a warranted-but-precluded finding for uplisting (this is part of the annual resubmitted petition finding)

___ Candidate that received funding for a proposed listing determination; assessment not updated

___ New candidate

___ Continuing candidate

___ Listing priority number change
Former LPN: ___
New LPN: ___

___ Candidate removal: Former LPN: ___
___ A – Taxon is more abundant or widespread than previously believed or not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status.
___U – Taxon not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status due, in part or totally, to conservation efforts that remove or reduce the threats to the species.
___ F – Range is no longer a U.S. territory.
___ I – Insufficient information exists on taxonomy, or biological vulnerability and threats, to support listing.
___ M – Taxon mistakenly included in past notice of review.
___ N – Taxon does not meet the Act's definition of "species."
___ X – Taxon believed to be extinct.

Date when the species first became a Candidate (as currently defined):

Petition Information:
___ Non-petitioned
_X_ Petitioned; Date petition received: First received on August 24, 2010, and revised on September 1, 2011, by the Center for Biological Diversity.
90-day substantial finding FR publication date: June 5, 2012 (77 FR 33143)
12-month warranted but precluded finding FR publication date: NA

FOR PETITIONED CANDIDATE SPECIES
a. Is listing warranted (if yes, see summary of threats below)? NA
b. To date, has publication of a proposal to list been precluded by other higher priority listing actions? NA
c. Why is listing precluded? NA

ANIMAL/PLANT GROUP AND FAMILY: Bird, Phasianidae (pheasant family)

HISTORICAL STATES/TERRITORIES/COUNTRIES OF OCCURRENCE: Colorado, Wyoming, New Mexico

CURRENT STATES/COUNTIES/TERRITORIES/COUNTRIES OF OCCURRENCE: Colorado, New Mexico

LAND OWNERSHIP: Nearly all suitable habitat for the southern-white tailed ptarmigan occurs on lands managed by Federal land management agencies, with over 85 percent managed by the U.S. Forest Service, over 5 percent managed by the National Park Service, and 4 percent managed by the Bureau of Land Management (Table 1). Approximately 6 percent of suitable habitat is located on privately owned land (Table 1).

Table 1. Approximate percentages of landownership across the predicted range of the southern white-tailed ptarmigan. Based on the predicted range model by Colorado Parks and Wildlife (Seglund *et al.* 2018, p. 38).

Land Ownership Type	Percent of Predicted Range
U.S. Forest Service	85 percent
Private	6 percent
National Park Service	5 percent
Bureau of Land Management	4 percent

LEAD REGION CONTACT: Craig Hansen, Mountain-Prairie Regional Office, 303–236–4749, craig_hansen@fws.gov

LEAD FIELD OFFICE CONTACT: Karen Newlon, Montana Ecological Services Field Office, 406–449–5225, ext. 209, karen_newlon@fws.gov

BIOLOGICAL INFORMATION

Species Description

The southern white-tailed ptarmigan is a small bird in the grouse family that lives in alpine ecosystems at or above treeline in Colorado, northern New Mexico, and historically in southern Wyoming (Figure 1). Southern white-tailed ptarmigan experience extreme variability in temperature, precipitation, wind, and snow cover and exhibit a high level of plasticity and adaptability to these alpine conditions.

Figure 1. A male southern white-tailed ptarmigan with summer plumage (left) and alpine habitats during the winter (right), both at Guanella Pass, Colorado (Photos by U.S. Fish and Wildlife Service).

The southern white-tailed ptarmigan has plumage that changes annually, from white in winter to grayish brown in summer, to match the coloration and patterns in their alpine habitat (Martin *et al.* 2015, unpaginated) (Figure 2). The southern white-tailed ptarmigan has complex molts and plumages (Martin *et al.* 2015, unpaginated), and is in a nearly continuous state of molting from April to November (Hoffman 2006, p. 12). Tail feathers (rectrices) remain perpetually white year-round, which distinguishes the species from rock (*L. muta)* and willow (*L. lagopus)* ptarmigan (Martin *et al.* 2015, unpaginated). Males and females are similar in size (Hoffman 2006, p. 12). During the winter, both males and females are glossy white, except for black eyes, toenails, and beak (Hoffman 2006, p. 12). Summer plumage of males is vermiculated (wavy) with brownish-gray with black-tipped head and neck feathers, giving a hooded appearance (Johnsgard 1973, p. 242). Summer plumage of females is more regularly barred with black and yellowish markings (Johnsgard 1973, p. 242). Both sexes have eyecombs, but eyecombs of males are more prominent and bright red (Figure 1, above).

Both males and females have heavily feathered feet that act as snowshoes to support them as they walk across the snow (Martin *et al.* 2015, unpaginated). The southern white-tailed ptarmigan is the largest of the five subspecies of white-tailed ptarmigan (Langin *et al.* 2018, p. 1482).

Figure 2. Southern white-tailed ptarmigan with winter plumage (left) and summer plumage (right), which camouflages individuals with their seasonally diverse alpine habitats. (Left photo by U.S. Fish and Wildlife Service, right photo by Joyce Gelhorn).

Taxonomy

The white-tailed ptarmigan is the smallest grouse in North America, occurring in the taxonomic order Galliformes, family Phasianidae, and the subfamily Tetraoninae (Dimcheff *et al.* 2002, p. 203; Martin *et al.* 2015, unpaginated), which includes the grouse, or ground-feeding game birds (Hoffman 2006, p. 11). Five subspecies of white-tailed ptarmigan are currently recognized based largely on phenotypic differences (American Ornithological Union (AOU) 1957, p. 135). Since 1957, the AOU has not conducted a review of its subspecific distinction and no longer lists subspecies as of the 6th edition (AOU 1983). However, the AOU recommends the continued use of its 5th edition for taxonomy at the subspecific level (1998, p. xii). Based on their 1957 consideration of the taxon, the AOU recognizes the southern white-tailed ptarmigan as a valid subspecies.

Two subspecies, the southern white-tailed ptarmigan and the Vancouver Island white-tailed ptarmigan (*L. l. saxatilis*), are somewhat geographically isolated. The southern white-tailed ptarmigan occupies the Rocky Mountains in Colorado, New Mexico, and historically in southern Wyoming. The Vancouver Island white-tailed ptarmigan is restricted to Vancouver Island, British Columbia (Martin *et al.* 2015, unpaginated). Recent genomic work (Langin *et al.* 2018, entire) provides evidence that *L.l. altipetens* and *L.l. saxatilis* display substantial genetic divergence from each other and from the other three currently recognized subspecies (Langin *et al.* 2018, p. 1480).

The level of divergence is more subtle among the other three subspecies (Langin *et al.* 2018, p. 1480), with some evidence to support the currently recognized subspecies (Langin *et al.* 2018, pp. 1478–1479). However, additional sampling will be needed to determine the validity of these three subspecies and the location of their respective geographic boundaries (Langin *et al.* 2018, p. 1482).

At the time of this assessment, the best available scientific and commercial information suggests that the five subspecies identified by the AOU are valid, including strong genetic evidence for the designation of the *L.l. altipetens* subspecies (Langin *et al.* 2018, entire). Therefore, we accept the taxonomic characterization of the southern white-tailed ptarmigan as a valid taxon, a recognized subspecies, and a listable entity under the Endangered Species Act (Act). Our SSA report provides additional detail regarding the taxonomy and genetics of the southern white-tailed ptarmigan (Service 2020, pp. 3–5).

Habitat/Life History

The southern white-tailed ptarmigan primarily inhabits alpine ecosystems at or above treeline year-round (Hoffman 2006, p. 12), although areas below treeline are also used in winter (Braun *et al.* 1976, p. 4; Seglund *et al.* 2018, p. 130). Southern white-tailed ptarmigan, along with other alpine species, experience extreme variability in temperature, precipitation, wind, and snow cover (Martin and Wiebe 2004, p. 177). Southern white-tailed ptarmigan exhibit a high level of plasticity and adaptability to these conditions (Martin and Wiebe 2004, p. 177; Wann 2017, p. 5). In Colorado, southern white-tailed ptarmigan occupy habitats between 3,353–4,114 meters (11,000–13,500 feet) in elevation (Seglund *et al.* 2018, p. 130). These alpine habitats are characterized by high winds, cold temperatures, short growing seasons, low atmospheric oxygen concentrations, and intense solar radiation (Martin and Wiebe 2004, p. 177; Sandercock *et al.* 2005a, p. 13) (Figure 3). We describe the habitat for the southern white-tailed ptarmigan in greater detail in our SSA report (Service 2020, pp. 11–14).

Figure 3. A southern white-tailed ptarmigan in high-elevation, alpine habitats during the winter at Guanella Pass, Colorado (Photo by U.S. Fish and Wildlife Service).

Southern white-tailed ptarmigan have several adaptations to cold, snowy conditions. Southern white-tailed ptarmigan are fairly sedentary during winter and limit movements to conserve energy (Braun and Schmidt 1971, p. 243). Legs and feet are heavily feathered, creating a snowshoe effect that allows ptarmigan to save energy by walking on top of snow rather than flying (Hohn 1977, p. 382). Metabolic rates are low, allowing the white-tailed ptarmigan to gain weight during the winter (May 1975 *in* Hoffman 2006, p. 31). Ptarmigan plumage is highly insulative (Johnson 1968, p. 1010), and low evaporative efficiencies prevent the loss of body heat (Johnson 1968, p. 1010). As a result, ptarmigan are highly susceptible to heat stress (Johnson 1968, p. 1011), exhibiting signs of stress (e.g., panting, snow bathing) at ambient air temperatures over 21°C (70°F) (Johnson 1968, p. 1003). In summer, birds select microsites such as late-lying snowfields or the shade of boulders or willows as thermal refugia (Johnson 1968, p. 1003; Wiebe and Martin 1998, p. 1143). In the southern portion of the southern white-tailed ptarmigan range, afternoon precipitation associated with monsoonal thunderstorms can provide substantial added moisture along with cooler temperatures during the warm summer months (mid-July through August) (Steenburgh *et al.* 2013, p. 61).

Willow buds and twigs provide the primary food source for ptarmigan from late fall through spring (May and Braun 1972, p. 1182), and the presence of willow may have the greatest influence on the distribution of white-tailed ptarmigan during this period (Braun *et al.* 1976, p. 10; Hoffman 2006, p. 23). During winter (November to April), ptarmigan often use windswept areas at the upper reaches of drainage basins that provide abundant willow growth above the snow and areas where soft snow accumulates (Braun *et al.* 1976, p. 2-4). Wind-blown areas above treeline provide access to short-statured willow, such as snow willow (*Salix nivalis*), whereas riparian areas and swales support taller willow species, such as planeleaf willow (*S. planifolia*). During winter, southern white-tailed ptarmigan burrow in soft snow for roosting during the night and occasionally during the day if weather conditions are unfavorable (Braun and Schmidt 1971, p. 244; Braun *et al.* 1976, p. 7).

As alpine winter transitions to spring, both males and females migrate upward in elevation to areas that are free of snow with access to willows by mid-May (May and Braun 1972, p. 1183; Hoffman and Braun 1975, p. 486). Pair formation is typically complete by late May and breeding territories expand with snowmelt and vegetation green up (May and Braun 1972, p. 1182–1183). Females require snow-free areas to place their nests (Martin and Wiebe 2004, p. 182), and late snowmelt can negatively impact breeding success and productivity (Martin and Wiebe 2004, p. 183). Additionally, females delay egg laying until they have undergone molt into their cryptic breeding plumage, the onset of which is tied to the amount of snow cover as well as photoperiod (Braun and Rogers 1971, p. 36). Spring snowstorms can delay nesting (Martin and Wiebe 2004, p. 182; Wann et al., 2016, p. 10), and females must be flexible in the timing of reproduction (Martin and Wiebe 2004, p. 182).

Males begin defending breeding territories in mid-April, and females arrive on breeding grounds in late April or early May, depending upon snow conditions (Giesen *et al.* 1980, pp. 188–189). Females breed in their first year of life and each year thereafter (Sandercock *et al.* 2005b, p. 2177).

Females produce one brood per season, but can renest if their first clutch is lost during egg-laying or early incubation (Giesen and Braun 1979, p. 217).
Adult females tend to renest at a higher rate than subadults (Sandercock *et al.* 2005a, p. 16; Seglund *et al.* 2018, p. 120). White-tailed ptarmigan are primarily monogamous; polygyny occurs but is uncommon (Hoffman 2006, p. 19, Martin *et al.* 2015, unpaginated).

The timing of nest building and initiation of egg laying depends on the availability of snow-free areas, but typically begins in early to mid-June, with incubation occurring in mid-to late June and hatching in early to mid-July (Hoffman 2006, p. 20; Seglund *et al.* 2018, p. 105-106). Chicks are able to leave the nest within a few hours after hatching and are capable of flight at 10–12 days old (Martin *et al.* 2015, unpaginated). Chicks are dependent on hens for thermoregulation, protection from predators, and food selection during the first three weeks of life (Martin *et al.* 2015, unpaginated) and remain with hens for 8 to 10 weeks (Hoffman 2006, p. 33). Incubation and care of the young are conducted exclusively by females.

Suitable nest sites often have some type of cover (e.g., boulders, willows) adjacent to the nest, which serves largely as protection against the elements (Giesen *et al.* 1980, p. 194, p. 196; Wiebe and Martin 1998, p. 1142, Seglund *et al.* 2018, p. 109; Spear *et al.* 2020, p. 181), although females will also place nests in open areas of low-statured alpine vegetation (Giesen *et al.* 1980, p. 195, Wiebe and Martin 1998, p. 1142, Seglund *et al.* 2018, p. 109). Boulders (large rocks greater than 30 cm) (Frederick and Gutierrez 1992, p. 899) may provide better protective and thermal cover for nests than vegetation (Wiebe and Martin 1998, p. 1143), and females may preferentially place nests adjacent to boulders (Wiebe and Martin 1998, p. 1142). Incubating females display high nest attentiveness, which may serve to reduce the likelihood of predation (Giesen and Braun 1979, p. 216; Wiebe and Martin 1997, p. 221). Suitable feeding sites for incubating females are typically in close proximity to the nest (Wiebe and Martin 1997, p. 222; Spear *et al.* 2020, p. 181).

Females select nest sites with greater cover of desirable forage forbs at the scale of the nest patch (200 square meters; 2,153 square feet) (Spear *et al.* 2020, p. 178). After hatching, hens with chicks typically remain within several hundred meters of the nest for up to a week after hatching (May and Braun 1972, p. 1183), although hens nesting near treeline may move farther with their broods to habitats at higher elevations (Rick Hoffman 2020, pers. comm.). Prolonged cool and wet weather conditions during the early brood-rearing period can have a negative impact on chick survival, as young chicks are unable to thermoregulate independently during their first weeks of life (Wann *et al.* 2016, p. 12).

Invertebrates are an important food source for chicks less than three weeks old (May 1975 *in* Martin *et al.* 2015, unpaginated), and females may select brood sites with abundant invertebrates during this period (Spear *et al.* 2020, p. 180). Females provide cues to chicks for the selection of protein-rich forage items (Allen and Clarke 2005, p. 308) and select foraging sites with abundant low-growing forbs and low-growing snow willow (May and Braun 1972, p. 1183; Clarke and Johnson 2005, p. 172; Allen and Clarke 2005, p. 308).

Brood-rearing habitat for females, and summer areas for post-territorial males and unsuccessful females, occur at higher elevations than breeding territories (Hoffman 2006, p. 26). These late summer habitats tend to occur on high, rocky, windswept areas near late-lying snowfields or other moist sites.

Drier alpine fellfields adjacent to these moist sites are also important summer use areas (Hoffman 2006, p. 26) that support key forage species (Clarke and Johnson 2005, p. 172). Late summer diets differ between male and female southern white-tailed ptarmigan.

Life span records for wild white-tailed ptarmigan include a female of 12 years and a male of 15 years (Martin *et al.* 2015, unpaginated). In general, generation time for white-tailed ptarmigan is relatively short at less than three years (Sandercock *et al.* 2005a, p. 21). Annual survival is highly variable (Wann *et al.* 2014, p. 560; Seglund *et al.* 2018, p. 79). Mean daily chick survival increases with age (Seglund *et al.* 2018, p. 117; Wann *et al*. 2019, p. 7208). During a four-year study across the southern white-tailed ptarmigan range of Colorado, the probability of a chick surviving to 49 days varied by year and population, ranging from 78 percent in the northern population in 2015 to 4.7 percent in the southern population in 2013 (Seglund *et al.* 2018, p. 117).

Both natal and breeding dispersal occur, particularly for females (Giesen and Braun 1993, entire; Martin *et al.* 2000, p. 509). Few juvenile ptarmigan return to their natal areas (Sandercock *et al.* 2005b, p. 2180). Juvenile females disperse farther than males from their natal areas (Giesen and Braun 1993, p. 74), and most recruitment has been observed to occur from outside of study area boundaries (Giesen and Braun 1993, p. 75; Martin *et al.* 2000, p. 511). Juveniles of both sexes generally move farther than adults, and movement of juvenile females across populations is integral to maintaining stable populations of ptarmigan (Martin *et al.* 2000, p. 514; Wann 2017, p. 90).
The maximum dispersal distance recorded for ptarmigan is of an adult female moving 53 kilometers (33 miles) (Seglund *et al.* 2018, p. 76). Introduced populations of white-tailed ptarmigan have been observed crossing 10 to 20 kilometer (6.2 to 12.4 mile) gaps of unsuitable habitat, such as low-elevation forests (Frederick and Gutierrez 1992, p. 899). Our SSA report further describes the life history, life cycle, and needs of the southern white-tailed ptarmigan (Service 2020, pp. 8–23).

Historical Range/Distribution

The southern white-tailed ptarmigan historically inhabited alpine areas in the Rocky Mountains from the Snowy Range in southern Wyoming (Braun and Wann 2017, p. 207) south through alpine habitats of Colorado (Braun and Rogers 1971, entire) and into northern New Mexico south to near Santa Fe, New Mexico (Braun and Williams 2015, p. 236).

Current Range/Distribution

The distribution of southern white-tailed ptarmigan is largely unchanged from historical levels in Colorado and New Mexico, but presumed extirpated in southern Wyoming (Hoffman 2006, p. 16) (Figure 4). The lack of recent observations in the Snowy Range at the northern extent of the subspecies' range in southern Wyoming, since 1974, suggests that southern white-tailed ptarmigan populations no longer persist in Wyoming.

Colorado supports the largest distribution of white-tailed ptarmigan in the United States outside of Alaska (Hoffman 2006, p. 15). In Colorado, the southern white-tailed ptarmigan inhabits nearly all available alpine areas, except the Spanish Peaks and Greenhorn Mountain in the southern part of the state (Hoffman 2006, p. 15). The species was successfully introduced to the isolated Pikes Peak in 1975, over 60 kilometers (37.2 miles) from the nearest occupied habitat (Hoffman and Giesen 1983, p. 1758).

In Wyoming, credible observational and specimen data exist from only the Snowy Range in southern Wyoming (Braun and Wann 2017, p. 206), with the latest verified observation in the Snowy Range from 1974 (Braun and Wann 2017, p. 209). The Medicine Bow National Forest in southern Wyoming considers the ptarmigan to be present historically but currently extirpated from the Snowy Range (USDA 2003, pp. 3, 154; Hoffman 2006, p. 15). The latest verified observation in Wyoming was of two individual ptarmigan in 2005 approximately 24 kilometers (15 miles) north of the Snowy Range, suggesting movement of birds within Wyoming or possibly between Wyoming and Colorado (Braun and Wann 2017, p. 207); however, the lack of recent observations suggests that ptarmigan no longer persist in Wyoming (Braun and Wann 2017, p. 210). A combination of factors likely contributed to the presumed loss of ptarmigan from the Snowy Range in Wyoming. Currently, the area experiences heavy recreational activity, particularly winter snowmobile use (Braun and Wann 2017, p. 209). Additionally, suitable ptarmigan habitat is limited (less than 10 square kilometers (3.9 square miles)) and relatively isolated from the nearest suitable habitat in Colorado (Braun and Wann 2017, p. 204). Dispersal of birds from areas in northern Colorado (e.g., Mt. Zirkel) to the Snowy Range, although possible, is unlikely to occur in sufficient numbers to maintain a breeding population (Hoffman 2006, p. 15), and historical abundance of ptarmigan was likely low (Hoffman 2006, p. 16).

In New Mexico, the southern white-tailed ptarmigan historically inhabited all the ridges and peaks above treeline within the Sangre de Cristo Mountains from Santa Fe Baldy north to the Colorado border (Ligon 1961, p. 87; NMDGF 2016, p. 7; Braun and Williams 2015, p. 240). By the 1920s, it was presumed extirpated from the southern peaks and found only on the northernmost peaks of its former range (Braun and Williams 2015, p. 235). The northern (e.g., Wheeler Peak) and southern (e.g., Pecos Wilderness) peaks are separated by more than 50 km (31 mi) (NMDGF 2016, p. 7). Following declines and possible extirpation in the southernmost peaks, the New Mexico Department of Game and Fish listed the white-tailed ptarmigan as endangered in the state in 1975 (NMDGF 2016, p. 16). Approximately 43 birds from Colorado were translocated to the southern peaks of the Sangre de Cristo Mountains near the Pecos Wilderness in 1981 (Braun and Williams 2015, p. 238). Recent observations and reports indicate that a small population of ptarmigan remain in this translocation area, and populations continue to persist in the northernmost peaks (Braun and Williams 2015, p. 241).

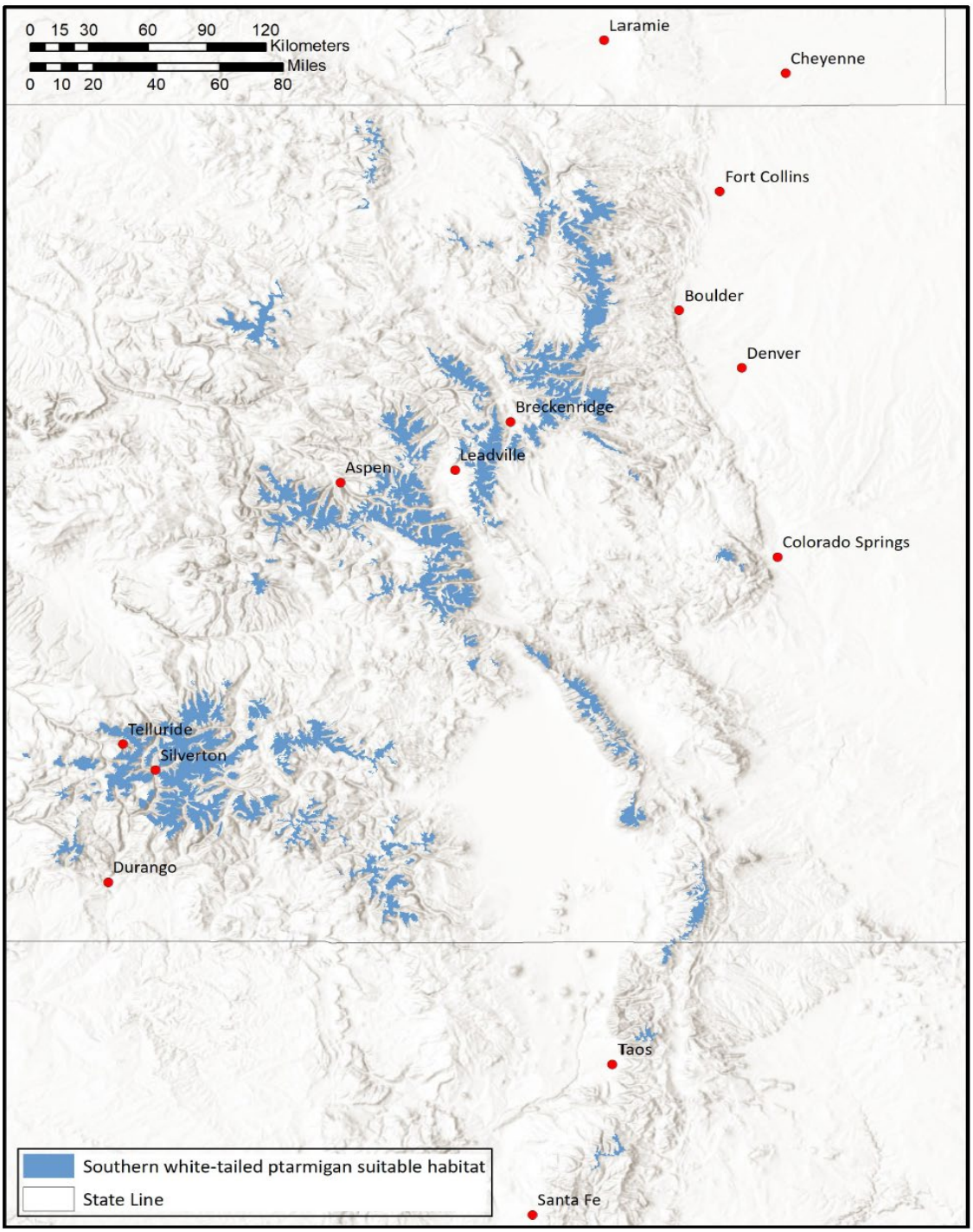

Figure 4. Potentially suitable habitat for the southern white-tailed ptarmigan in Colorado and New Mexico, based on a predicted range model for Colorado by Colorado Parks and Wildlife (CPW) (Seglund *et al.* 2018), and suitable habitat in New Mexico provided by the New Mexico Department of Game and Fish (Bulger 2019).

Based on the availability of both mat willow species and taller willow, alpine areas in the Pecos Wilderness, Wheeler Peak Wilderness, and the Culebra Range of the Sangre de Cristo Mountains likely provide year-round habitat for ptarmigan (NMDGF 2016, p. 4; Wolfe and Larsson 2018, pp. 4-5), whereas other areas may provide habitat only seasonally (NMDGF 2016, p. 7; Wolfe and Larsson 2018, p. 5). Alpine areas in New Mexico are relatively small and isolated, often linear, and contain areas of unsuitable habitat for ptarmigan (Braun and Williams 2015, p. 240).

Colorado Parks and Wildlife (CPW) has worked successfully with multiple wildlife agencies to introduce white-tailed ptarmigan from Colorado to areas outside of the subspecies' historical range to provide recreational hunting opportunities, including into the Sierra Nevada Mountains of California, the Uinta Mountains in Utah, and to Pike's Peak in Colorado (Hoffman 2006, p. 13). A translocation attempt in the Wallowa Mountains of northeastern Oregon in the late 1960s was ultimately unsuccessful, as no ptarmigan sightings have been reported since approximately 1990 (Braun *et al.* 2011, p. 4). For our analysis and our listing determination, we do not consider populations in California, Utah, or Pikes Peak that were introduced outside of the historical range of southern white-tailed ptarmigan. Our SSA report further describes the current range and distribution of the southern white-tailed ptarmigan (Service 2020, pp. 5–8).

Population Estimates/Status

Recent surveys conducted by CPW detected ptarmigan at 57 of 59 survey plots (Seglund 2011, p. 7), indicating that the distribution of ptarmigan in Colorado has not changed since earlier mapping of ptarmigan distribution by Braun and Rogers (1971). Recent statewide estimates of abundance (adults and chicks) provided by CPW varied from a low in 2014 of 147,798 (95 percent credible intervals 128,289–171,563) to a high in 2013 of 221,555 (95 percent credible interval 178,615–268,548) (Seglund *et al.* 2018, p. 72). These estimates are based on extrapolations of abundance from six study sites with relatively high densities throughout the range of southern white-tailed ptarmigan in Colorado. An estimate of the breeding population in Colorado of 34,800 birds was provided by Hoffman (2006, p. 16) based on an average breeding density of 6 southern white-tailed ptarmigan per square kilometer and 5,800 square kilometers (2,239 square miles) of suitable breeding habitat.

In New Mexico, surveys in 2018 observed no southern white-tailed ptarmigan in the Wheeler Peak Wilderness area, although two individuals were observed there in 2017. In 2018, two birds were observed in the Pecos Wilderness (six were observed there in 2017), and four birds were observed in the Culebra Range (five were observed there in 2017). Breeding in New Mexico, as evidenced by observations of females with broods, has been noted as recently as 2016 (John Bulger 2018, pers. comm.). It is unknown to what degree these areas regularly maintain functional breeding populations in New Mexico (Don Wolfe 2020, pers. comm.).

Several other areas have occasional sightings and likely just seasonal use (Latir Peak Wilderness, Little Costilla Peak, Santa Fe Baldy and Lake Peaks, and Gold Hill) (Wolfe and Larsson 2018, p. 5). There are no recent observations of the southern white-tailed ptarmigan in Wyoming.

Survival and productivity are highly variable across populations of southern white-tailed ptarmigan due largely to variability in climate and predation (Martin *et al.* 2000, p. 504, Seglund *et al.* 2018, p. 3), yet ptarmigan populations continue to persist throughout most of the historical range (Martin *et al.* 2000, p. 512; Martin *et al.* 2015, unpaginated; Seglund *et al.* 2018, p. 138). In Colorado, the survival of adult females has the greatest influence on population growth (Sandercock *et al.* 2005a, p. 21; Wilson and Martin 2011, p. 466; Wann 2017, p. 128), followed by juvenile survival (Wann 2017, p. 128).

Juvenile survival is one of the most difficult demographic rates to study, particularly for species like ptarmigan that generally emigrate from areas where they were born (Wann 2017, p. 72). Chick survival is lowest after hatch and increases with age, stabilizing at around 18 days old (Wann 2017, p. 47). Populations are maintained through immigration (Martin *et al.* 2000, p. 514; Sandercock *et al.* 2005b, p. 2183; Wann 2017, p. 91, p. 133), emphasizing the importance of demographic connectivity among suitable alpine habitats. Our SSA report provides a more detailed description of population monitoring and trends for the southern white-tailed ptarmigan (Service 2020, pp. 15–18).

PREVIOUS FEDERAL ACTIONS

In 2010, the U.S. Fish and Wildlife Service (FWS) received a petition to list either the U.S. population or the Rocky Mountain population of the white-tailed ptarmigan (*Lagopus leucura*) as threatened, distinct population segments (DPSs) and to designate critical habitat. Following correspondence with the FWS regarding the accepted taxonomy of the white-tailed ptarmigan and our DPS policy, the petitioner revised its petition on September 1, 2011. The revised petition requested that we list the southern white-tailed ptarmigan and the Mt. Rainier white-tailed ptarmigan (*L. l. rainierensis*) as threatened subspecies under the Act. On June 5, 2012, the FWS found that the petition presented substantial scientific or commercial information indicating that the listing of the southern white-tailed ptarmigan and Mt. Rainier ptarmigan may be warranted (77 FR 33143).

In early 2018, we began conducting updated, comprehensive scientific analyses for both the southern white-tailed ptarmigan and the Mt. Rainier white-tailed ptarmigan, using the FWS's SSA Framework (Smith *et al.* 2018, entire). For these SSAs, we reviewed all new information available since our 90-day finding, and reevaluated the factors previously considered to be threats to the subspecies, in the context of resiliency, redundancy, and representation. Below, we summarize our SSA analysis for the southern white-tailed ptarmigan. The species status assessment (SSA) for the Mt. Rainier white tailed-ptarmigan is summarized in a separate report.

SUMMARY OF THE SPECIES STATUS ASSESSMENT

We completed an SSA report for the southern white-tailed ptarmigan (Service 2020, entire), which is available online at http://regulations.gov in the docket for this finding. The SSA report provides the results of the comprehensive biological status review by the FWS for the southern white-tailed ptarmigan, and provides a thorough account of the subspecies' current and future overall viability, and therefore, risk of extinction (Service 2020, entire). Scientific experts contributed to our analysis, and our SSA report was peer reviewed and reviewed by partners. The SSA report for the southern white-tailed ptarmigan provides the best available biological information to inform the decision on whether or not the subspecies is warranted for listing under the Act. This decision involves the application of standards within the Act, its implementing regulations, and FWS policies, and is based upon analyses contained in the SSA report. The following discussion is a summary of the results and conclusions from the SSA report, which contains a more complete description of our scientific analysis (Service 2020, entire).

For this species status assessment, we defined viability as the ability of the species to sustain populations in natural ecosystems over a biologically meaningful timeframe, in this case, by the middle of the 21st century (2050). This timeframe is a period that allows us to reasonably project the potential effects of various stressors within the range of the subspecies and also accounts for approximately 10 generations of southern white-tailed ptarmigan. This is also consistent with the time scale for which we have data available on the subspecies and its primary stressor, climate change.

To assess the viability of the southern white-tailed ptarmigan, we used the three conservation biology principles of resiliency, redundancy, and representation, collectively known as the 3Rs (Shaffer *et al.* 2002, pp. 139–140; Wolf *et al.* 2015, entire; Smith *et al.* 2018, entire). In short:

- Resiliency is the ability for populations to persist in the face of stochastic events, or for populations to recover from years with low reproduction or reduced survival, and is associated with population size, growth rate, and the quality and quantity of habitats.
- Redundancy is the ability for the species to withstand catastrophic events, for which adaptation is unlikely, and is associated with the number and distribution of populations.
- Representation is the ability of a species to adapt to changes in the environment and is associated with its diversity, whether ecological, genetic, behavioral, or morphological.

For our analysis, we identified the subspecies' ecological requirements for survival and reproduction at the individual, population, and subspecies levels, and described the factors, both positive and negative, that influence the viability of the southern white-tailed ptarmigan, currently and into the future. We evaluated the subspecies' current levels of resiliency, redundancy, and representation, and projected plausible changes to these 3Rs into the future.

Summary of Southern White-Tailed Ptarmigan Needs

We summarized the habitat and distribution of the southern white-tailed ptarmigan above, and in greater detail in our SSA report (Service 2020, pp. 5–14). Individual southern white-tailed ptarmigan have specific habitat and resource needs, such as suitable winter snow conditions, available late-lying snowfields, summer precipitation and monsoonal moisture, brood-rearing habitat, and willows (Service 2020, pp. 11–14). At the population level, southern white-tailed ptarmigan need demographic factors, such as the external recruitment of immigrants, breeding dispersal, adult female survival, and population growth, to be resilient (Service 2020, pp. 15–18). The ecological needs of the southern white-tailed ptarmigan at the subspecies level include having a sufficient number and distribution of healthy populations to ensure that the subspecies can withstand annual variation in its environment (resiliency), catastrophes (redundancy), and novel biological and physical changes in its environment (representation). Additionally, demographic connectivity between populations is critical for resiliency, as it allows for genetic exchange, dispersal, and external recruitment. Multiple, healthy populations of southern white-tailed ptarmigan also guard against population losses due to catastrophic events and help maintain adaptive capacity across populations.

The ability of the southern white-tailed ptarmigan to withstand novel changes in its environment is influenced by its adaptive capacity, which is a function of its ecological, morphological, behavioral, physiological, and genetic variation.
Our SSA report details the subspecies' needs in greater detail (Service 2020, pp. 11–23).

Summary of the Analytical Framework used in the SSA

For the purposes of our analysis, we considered three representative units of the southern white-tailed ptarmigan; the northern representative unit, the southern representative unit, and the New Mexico representative unit (Figure 6). These units were delineated based on geographic, ecological, and genetic boundaries or differences between the three units (Langin *et al.* 2018, entire; Zimmerman *et al. in review*). For our analysis, we also divided the subspecies' range into 19 analytical units (AUs) (Figure 6). AUs represent study areas or other known occupied sites within the historical range of the subspecies that have some historical or current habitat and demographic information for southern white-tailed ptarmigan. Dividing the range into AUs allowed us to assess the varying condition of southern white-tailed ptarmigan across its range, and we attempted to capture the breadth of resiliency, redundancy, and representation across the range of the subspecies. We did not consider populations in California, Utah, or Pikes Peak in our analysis because they were introduced outside of the historical range of southern white-tailed ptarmigan.

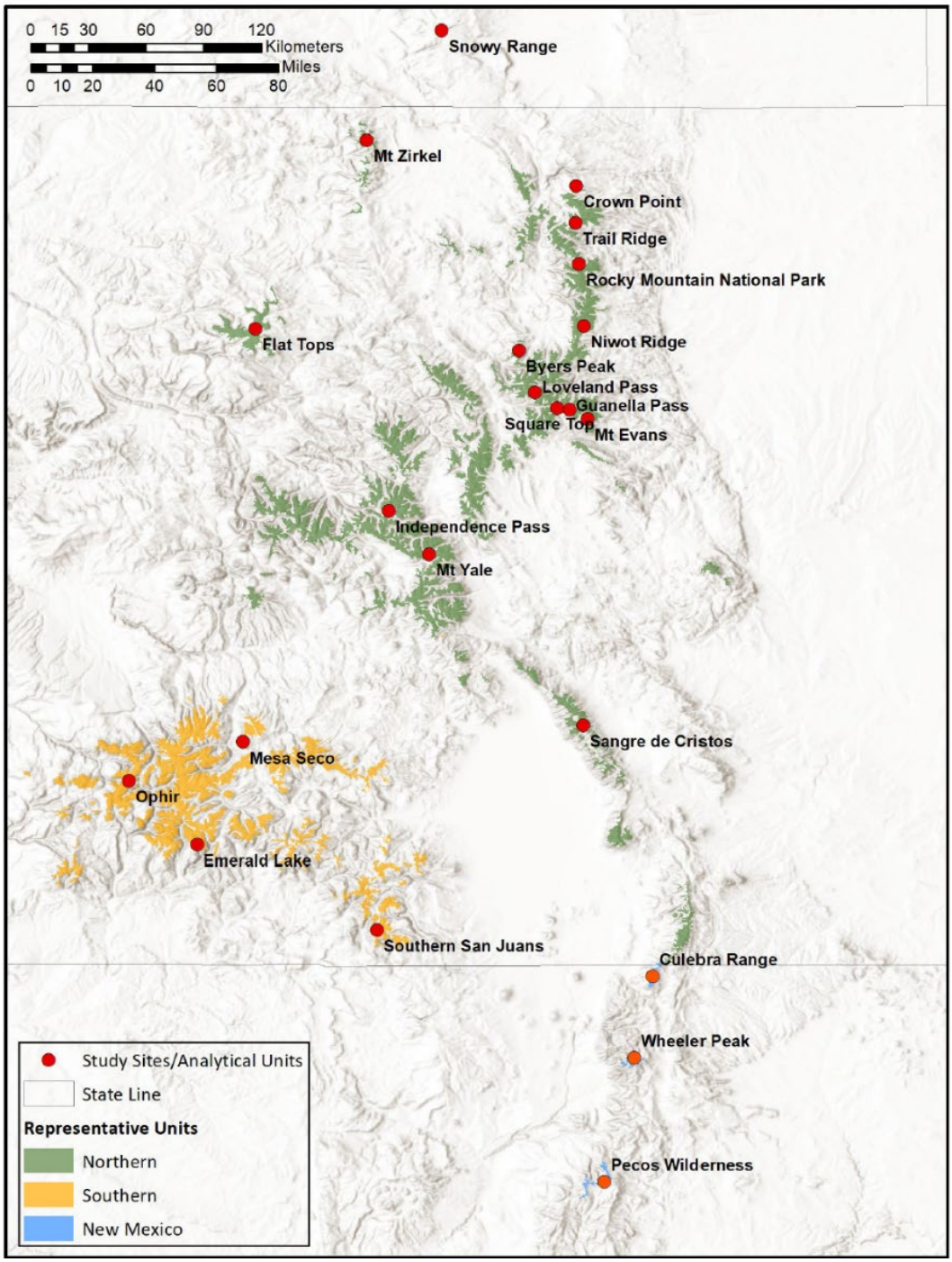

Figure 6. The three representative units (Northern, Southern, and New Mexico) and 19 Analytical Units (AUs) that we used for our analysis of current and future viability for the southern white-tailed ptarmigan, with the overall predicted range of the southern white-tailed ptarmigan (Seglund 2018).

In our SSA report, we describe the resiliency for each of the 19 AUs of the southern white-tailed ptarmigan in terms of the condition of the habitat and demographic factors needed by the subspecies.

Although we identified a variety of habitat and demographic factors needed by the southern white-tailed ptarmigan, we could not qualitatively or quantitatively measure the current or future condition for each of them. So, in order to evaluate resiliency, we selected the habitat and demographic factors that are most important to the resiliency of the southern white-tailed ptarmigan and that we could measure relatively consistently across all 19 analytical units. We used the following five habitat factors to evaluate the current and future condition for each AU: winter snow conditions; late-lying snowfields; summer precipitation/monsoonal moisture; brood-rearing habitat; and willow availability. Similarly, we used the following three demographic factors to evaluate current and future condition for each of the 19 AUs: external recruitment of individuals and breeding dispersal that maintain connectivity across analytical units; adult female survival; and population growth. We developed a categorical scale for each of these habitat and demographic factors, with high, medium, low, very low, and extirpated categories of resiliency to calibrate conditions for that factor in terms of stochastic risk (Service 2020, p. 38). Factors and AUs in higher condition categories are more resilient, or at less risk to stochastic disturbance, and those in lower condition categories are less resilient, or at more risk to stochastic disturbance. Our SSA report provides additional information about these factors, how they were selected, and the metrics we used to evaluate them (Service 2020, pp. 22–23, 36–38).

Summary of Causes and Effects

As documented in our SSA report, we evaluated potential stressors to the southern white-tailed ptarmigan, including predation, mining and related poisoning due to toxic concentrations of trace metals, hunting, recreation, livestock and native ungulate grazing, and the effects of global climate change (Service 2020, pp. 24–36, Appendix B). Through our analysis, which also considered the potential cumulative effects of the stressors (Service 2020, pp. 25, 36) we found that only climate change may influence the resiliency of the southern white-tailed ptarmigan. We found that other stressors may affect individuals or local areas, but they do not have a substantial negative impact to AU-level resiliency, alone or cumulatively, currently and into the future (Service 2020, pp. 24–36, Appendix B). For all stressors except climate change, we only had evidence of localized impacts and no evidence that those stressors currently have widespread effects to resiliency, redundancy, or representation, now or into the future. This evaluation led us to carry forward climate change in our detailed evaluation of current and future condition, as climate change could affect the habitat and demographic needs of the southern white-tailed ptarmigan and potentially affect the resiliency of AUs and the redundancy and representation of the subspecies.

Alpine areas are among the most vulnerable habitats to the impacts of climate change (Rangwala and Miller 2010, p. 89; Emakovich *et al.* 2014, p. 3256). Although there is little information regarding how climate change is currently impacting southern white-tailed ptarmigan, it is expected to have substantial negative impacts (Siegel *et al.* 2014, p. 7; Jackson *et al.* 2015, p. 11).

Several factors, including increases in minimum and maximum temperatures, changes in snow quantity, quality, extent, and duration, shifts in plant phenology, advancement of treeline and expansion of willow into alpine areas, and changes in the amount and timing of seasonal precipitation could affect the habitat and demographic needs for the southern white-tailed ptarmigan into the future, thereby also affecting the resiliency of analytical units and the redundancy and representation of the subspecies. Our SSA report describes our evaluation of Our SSA report describes our evaluation of climate change and potential effects to the southern white-tailed ptarmigan in greater detail (Service 2020, pp. 33–36, 44–52).

Summary of Current Condition

Of the 19 analytical units that we evaluated for the southern white-tailed ptarmigan, 14 currently have high resiliency, 3 have medium resiliency, 1 AU has very low resiliency, and 1 AU is presumed extirpated (Service 2020, pp. 39–43). Redundancy has remained largely unchanged from historical conditions, with the exception of the historical loss of one AU, the Snowy Range in Wyoming, at the northernmost extent of the subspecies' overall range. Currently, 18 of 19 AUs are distributed across Colorado and northern New Mexico, and the subspecies currently occurs within the three representative units. Our SSA report describes in more detail our analysis of current condition for the southern white-tailed ptarmigan, including associated uncertainties (Service 2020, pp. 36–43).

Summary of Future Conditions

We evaluated future conditions for the southern white-tailed ptarmigan using projections for the stressors, habitat factors, and demographic factors that influence resiliency, redundancy, and representation. Potential future change in climate is the primary factor expected to influence the future condition for the southern white-tailed ptarmigan, but there is uncertainty regarding how climatic factors, such as temperature and precipitation, may change and how these may affect the subspecies. Therefore, we considered three plausible future climatic scenarios developed by the Cooperative Institute for Research and Environmental Sciences and the North Central Climate Adaptation Science Center (NCCASC), University of Colorado, Boulder, to help inform our evaluation of future condition for the southern white-tailed ptarmigan. The three plausible future scenarios that we used to evaluate the future condition for the southern white-tailed ptarmigan were: Very Hot and Dry, Hot, and Hot and Very Wet (Rangwala 2020, entire). The climate models used to develop these three climate scenarios were downscaled for both the northern and southern portions of the overall range and represent the best available scientific information on potential future climatic conditions within the range of the southern white-tailed ptarmigan. These future scenarios represent projected changes in climate by the year 2050 based on the projected conditions averaged over the 30-year period, 2040 to 2069, relative to the historical conditions for the period 1971 to 2000. These future scenarios helped capture uncertainty and describe the range of plausible futures for future climatic trends within the overall range of the southern white-tailed ptarmigan. The climate models and our future scenarios are described in more detail in our SSA report (Service 2020, pp. 44–52).

For each future scenario, we evaluated the projected condition of each AU by 2050, using the same habitat factors, demographic factors, and metrics that we used to evaluate current condition. Overall, we found that of the 18 currently extant AUs, 17 will remain occupied under all scenarios, and 18 will remain occupied under the Hot and the Hot and Very Wet scenarios. In the future, resiliency for all of the AUs is expected to decrease under the Very Hot and Dry scenario, due to substantially hotter and drier climate conditions. We also expect a decrease in redundancy and representation under the Very Hot and Dry scenario due to the loss of the New Mexico representative unit, which represents an increased risk to the subspecies under this scenario. Under the Hot scenario, we expect that resiliency will be maintained similar to current conditions for all AUs with the exception of the Ophir AU, which declines under this scenario due to reductions in winter snow condition and late-lying snowfields. Under the Hot and Very Wet scenario, we anticipate reductions in resiliency across five AUs due to reductions in several habitat and demographic factors. Redundancy and representation are expected to be maintained under the Hot and the Hot and Very Wet scenarios. Therefore, risk to the subspecies generally stays the same as current condition by year 2050 under two out of the three future scenarios, with increased risk to the subspecies under one scenario, the Very Hot and Dry scenario, due to reductions in resiliency across 17 of the 18 extant AUs and the loss of one AU in New Mexico (Service 2020, p. 64). Our SSA report provides greater detail on our evaluation of future conditions for the southern white-tailed ptarmigan (Service 2020, pp. 53–63).

Table 2. Summary of the current and future conditions for the southern white-tailed ptarmigan in terms of the resiliency of analytical units (AUs), and redundancy and representation of the subspecies. Summarized from analyses documented in our SSA report (Service 2020, entire).

3Rs	Current Condition	Future Conditions by year 2050		
		Very Hot and Dry Scenario	Hot Scenario	Hot and Very Wet Scenario
Resiliency	•14 out of 19 AUs are currently in high condition. •3 AUs are currently in medium condition. •1 AU is in very low condition. •1 AU is presumed extirpated (Snowy Range in Wyoming).	All AUs have reduced resiliency from current conditions •11 AUs currently in high condition will decline to Medium •3 AUs currently in high condition will decline to Low •3 AUs currently in medium condition will decline to Low •New Mexico expected to be extirpated from very low condition currently.	Resiliency maintained for all AUs at current condition levels, with the exception of the Ophir AU, which declines from high to medium condition, due to decrease in late-lying snow.	• 9 AUs remain in High condition; 5 AUs decline from High to Medium condition •3 AUs remain in Medium condition •1 AU remains in Very Low condition
Redundancy	Number and distribution of AUs largely unchanged from historical levels except for the loss of Snowy Range AU.	17 of 18 AUs remain, with the same distribution.	Continue to have 18 AUs, with the same distribution	Continue to have 18 AUs, with the same distribution
Representation	18 out of 19 AUs occupied across three representative units	Ecological and possibly genetic diversity decline due to loss of New Mexico	Expect ecological and genetic diversity to be maintained	Expect ecological and genetic diversity to be maintained

DETERMINATION OF SUBSPECIES STATUS

Standard for Review

Section 4 of the Act (16 U.S.C. 1533) and its implementing regulations (50 CFR part 424) set forth the procedures for determining whether a species meets the definition of "endangered species" or "threatened species." The Act defines an "endangered species" as a species that is "in danger of extinction throughout all or a significant portion of its range," and a "threatened species" as a species that is "likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range." The Act requires that we determine whether a species meets the definition of "endangered species" or "threatened species" because of any of the following factors:

(A) The present or threatened destruction, modification, or curtailment of its habitat or range;
(B) Overutilization for commercial, recreational, scientific, or educational purposes;
(C) Disease or predation;
(D) The inadequacy of existing regulatory mechanisms; or
(E) Other natural or manmade factors affecting its continued existence.

These factors represent broad categories of natural or human-caused actions or conditions that could have an effect on a species' continued existence. In evaluating these actions and conditions, we look for those that may have a negative effect on individuals of the species, as well as other actions or conditions that may ameliorate any negative effects or may have positive effects.

We use the term "threat" to refer in general to actions or conditions that are known to or are reasonably likely to negatively affect individuals of a species. The term "threat" includes actions or conditions that have a direct impact on individuals (direct impacts), as well as those that affect individuals through alteration of their habitat or required resources (stressors). The term "threat" may encompass—either together or separately—the source of the action or condition or the action or condition itself.

However, the mere identification of any threat(s) does not necessarily mean that the species meets the statutory definition of an "endangered species" or a "threatened species." In determining whether a species meets either definition, we must evaluate all identified threats by considering the expected response by the species, and the effects of the threats—in light of those actions and conditions that will ameliorate the threats—on an individual, population, and species level. We evaluate each threat and its expected effects on the species, then analyze the cumulative effect of all of the threats on the species as a whole.

We also consider the cumulative effect of the threats in light of those actions and conditions that will have positive effects on the species—such as any existing regulatory mechanisms or conservation efforts. The Secretary determines whether the species meets the definition of an "endangered species" or a "threatened species" only after conducting this cumulative analysis and describing the expected effect on the species now and in the foreseeable future.

Until recently, the FWS has presented its evaluation of information under the five listing factors in an outline format, discussing all of the information relevant to any given factor and providing a factor-specific conclusion before moving to the next factor. However, the Act does not require findings under each of the factors, only that we examine information related to each of the factors and make an overall determination as to the species' status (for example, endangered species, threatened species, or not warranted). Ongoing efforts to improve the efficiency and efficacy of the FWS's implementation of the Act have led us to present this information in a different format that we find leads to greater clarity in our understanding of the science, its uncertainties, the interactions between and cumulative effects of different factors, and our application of our statutory framework to that science. Therefore, while the presentation of information in this document differs from past practice, it differs in format only. We have evaluated the same body of information that, in the past, we have discussed under an outline of the five listing factors. In this analysis, we are applying the same statutory framework in reaching our conclusions and ultimate determination of the status of the species under the Act.

In our finding, we correlate the threats acting on the species to the factors in section 4(a)(1) of the Act. We summarize the status assessment for the southern white-tailed ptarmigan below.

Summary of Analysis

The biological information we reviewed and analyzed as the basis for our findings is documented in the SSA report (Service 2020, entire), a summary of which is provided above. The projections for the future condition of the species are based on our expectations of the potential stressors that may affect the subspecies. The potential stressors we evaluated in detail in the SSA report (Service 2020, entire) that fall under Factors A, B, C, and E of the Act are: predation (Factor C); mining and related poisoning due to toxic concentrations of trace minerals (Factors A and E); hunting (Factor B); recreation (Factor A and E); livestock and native ungulate grazing (Factor A and E); and climate change (Factors A and E). Because we did not find that any of these stressors to be threats that are affecting the viability of the southern white-tailed ptarmigan at the subspecies level, an evaluation of the adequacy of regulatory mechanisms to address those threats (Factor D) is not required.

The purpose of the SSA was to characterize the current and future viability of the southern white-tailed ptarmigan in terms of the 3Rs, considering the potential current and future effects of stressors. In our SSA report, we described the current condition and three plausible future conditions for the southern white-tailed ptarmigan in terms of its resiliency, redundancy, and representation (Service 2020, entire).

The overall results of our status assessment found that the best available information indicates that the current condition of the southern white-tailed ptarmigan is characterized by 19 AUs in 3 representative units distributed across alpine habitats in Colorado and northern New Mexico (Figure 6, above) (Service 2020, pp. 39–43). Based on important habitat, demographic, and environmental factors, our analysis found that currently 14 AUs have high resiliency, 3 have medium resiliency, and 1 AU has very low resiliency.

One AU, the Snowy Range AU in Wyoming at the northernmost extent of the subspecies' range, is presumed extirpated with no resiliency. In our evaluation of the future viability of the southern white-tailed ptarmigan by year 2050, we determined that the future condition of the southern white-tailed ptarmigan could range from approximately the same levels of the 3Rs as current condition, to a reduction in resiliency for 18 out of the 19 AUs, which represents increased risk to the subspecies. Under the Very Hot and Dry scenario, 11 AUs decline from high to medium resiliency, 3 AUs decline from high to low resiliency, 3 AUs decline from medium to low resiliency, and 1 AU in New Mexico declines from very low resiliency to an extirpated condition. Redundancy and representation stay the same for two future scenarios, but decreases under one scenario due to the decrease in resiliency for New Mexico from very low currently to extirpated in the future.

Application of Analysis to Determinations

The SSA describes the current and future viability of the southern white-tailed ptarmigan in terms of the 3Rs, which characterize risk to the subspecies in terms of stochasticity (resiliency), catastrophes (redundancy), and long-term environmental change (representation) (Service 2020, entire). This analysis forms the basis for our determinations under the Act. Because of uncertainties regarding the future effects of climate change, we evaluated future condition for three plausible future scenarios designed to capture the relevant uncertainties regarding climate projections. The fundamental question before the FWS is whether the projections of extinction risk, described in the SSA Report in terms of the resiliency, redundancy, and representation of the subspecies under a range of future scenarios, indicate that the species warrants protection as an endangered or threatened species under the Act. Theoretically, if the abundance, distribution, and diversity of the subspecies decreases, the extinction risk of the subspecies would increase as its overall viability decreases.

We note that by using the SSA framework to guide our analysis of the scientific information documented in the SSA report, we have not only analyzed individual effects of stressors on individuals, populations, and the subspecies, but we have also analyzed their potential cumulative effects. We incorporate the cumulative effects into our analysis when we characterize the current and future condition of the species across 3 representative units and 19 AUs. Our assessment of the current and future conditions encompasses and incorporates the threats individually and cumulatively (Service 2020, pp. 24, 25, 36). Our current and future condition assessment is iterative because it accumulates and evaluates the effects of all the factors that may be influencing the subspecies, including negative influences from stressors and positive influences from conservation efforts. We evaluate potential effects from these influences consistently across the same subset of habitat and demographic needs for the subspecies, both currently and into the future. Because the SSA framework considers not just the presence of the factors, but also to what degree they collectively influence risk to the entire subspecies, our assessment integrates the cumulative effects of the factors and replaces a standalone cumulative effects analysis.

As described in the determinations below, we first evaluate whether the southern white-tailed ptarmigan is in danger of extinction throughout its range now. We then evaluate whether the subspecies is likely to become in danger of extinction throughout its range in the foreseeable future. We finally considere whether the southern white-tailed ptarmigan is an endangered or threatened species in a significant portion of its range (SPR).

Determination of Status Throughout its Range

Section 4 of the Act (16 U.S.C. 1533) and its implementing regulations (50 CFR part 424) set forth the procedures for determining whether a species meets the definition of an endangered species or a threatened species. The Act defines “endangered species” as a species “in danger of extinction throughout all or a significant portion of its range,” and “threatened species” as a species “likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.” The Act requires that we determine whether a species meets the definition of “endangered species” or “threatened species” because of any of the following factors: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) Overutilization for commercial, recreational, scientific, or educational purposes; (C) Disease or predation; (D) The inadequacy of existing regulatory mechanisms; or (E) Other natural or manmade factors affecting its continued existence.

Standard: In Danger of Extinction Throughout its Range

Under the Act, an endangered species is any species that is "in danger of extinction throughout all or a significant portion of its range." In this finding, we evaluate the best available scientific information about the subspecies' current and predicted future levels of demographic and habitat factors (these are described in the SSA report in terms of resiliency, redundancy, and representation) to describe the viability of the subspecies, and how it may change over time (using three plausible future scenarios). Ultimately, we compare our evaluation of the subspecies risk of extinction against the definition of an endangered species.

Evaluation and Finding: In Danger of Extinction Throughout its Range

Our review found that overall, the southern white-tailed ptarmigan currently has 19 AUs distributed across 3 representative units in Colorado and northern New Mexico (Service 2020, pp. 39–43). Based on our evaluation of multiple habitat and demographic factors that are important to resiliency, 14 of the 19 AUs currently have high resiliency, 3 AUs have medium resiliency, 1 AU in New Mexico has very low resiliency, and the Snowy Range AU in Wyoming is presumed extirpated with no resiliency. The subspecies currently occupies most of its historical range, except for the potential extirpation in the Snowy Range in Wyoming and the southernmost peaks in New Mexico. However, the abundance of southern white-tailed ptarmigan in the Snowy Range was likely low before the presumed extirpation due to limited habitats and relative isolation (Service 2020, p. 7). Despite the presumed extirpation in the Snowy Range and local declines in New Mexico, the southern white-tailed ptarmigan currently occupies nearly all of its historical range, and the distribution across three representative units of the subspecies has remained largely unchanged (Service 2020, p. 41).

Given the current levels of resiliency in 18 out of 19 AUs, the stability and wide distribution of the AUs across Colorado, the lack of significant stressors (Service 2020, pp. 24–36, Appendix B), and the life-history characteristics of the subspecies that make it uniquely adapted to the environmental extremes of its alpine habitats (Service 2020, pp. 5, 12-13), we believe that the southern white-tailed ptarmigan currently has sufficient ability to withstand stochastic events, catastrophic events, and to adapt to environmental changes. Therefore, we conclude that the current risk of extinction is low, such that the southern white-tailed ptarmigan is not in danger of extinction throughout all of its range.

Having found that the southern white-tailed ptarmigan is not in danger of extinction throughout its range, we next evaluated whether the subspecies is likely to become an endangered subspecies within the foreseeable future throughout all of its range.

Standard: Likely to Become Endangered Throughout its Range

Under the Act, a threatened species is any species that is "likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range." The term foreseeable future extends only so far into the future as the FWS can reasonably determine that both the future threats and the subspecies' responses to those threats are likely. The foreseeable future extends only so far as the predictions about the future are reliable.

The FWS will describe the foreseeable future on a case-by-case basis, using the best available data and taking into account considerations such as the species' life history characteristics, threat-projection timeframes, and environmental variability (50 CFR 424.11(d)). The key statutory difference between a threatened species and an endangered subspecies is the timing of when a subspecies may be in danger of extinction, either now (endangered species) or in the foreseeable future (threatened species).

Evaluation and Finding: Threatened Throughout its Range

In considering the foreseeable future, we projected a range of plausible future scenarios for the southern white-tailed ptarmigan and evaluated the condition of demographic factors (external recruitment of immigrants/breeding dispersal, adult female survival, and population growth) and habitat factors (winter snow conditions, late-lying snowfields, summer precipitation/monsoonal moisture, brood rearing habitats, and willow availability) under each future scenario. We then summarized the future viability for the subspecies in terms of its resiliency, redundancy, and representation under each of the three future scenarios. For the purposes of this finding, we generally define viability as the ability of the species to sustain a population in the wild over a biologically meaningful timeframe, in this case, by approximately 2050. We chose this timeframe because it corresponds to information available in climate projection models provided by the Cooperative Institute for Research and Environmental Sciences and the NCCASC, University of Colorado, Boulder, for the northern and southern parts of the subspecies' range (Rangwala 2020, entire), and future changes in climate are the primary factor expected to influence the future condition of the southern white-tailed ptarmigan.

This timeframe is also biologically relevant for the subspecies, as the generation time of southern white-tailed ptarmigan is approximately 3 years (Sandercock *et al.* 2005a, p. 21), so this timeframe captures approximately 10 generations. Therefore, the 2050 timeframe should be sufficient to be able to observe changes in the condition of the subspecies through multiple generations, multiple cycles of changes to climate conditions, such as drought and precipitation, and is a timeframe in which we can reasonably rely on predictions about the future.

To assist us in evaluating the status of the subspecies in the foreseeable future by approximately 2050, we evaluated the future condition of the southern white-tailed ptarmigan under three plausible future scenarios: Very Hot and Dry, Hot, and Hot and Very Wet. These scenarios were designed to capture the full range of plausible futures and uncertainty associated with changes to climate, the primary stressor for the southern white-tailed ptarmigan. Although the likelihood of each scenario occurring in the future may vary, the changes in climate projected by the three scenarios are all plausible, so the scenarios capture the full range of environmental conditions that the southern white-tailed ptarmigan could experience by 2050. We evaluated the viability of the southern white-tailed ptarmigan under each of these scenarios in terms of its expected resiliency, redundancy, and representation into the foreseeable future.

Looking into the foreseeable future by year 2050, we anticipate that the future condition of the southern white-tailed ptarmigan remains relatively similar to current condition. We expect that of the 18 currently extant AUs, 17 will remain occupied into the future under all future scenarios, and all 18 will remain occupied under two scenarios. Despite anticipated future changes to climate, the only potential extirpation is in New Mexico, which is currently in very low condition. Redundancy and representation remain the same under two out of the three future scenarios, with a reduction of one AU and one representative unit in the remaining scenario due to the potential extirpation in New Mexico. Therefore, risk to the subspecies generally stays the same as current condition into the future under all three scenarios, with a reduction in redundancy and representation in one scenario.

Redundancy and representation for the southern white-tailed ptarmigan decreases in the future only under the Very Hot and Dry scenario, due to the loss of the New Mexico representative unit and its one AU. Additionally, under this scenario, resiliency for all of the 18 extant AUs is expected to decrease due to substantially hotter and drier climate conditions. The loss of New Mexico under this scenario represents an increased risk to the subspecies. However, resiliency in New Mexico is currently very low, and although the New Mexico representative unit may provide some genetic or ecological diversity, this is complicated by the 1981 translocation of southern white-tailed ptarmigan from Colorado into the Pecos Wilderness area of New Mexico. As a result, we do not know if the genetic variation of southern white-tailed ptarmigan in New Mexico is the result of local adaptations that were already present in the southern white-tailed ptarmigan in New Mexico or if these adaptations represent relatively rapid evolution of the translocated birds to local climatic conditions in New Mexico. Regardless of whether the genetic adaptations are a recent development or were already present in New Mexico, such evidence of adaptations to local climate variables may be useful to the southern white-tailed ptarmigan in the future.

Our analysis of future viability for the southern white-tailed ptarmigan projects reductions in resiliency under all three scenarios. We do expect a minor reduction in redundancy and representation in the future due to the potential loss of New Mexico. However, 17 AUs distributed across 2 representative units remain resilient across all future scenarios, which reduces risk to the subspecies from stochastic events, catastrophic events, and long-term environmental change. Overall, by year 2050, the subspecies maintains enough resiliency to withstand stochastic events, and remains well-distributed across its historical range in Colorado to withstand catastrophic events and adapt to changing conditions.

Therefore, we find that the southern white-tailed ptarmigan has a low future risk of extirpation due to stochastic events and catastrophic events that could plausibly occur in the future. Due to these conditions, we expect that the subspecies will be able to withstand plausible stochastic events, catastrophic events, and retain sufficient adaptive capacity to withstand environmental change. Therefore, we conclude that the risk of extinction in the foreseeable future is low, such that the southern white-tailed ptarmigan is not likely to become an endangered subspecies within the foreseeable future throughout all of its range.

Therefore, after assessing the best available information, we conclude that the southern white-tailed ptarmigan is not in danger of extinction throughout all of its range nor is it likely to become so in the foreseeable future.

Determination of Status Throughout a Significant Portion of its Range

Under the Act and our implementing regulations, a subspecies may warrant listing if it is in danger of extinction or likely to become so in the foreseeable future throughout all or a significant portion of its range. Having determined that the southern white-tailed ptarmigan is not in danger of extinction or likely to become so in the foreseeable future throughout all of its range, we now consider whether it may be in danger of extinction or likely to become so in the foreseeable future in a significant portion of its range—that is, whether there is any portion of the subspecies' range for which it is true that both (1) the portion is significant; and, (2) the subspecies is in danger of extinction now or likely to become so in the foreseeable future in that portion. Depending on the case, it might be more efficient for us to address the "significance" question or the "status" question first. We can choose to address either question first. Regardless of which question we address first, if we reach a negative answer with respect to the first question that we address, we do not need to evaluate the other question for that portion of the subspecies' range.

In undertaking this analysis for the southern white-tailed ptarmigan, we choose to address the status question first—we consider information pertaining to the geographic distribution of both the subspecies and the threats that the subspecies faces to identify any portions of the range where the subspecies is endangered or threatened.

Southern White-Tailed Ptarmigan Determination of Significant Portion of its Range

For the southern white-tailed ptarmigan, we considered whether the threats are geographically concentrated in any portion of the subspecies' range at a biologically meaningful scale. We examined the following threats: predation; mining and related poisoning due to toxic concentrations of trace metals; hunting, recreation, livestock and native ungulate grazing, climate change, including cumulative effects (Service 2020, pp. 24–36; Appendix B). With the exception of climate change, we did not identify any areas of the subspecies' range where stressors are currently having any negative population-level affects to the southern white-tailed ptarmigan.

While climate change is expected to have increasing impacts to the southern white-tailed ptarmigan into the foreseeable future, the anticipated effects would affect the entire range of the southern white-tailed ptarmigan rather uniformly, with some differences from north to south between the three representative units.

We explored the possibility of a concentration of threats in New Mexico, given its lower current and projected future condition. However, alpine areas in New Mexico are relatively small and isolated, often linear, and contain areas of unsuitable habitat for ptarmigan. Therefore, the current and future condition for New Mexico is driven largely by the extent and quality of its habitats, and not due to a specific threat or a concentration of threats. As explained above, climate change is not expected to ultimately affect the viability of the subspecies within the foreseeable future.

We found no concentration of threats in any portion of the southern white-tailed ptarmigan range at a biologically meaningful scale. Therefore, no portion of the subspecies' range can provide a basis for determining that the subspecies is in danger of extinction now or likely to become so in the foreseeable future in a significant portion of its range, and we find the subspecies is not in danger of extinction now or likely to become so in the foreseeable future in any significant portion of its range. This is consistent with the courts' holdings in *Desert Survivors* v. *Department of the Interior*, No. 16-cv-01165-JCS, 2018 WL 4053447 (N.D. Cal. Aug. 24, 2018), and *Center for Biological Diversity v. Jewell*, 248 F. Supp. 3d , 946, 959 (D. Ariz. 2017).

Determination of Status for the Southern White-Tailed Ptarmigan

Our review of the best available scientific and commercial information indicates that the southern white-tailed ptarmigan does not meet the definition of an endangered or a threatened subspecies in accordance with section 3(6) and 3(20) of the Act. Therefore, we find that listing the southern white-tailed ptarmigan is not warranted at this time.

We request that you submit any new information concerning the status of, or threats to, the southern white-tailed ptarmigan to our Colorado Ecological FWS's Field Office (see LEAD FIELD OFFICE CONTACT) whenever it becomes available. If an emergency situation develops for the southern white-tailed ptarmigan, we will evaluate that situation in accordance with the Act.

RECOMMENDED CONSERVATION MEASURES

None

COORDINATION WITH STATES

Indicate which State(s) (within the range of the subspecies) provided information or comments on the species or latest species assessment: Colorado, New Mexico, and Wyoming

Indicate which State(s) did not provide any information or comments: None

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APPROVAL/CONCURRENCE:

Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes, including elevations or removals from candidate status and listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all resubmitted 12-month petition findings, additions or removal of species from candidate status, and listing priority changes.

Approve:

MATTHEW HOGAN Digitally signed by MATTHEW HOGAN
Date: 2020.06.12 11:26:41 -06'00'

Regional Director, Interior Regions 5 and 7
U.S. Fish and Wildlife Service

☐ Concur

☐ Do not Concur

AURELIA SKIPWITH Digitally signed by AURELIA SKIPWITH
Date: 2020.11.19 17:31:03 -05'00'

Director, U.S. Fish and Wildlife Service

Director's Remarks: