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Part II

Department of the Interior

Fish and Wildlife Service

50 CFR Part 17

Endangered and Threatened Wildlife and Plants; Determination for the Gunnison Sage-grouse as a Threatened or Endangered Species; Proposed Rule

DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

[DOCKET NO. FWS-R6-ES-2009-0080]

MO 92210-0-0008

Endangered and Threatened Wildlife and Plants; Determination for the Gunnison Sage-grouse as a Threatened or Endangered Species

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Notice of the results of a status review.

SUMMARY: We, the U.S. Fish and Wildlife Service (Service), announce our 12–month finding on whether to list the Gunnison sage-grouse (*Centrocercus minimus*) as threatened or endangered under the Endangered Species Act of 1973, as amended (Act). After reviewing the best available scientific and commercial information, we find that the species is warranted for listing. Currently, however, listing the Gunnison sage-grouse is precluded by higher priority actions to amend the Lists of Endangered and Threatened Wildlife and Plants. Upon publication of this 12-month finding, we will add the Gunnison sage-grouse to our candidate species list. We will develop a proposed rule to list this species as our priorities allow. We will make any determination on critical habitat during development of the proposed listing rule.

DATES: The determination announced in this document was made on September 28, 2010.

ADDRESSES: This finding is available on the Internet at *http://www.regulations.gov* at Docket Number FWS-R6-ES-2009-0080. Supporting documentation we used in preparing this finding is available for public inspection, by appointment, during normal business hours at the U.S. Fish and Wildlife Service, Western Colorado Ecological Services Field Office, U.S. Fish and Wildlife Service, 764 Horizon Drive, Building B, Grand Junction, Colorado 81506-3946. Please submit any new information, materials, comments, or questions concerning this finding to the above address.

FOR FURTHER INFORMATION CONTACT: Allan Pfister, Western Colorado Supervisor (see **ADDRESSES** section); by telephone at (970) 243-2778 ext. 29; or by facsimile at (970) 245-6933. If you use a telecommunications device for the deaf (TDD), please call the Federal Information Relay Service (FIRS) at 800–877–8339.

SUPPLEMENTARY INFORMATION:

Background

Section 4(b)(3)(A) of the Act (16 U.S.C. 1531 *et seq.*) requires that, for any petition to revise the Federal Lists of Threatened and Endangered Wildlife and Plants that contains substantial scientific or commercial information that listing a species may be warranted, we make a finding within 12 months of the date of receipt of the petition. In this finding, we determine whether the petitioned action is: (a) Not warranted, (b) warranted, or (c) warranted, but immediate proposal of a regulation implementing the petitioned action is precluded by other pending proposals to determine whether species are threatened or endangered, and expeditious progress is being made to add or remove qualified species from the Federal Lists of Endangered and Threatened Wildlife and Plants. Section 4(b)(3)(C) of the Act requires that we treat a petition for which the requested action is found to be warranted but precluded as though resubmitted on the date of such finding, that is, requiring a subsequent finding to be made within 12 months. We must publish these 12–month findings in the **Federal Register**.

Previous Federal Actions

On January 18, 2000, we designated the Gunnison sage-grouse as a candidate species under the Act, with a listing priority number of 5. However, Candidate Notices of Review (CNOR) are only published annually; therefore, the **Federal Register** notice regarding this decision was not published until December 28, 2000 (65 FR 82310). Candidate species are plants and animals for which the Service has sufficient information on their biological status and threats to propose them as endangered or threatened under the Act, but for which the development of a proposed listing regulation is precluded by other higher priority listing activities. A listing priority of 5 is assigned to species with high magnitude threats that are non-imminent.

On January 26, 2000, American Lands Alliance, Biodiversity Legal Foundation, and others petitioned the Service to list the Gunnison sage-grouse (Webb 2000, pp. 94-95). In 2003, the U.S. District Court ruled that the species was designated as a candidate by the Service prior to receipt of the petition, and that the determination that a species should be on the candidate list is equivalent to a 12-month finding (*American Lands Alliance* v. *Gale A. Norton*, C.A. No. 00-2339, D. D.C.). Therefore, we did not need to respond to the petition.

In the 2003 CNOR, we elevated the listing priority number for Gunnison sage-grouse from 5 to 2 (69 FR 24876; May 4, 2004), as the imminence of the threats had increased. In the subsequent CNOR (70 FR 24870; May 11, 2005), we maintained the listing priority number for Gunnison sage-grouse as a 2. A listing priority number of 2 is assigned to species with high magnitude threats that are imminent.

Plaintiffs amended their complaint in May 2004, to allege that the Service's warranted but precluded finding and decision not to emergency list the Gunnison sage-grouse were in violation of the Act. The parties filed a stipulated settlement agreement with the court on November 14, 2005, which included a provision that the Service would make a proposed listing determination by March 31, 2006. On March 28, 2006, the plaintiffs agreed to a one-week extension (April 7, 2006) for this determination.

In April 2005, the Colorado Division of Wildlife (CDOW) applied to the Service for an Enhancement of Survival Permit for the Gunnison sage-grouse pursuant to section 10(a)(1)(A) of the Act. The permit application included a proposed Candidate Conservation Agreement with Assurances (CCAA) between CDOW and the Service. The standard that a CCAA must meet is that the "benefits of the conservation measures implemented under a CCAA, when combined with those benefits that would be achieved if it is assumed that conservation measures were also to be implemented on other necessary properties, would preclude or remove any need to list the species." The CCAA, the permit application, and the Environmental Assessment were made available for public comment on July 6, 2005 (70 FR 38977). The CCAA and Environmental Assessment were finalized in October 2006, and the associated permit was issued on October 23, 2006. Landowners with eligible property in southwestern Colorado who wish to participate can voluntarily sign up under the CCAA and associated permit through a Certificate of Inclusion by providing habitat protection or enhancement measures on their lands. If the Gunnison sage-grouse is listed under the Act, the permit authorizes incidental take of Gunnison sage-grouse due to otherwise lawful activities in accordance with the terms of the CCAA (e.g., crop cultivation, crop harvesting, livestock grazing, farm equipment operation, commercial/residential development, etc.), as long as the participating landowner is performing

activities identified in the Certificate of Inclusion. Four Certificates of Inclusion have been issued by the CDOW and Service to private landowners to date.

On April 11, 2006, the Service determined that listing the Gunnison sage-grouse as a threatened or endangered species was not warranted and published the final listing determination in the **Federal Register** on April 18, 2006 (71 FR 19954). Consequently, we removed Gunnison sage-grouse from the candidate species list at the time of the final listing determination. On November 14, 2006, Plaintiffs (the County of San Miguel, Colorado; Center for Biological Diversity; WildEarth Guardians; Public Employees for Environmental Responsibility; National Audubon Society; The Larch Company; Center for Native Ecosystems; Sinapu; Sagebrush Sea Campaign; Black Canyon Audubon Society; and Sheep Mountain Alliance) filed a Complaint for Declaratory and Injunctive relief, pursuant to the Act, and on October 24, 2007, filed an amended Complaint for Declaratory and Injunctive relief, alleging that the 12–month finding on the Gunnison sage-grouse violated the Act. On August 18, 2009, a stipulated settlement agreement and Order was filed with the court, with a June 30, 2010, date by which the Service shall submit to the **Federal Register** a 12–month finding, pursuant to 16 U.S.C. § 1533(b)(3)(B), that listing the Gunnison sage-grouse under the Act is (a) warranted; (b) not warranted; or (c) warranted but precluded by higher priority listing actions. We published a notice of intent to conduct a status review of Gunnison sage-grouse on November 23, 2009 (74 Fr 61100). The Court approved an extension of the June 30, 2010, deadline for the 12–month finding to September 15, 2010.

Additional Special Status Considerations

The Gunnison sage-grouse has an International Union for Conservation of Nature (IUCN) Red List Category of "endangered" (Birdlife International 2009). NatureServe currently ranks the Gunnison sage-grouse as G1—Critically Imperiled (Nature Serve 2010, entire). The Gunnison sage-grouse is on the National Audubon Society's WatchList 2007 Red Category which is "for species that are declining rapidly or have very small populations or limited ranges, and face major conservation threats."

Biology and Ecology of Gunnison Sage-grouse

Gunnison Sage-grouse Species Description

Sage-grouse are the largest grouse in North America. Sage-grouse (both greater and Gunnison) are most easily identified by their large size, dark brown color, distinctive black bellies, long pointed tails, and association with sagebrush habitats. They are dimorphic in size, with females being smaller. Both sexes have yellow-green eye combs, which are less prominent in females. Sage-grouse are known for their elaborate mating ritual where males congregate on strutting grounds called leks and "dance" to attract a mate. During the breeding season, males have conspicuous filoplumes (specialized erectile feathers on the neck), and exhibit yellow-green apteria (fleshy bare patches of skin) on their breasts (Schroeder *et al.* 1999, p. 2, 18). Gunnison sage-grouse are smaller in size, have more white barring in their tail feathers, and have more filoplumes than greater sage-grouse.

Since Gunnison and greater sage-grouse were only recognized as separate species in 2000, the vast majority of the research relative to the biology and management of the two species has been conducted on greater sage-grouse. Gunnison sage-grouse and greater sage-grouse have similar life histories and habitat requirements (Young 1994, p. 44). In this finding, we use information specific to the Gunnison sage-grouse where available but still apply scientific management principles found relevant for greater sage-grouse to Gunnison sage-grouse management needs and strategies, a practice followed by the wildlife agencies that have responsibility for management of both species and their habitat.

Taxonomy

Gunnison sage-grouse and greater sage-grouse are members of the Phasianidae family. For many years, sage-grouse were considered a single species. Gunnison sage-grouse (*Centrocercus minimus*) were identified as a distinct species based on morphological (Hupp and Braun 1991, pp. 257-259; Young *et al.* 2000, pp. 447-448), genetic (Kahn *et al.* 1999, pp. 820-821; Oyler-McCance *et al.* 1999, pp. 1460-1462), and behavioral (Barber 1991, pp. 6-9; Young 1994; Young *et al.* 2000, p. 449-451) differences and geographical isolation (Young *et al.* 2000, pp. 447-451). Based on these differences, the American Ornithologist's Union (2000, pp. 849-850) accepted the Gunnison sage-grouse as a distinct species. The current ranges of the two species do not overlap (Schroeder *et al.* 2004, p. 369). Due to the several lines of evidence separating the two species cited above, we determined that the best available information indicates that the Gunnison sage-grouse is a valid taxonomic species and a listable entity under the Act.

Life History Characteristics

Gunnison and greater sage-grouse depend on a variety of shrub-steppe habitats throughout their life cycle and are considered obligate users of several species of sagebrush (Patterson 1952, p. 42; Braun *et al.* 1976, p. 168; Schroeder *et al.* 1999, pp. 4-5; Connelly *et al.* 2000a, pp. 970-972; Connelly *et al.* 2004, p. 4-1, Miller *et al.* in press, p. 10). Dietary requirements of the two species are also similar, being composed of nearly 100 percent sagebrush in the winter, and forbs and insects as well as sagebrush in the remainder of the year (Wallestad *et al.* 1975, p. 21; Schroeder *et al.* 1999, p. 5; Young *et al.* 2000, p. 452). Gunnison and greater sage-grouse do not possess muscular gizzards and, therefore, lack the ability to grind and digest seeds (Leach and Hensley 1954, p. 389).

In addition to serving as a primary year-round food source, sagebrush also provides cover for nests (Connelly *et al.* 2000a, pp. 970-971). Thus, sage-grouse distribution is strongly correlated with the distribution of sagebrush habitats (Schroeder *et al.* 2004, p. 364). Connelly *et al.* (2000a, p. 970-972) segregated habitat requirements into four seasons: (1) breeding (2) summer - late brood-rearing (3) fall and (4) winter. Depending on habitat availability and proximity, some seasonal habitats may be indistinguishable. The Gunnison Sage-grouse Rangewide Steering Committee (GSRSC) (2005, p. 27-31) segregated habitat requirements into three seasons: (1) breeding (2) summer–late fall and (3) winter. For purposes of this finding, the seasons referenced in GSRSC (2005) are used because that publication deals specifically with Gunnison sage-grouse.

Sage-grouse exhibit strong site fidelity (loyalty to a particular area) to seasonal habitats, which includes breeding, nesting, brood rearing, and wintering areas, even when the area is no longer of value (Connelly *et al.* 2004, p. 3-1). Adult sage-grouse rarely switch among these habitats once they have been selected, limiting their adaptability to changes. Sage-grouse distribution is associated with sagebrush (Schroeder *et al.* 2004 p. 364), although sagebrush is more widely distributed than sage-grouse because sagebrush does not

always provide suitable habitat due to fragmentation and degradation (Schroeder *et al.* 2004, pp. 369, 372). Very little of the extant sagebrush in North America is undisturbed, with up to 50 to 60 percent having altered understories (forb and grass vegetative composition under the sagebrush) or having been lost to direct conversion (Knick *et al.* 2003, p. 612 and references therein). Mapping altered and depleted understories is challenging, particularly in semi-arid regions, so maps depicting only sagebrush as a dominant cover type are deceptive in their reflection of habitat quality and, therefore, use by sage-grouse (Knick *et al.* 2003, p. 616 and references therein). As such, variations in the quality of sagebrush habitats for sage-grouse (from either abiotic or anthropogenic events) are better reflected by sage-grouse distribution and densities, rather than by broad geographic scale maps of the distribution of sagebrush.

Sage-grouse exhibit a polygamous mating system where a male mates with several females. Males perform courtship displays and defend their leks (Patterson 1952, p. 83). Lek displaying occurs from mid-March through late May, depending on elevation (Rogers 1964, p. 21; Young *et al.* 2000, p. 448). Numerous researchers have observed that a relatively small number of dominant males account for the majority of copulations on each lek (Schroeder *et al.* 1999, p. 8). However, an average of 45.9 percent (range 14.3 to 54.5 percent) of genetically identified males in a population fathered offspring in a given year (Bush 2009, p. 106). This more recent work suggests that males and females likely engage in off-lek copulations. Males do not incubate eggs or assist in chick rearing.

Lek sites can be located on areas of bare soil, wind-swept ridges, exposed knolls, low sagebrush, meadows, and other relatively open sites with good visibility and low vegetation structure (Connelly *et al.* 1981, pp. 153-154; Gates 1985, pp. 219-221; Klott and Lindzey 1989, pp. 276-277; Connelly *et al.* 2004, pp. 3-7 and references therein). In addition, leks are usually located on flat to gently sloping areas of less than 15 percent grade (Patterson 1952, p. 83; Giezentanner and Clark 1974, p. 218; Wallestad 1975, p. 17; Autenrieth 1981, p. 13). Leks are often surrounded by denser shrub-steppe cover, which is used for escape, and thermal and feeding cover. Leks can be formed opportunistically at any appropriate site within or adjacent to nesting habitat (Connelly *et al.* 2000a, p. 970). Lek habitat availability is not considered to be a limiting factor for sage-grouse (Schroeder 1997, p. 939). However, adult male sage-grouse demonstrate strong yearly fidelity to lek sites (Patterson 1952, p. 91; Dalke 1963 *et al.*, pp. 817-818), and some Gunnison sage-grouse leks have been used since the 1950s (Rogers 1964, pp. 35-40).

The pre-laying period is from late-March to April. Pre-laying habitats for sage-grouse need to provide a diversity of vegetation including forbs that are rich in calcium, phosphorous, and protein to meet the nutritional needs of females during the egg development period (Barnett and Crawford 1994, p. 117; Connelly *et al.* 2000a, p. 970). During the pre-egg laying period, female sage-grouse select forbs that generally have higher amounts of calcium and crude protein than sagebrush (Barnett and Crawford 1994, p. 117).

Nesting occurs from mid-April to June. Average earliest nest initiation was April 30, and the average latest nest initiation was May 19, in the western portion of the Gunnison Basin (Childers 2009, p. 3). Radio-tracked Gunnison sage-grouse nest an average of 4.3 kilometers (km) (2.7 miles (mi)) from the lek nearest to their capture site, with almost half nesting within 3 km (2 mi) of their capture site (Young 1994, p. 37). Nest sites are selected independent of lek locations, but the reverse is not true (Bradbury *et al.* 1989, p. 22; Wakkinen *et al.* 1992, p. 382). Thus, leks are indicative of nesting habitat. Eighty-seven percent of all Gunnison sage-grouse nests were located less than 6 km (4 mi) from the lek of capture (Apa 2004, p. 21). While earlier studies indicated that most greater sage-grouse hens nest within 3 km (2 mi) of a lek, more recent research indicated that many hens actually move much further from leks to nest based on nesting habitat quality (Connelly *et al.* 2004, p. 4-4). Female greater sage-grouse have been documented to travel more than 20 km (13 mi) to their nest site after mating (Connelly *et al.* 2000a, p. 970). Female Gunnison sage-grouse exhibit strong fidelity to nesting locations (Young 1994, p. 42; Lyon 2000, p. 20, Connelly *et al.* 2004, p. 4-5; Holloran and Anderson 2005, p. 747). The degree of fidelity to a specific nesting area appears to diminish if the female's first nest attempt in that area was unsuccessful (Young 1994, p. 42). However, there is no statistical indication that movement to new nesting areas results in increased nesting success (Connelly *et al.* 2004, p. 3-6; Holloran and Anderson 2005, p. 748).

Gunnison sage-grouse typically select nest sites under sagebrush cover with some forb and grass cover (Young 1994, p. 38), and successful nests were found in higher shrub density and greater forb and grass cover than unsuccessful nests (Young 1994, p. 39). The understory of productive sage-grouse nesting areas contains native grasses and forbs, with horizontal and vertical structural diversity that provides an insect prey base, herbaceous forage for pre-laying and nesting hens, and cover for the hen while she is incubating (Schroeder *et al.* 1999, p. 11; Connelly *et al.* 2000a, p. 971; Connelly *et al.* 2004, pp. 4-5–4-8). Shrub canopy and grass cover provide concealment for sage-grouse nests and young, and are critical for reproductive success (Barnett and Crawford 1994, pp. 116-117; Gregg *et al.* 1994, pp. 164-165; DeLong *et al.* 1995, pp. 90-91; Connelly *et al.* 2004, p. 4-4). Few herbaceous plants are growing in April when nesting begins, so residual herbaceous cover from the previous growing season is critical for nest concealment in most areas (Connelly *et al.* 2000a, p. 977).

Nesting success for Gunnison sage-grouse is highest in areas where forb and grass covers are found below a sagebrush canopy cover of 15 to 30 percent (Young *et al.* 2000, p. 451). These numbers are comparable to those reported for the greater sage-grouse (Connelly *et al.* 2000a, p. 971). Nest success for greater sage-grouse is greatest where grass cover is present (Connelly *et al.* 2000a, p. 971). Because of the similarities between these two species, we believe that increased nest success in areas of forb and grass cover below the appropriate sagebrush canopy cover is likely the case for Gunnison sage-grouse as well.

Mean clutch size for Gunnison sage-grouse is 6.8 ± 0.7 eggs (Young 1994, p. 37). The mean clutch size for Gunnison sage-grouse in the Gunnison Basin was 6.3, with 94 percent of eggs in successful nests hatching (Childers 2009, p. 3). Despite average clutch sizes of 7 eggs (Connelly *et al.* in press, p. 15), little evidence exists that populations of sage-grouse produce large annual surpluses (Connelly *et al.* in press, p. 15, 24). The inability of sage-grouse to produce large annual surpluses limits their ability to respond under favorable environmental conditions to make up for population declines. Re-nesting rates following the loss of the original nest appear very low in Gunnison sage-grouse, with one study reporting re-nesting rates of 4.8 percent (Young 1994, p. 37). Only one instance of re-nesting was observed over a 5–year period during which a total of 91 nesting Gunnison sage-grouse hens were monitored (Childers 2009, p. 3).

Most sage-grouse eggs hatch in June, with a peak between June 10 and June

20 (GSRSC, 2005, p. 24). Chicks are precocial (mobile upon hatching) and leave the nest with the hen shortly after hatching. Forbs and insects are essential nutritional components for sage-grouse chicks (Klebenow and Gray 1968, pp. 81-83; Peterson 1970, pp. 149-151; Johnson and Boyce 1991, p. 90; Connelly *et al.* 2004, p. 3-3). Therefore, early brood-rearing habitat for females with chicks must provide adequate cover adjacent to areas rich in forbs and insects to assure chick survival during this period (Connelly *et al.* 2000, p. 971; Connelly *et al.* 2004, p. 4-11). Gunnison sage-grouse chick dietary requirements of insects and forbs also are expected to be similar to greater sage-grouse and other grouse species (Apa 2005, pers. comm.).

The availability of food and cover are key factors that affect chick and juvenile survival. During the first 3 weeks after hatching, insects are the primary food of chicks (Patterson 1952, p. 201; Klebenow and Gray 1968, p. 81; Peterson 1970, pp. 150-151; Johnson and Boyce 1990, pp. 90-91; Johnson and Boyce 1991, p. 92; Drut *et al.* 1994b, p. 93; Pyle and Crawford 1996, p. 320; Fischer *et al.* 1996a, p. 194). Diets of 4- to 8-week-old greater sage-grouse chicks were found to have more plant material as the chicks matured (Peterson 1970, p. 151). Succulent forbs are predominant in the diet until chicks exceed 3 months of age, at which time sagebrush becomes a major dietary component (Klebenow 1969, pp. 665-656; Connelly and Markham 1983, pp. 171-173; Fischer *et al.* 1996b, p. 871; Schroeder *et al.* 1999, p. 5).

Early brood-rearing habitat is found close to nest sites (Connelly *et al.* 2000a, p. 971), although individual females with broods may move large distances (Connelly 1982, as cited in Connelly *et al.* 2000a, p. 971). Young (1994, pp. 41-42) found that Gunnison sage-grouse with broods used areas with lower slopes than nesting areas, high grass and forb cover, and relatively low sagebrush cover and density. Broods frequently used the edges of hay meadows, but were often flushed from areas found in interfaces of wet meadows and habitats providing more cover, such as sagebrush or willow-alder (*Salix-Alnus*).

By late summer and into the early fall, individuals become more social, and flocks are more concentrated (Patterson 1952, p. 187). Intermixing of broods and flocks of adult birds is common, and the birds move from riparian areas to sagebrush-dominated landscapes that continue to provide green forbs. During this period, Gunnison sage-grouse can be observed in atypical habitat such as agricultural fields (Commons 1997, pp. 79-81). However, broods in the Gunnison Basin typically do not use hay meadows further away than 50 meters (m) (165 feet (ft)) of the edge of sagebrush stands (Colorado Sage Grouse Working Group (CSGWG) 1997, p. 13).

As fall approaches, sage-grouse move from riparian to upland areas and start to shift to a winter diet (GSRSC 2005, p. 25). Movements to winter ranges are slow and meandering (Connelly *et al.* 1988, p. 119). The extent of movement varies with severity of winter weather, topography, and vegetation cover. Sage-grouse may travel short distances or many miles between seasonal ranges. In response to severe winters, Gunnison sage-grouse move as far as 27 km (17 mi) (Root 2002, p. 14). Flock size in winter is variable (15 to 100+), and flocks frequently consist of a single sex (Beck 1977, p. 21).

From late autumn through early spring, greater and Gunnison sage-grouse diet is almost exclusively sagebrush (Rasmussen and Griner 1938, p. 855; Batterson and Morse 1948, p. 20; Patterson 1952, pp. 197-198; Wallestad *et al.* 1975, pp. 628-629; Young *et al.* 2000, p. 452). Many species of sagebrush can be consumed (Remington and Braun 1985, pp. 1056-1057; Welch *et al.* 1988, p. 276, 1991; Myers 1992, p. 55). Characteristics of sage-grouse winter habitats are also similar through the range of both species (Connelly *et al.* 2000a, p. 972). In winter, Gunnison sage-grouse are restricted to areas of 15 to 30 percent sagebrush cover, similar to the greater sage-grouse (Connelly *et al.* 2000a, p. 972; Young *et al.* 2000, p. 451). However, they may also use areas with more deciduous shrubs during the winter (Young *et al.* 2000, p. 451).

Sagebrush stand selection in winter is influenced by snow depth (Patterson 1952, pp. 188-189; Connelly 1982 as cited in Connelly *et al.* 2000a, p. 980) and in some areas, topography (Beck 1977, p. 22; Crawford *et al.* 2004, p. 5). Winter areas are typically characterized by canopy cover greater than 25 percent and sagebrush greater than 30 to 41 cm (12 to 16 in) tall (Shoenberg 1982, p. 40) associated with drainages, ridges, or southwest aspects with slopes less than 15 percent (Beck 1977, p. 22). Lower flat areas and shorter sagebrush along ridge tops provide roosting areas. In extreme winter conditions, greater sage-grouse will spend nights and portions of the day burrowed into "snow burrows" (Back *et al.* 1987, p. 488).

Hupp and Braun (1989, p. 825) found that most Gunnison sage-grouse feeding activity in the winter occurred in drainages and on slopes with south or west aspects in the Gunnison Basin. During a severe winter in the Gunnison Basin in 1984, less than 10 percent of the sagebrush was exposed above the snow and available to sage-grouse (Hupp, 1987, pp. 45-46). In these conditions, the tall and vigorous sagebrush typical in drainages was an especially important food source.

Sage-grouse typically live between 3 and 6 years, but individuals up to 9 years of age have been recorded in the wild (Connelly *et al.* 2004, p. 3-12). Adult female Gunnison sage-grouse apparent survival rates from April through September averaged 57 percent, and adult male survival averaged 45 percent (Childers 2009, p. 2). From October through March, adult female Gunnison sage-grouse apparent survival rates averaged 79 percent, and adult male survival averaged 96 percent (Childers 2009, p.2). In one study, Gunnison sage-grouse survival from April 2002 through March 2003 was 48 (± 7) percent for males and 57 (± 7) percent for females (Apa 2004, p. 22). Preliminary results from the Gunnison and San Miguel populations indicate potential important temporal and spatial variation in demographic parameters, with apparent annual adult survival rates ranging from approximately 65 to 80 percent (CDOW 2009a, p. 8). Gunnison sage-grouse female survival in small isolated populations was 52 (± 8) percent, compared to 71 (± 11) percent survival in the Gunnison Basin, the only population with greater than 500 individuals (Apa 2004, p. 22). Higher adult survival has been observed in a lower elevation and warmer area (Dry Creek Basin of the San Miguel population – 90 percent) than in a higher elevation and colder, snowier, area (Miramonte portion of the San Miguel population – 65 percent) (CDOW 2009a, p.8). Other factors affecting survival rates include climatic differences between years and age (Zablan 1993, pp. 5-6).

Apparent chick survival from hatch to the beginning of fall (30 September) averaged 7 percent over a 5–year period in the western portion of the Gunnison Basin (Childers 2009, pp. 4-6). Apparent chick survival to 90 days of age has ranged from approximately 15 to 30 percent in the Gunnison Basin, with no juvenile recruitment observed over several years in the San Miguel population (CDOW 2009a, p. 8). Based on a review of many field studies, juvenile survival rates range from 7 to 60 percent (Connelly *et al.* 2004, p. 3-12). The variation in juvenile survival rates may be associated with sex, weather, harvest rates (no harvesting of Gunnison sage-grouse is currently permitted), age of brood female (broods with adult females have higher

survival), and with habitat quality (rates decrease in poor habitats) (Schroeder *et al.* 1999, p. 14; Connelly *et al.*, in press, p. 20).

Greater sage-grouse require large, interconnected expanses of sagebrush with healthy, native understories (Patterson 1952, p. 9; Knick *et al.* 2003, p. 623; Connelly *et al.* 2004, pp. 4-15; Connelly *et al.* in press, p. 10; Pyke in press, p. 7; Wisdom *et al.* in press, p. 4). However, little information is available regarding minimum sagebrush patch sizes required to support populations of greater or Gunnison sage-grouse. Gunnison sage-grouse have not been observed to undertake the large seasonal and annual movements observed in greater sage-grouse. However, movements of up to 24 km (15 mi) have been observed in individual Gunnison sage-grouse in the Gunnison Basin population only (Phillips 2010, pers. comm.).

Sage-grouse typically occupy large expanses of sagebrush-dominated habitats composed of a diversity of sagebrush species and subspecies. Use of other habitats intermixed with sagebrush, such as riparian meadows, agricultural lands, steppe dominated by native grasses and forbs, scrub willow (*Salix spp.*), and sagebrush habitats with some conifer or quaking aspen (*Populus tremuloides*), is not uncommon (Connelly *et al* 2004, p. 4-18 and references therein). Sage-grouse have been observed using human-altered habitats throughout their range.

However, the use of non-sagebrush habitats by sage-grouse is dependent on the presence of sagebrush habitats in close proximity (Connelly *et a.lal* 2004, p. 4-18 and references therein).

Historic Range and Distribution of Gunnison Sage-grouse

Based on historical records, museum specimens, and potential habitat distribution, Gunnison sage-grouse historically occurred in southwestern Colorado, northwestern New Mexico, northeastern Arizona, and southeastern Utah (Schroeder *et al.* 2004, pp. 370-371). Accounts of Gunnison sage-grouse in Kansas and Oklahoma, as suggested by Young *et al.* (2000, pp. 446-447), are not supported with museum specimens, and Schroeder *et al.* (2004, p. 371) found inconsistencies with the historical records and the sagebrush habitat currently available in those areas. Applegate (2001, p. 241) found that none of the sagebrush species closely associated with sage-grouse occurred in Kansas. He attributed historical, anecdotal reports as mistaken locations or misidentification of lesser prairie chickens. For these reasons, southwestern Kansas and western Oklahoma are not considered within the historic range of Gunnison sage-grouse (Schroeder *et al.* 2004, p. 371).

The GSRSC (2005) modified the historic range from Schroeder *et al.* (2004), based on more complete information on historic and current habitat and the distribution of the species (GSRSC 2005, pp. 34-35). Based on this information, the maximum Gunnison sage-grouse historical (presettlement) range is estimated to have been 55,350 square kilometers (km^2) (21,370 square miles (mi^2)) (GSRSC 2005, p. 32). To be clear, only a portion of the historical range would have been occupied at any one time, while all of the current range is considered occupied. Also, we do not know what portion of the historical range was simultaneously occupied, or what the total population was.

Much of what was once Gunnison sage-grouse sagebrush habitat was already lost prior to 1958. A qualitative decrease in sagebrush was attributed to overgrazing from the 1870s until about 1934 (Rogers 1964, p. 13). Additional adverse effects occurred as a result of newer range management techniques implemented to support livestock by the Bureau of Land Management (BLM), Soil Conservation Service, and U.S. Forest Service (USFS) (Rogers 1964, p. 13). In the 1950s, large areas of sagebrush within the range of Gunnison sage-grouse were eradicated by herbicide spraying or burning (Rogers 1964, pp. 12-13, 22-23, 26).

About 155,673 hectares (ha) (384,676 ac) of sagebrush habitat was lost from 1958 to 1993 within southwestern Colorado (Oyler-McCance *et al.* 2001, p. 327). Sagebrush loss was lower in the Gunnison Basin (11 percent) compared to all other areas in southwestern Colorado (28 percent) (Oyler-McCance *et al.* 2001, p. 328). Considerable fragmentation of sagebrush vegetation was also quantitatively documented during that same time period (Oyler-McCance *et al.* 2001, p. 329). Sage-grouse habitat in southwestern Colorado (the majority of the range of Gunnison sage-grouse) has been more severely impacted than sagebrush habitat elsewhere in Colorado.

The Colorado River Storage Project (CRSP) resulted in construction of three reservoirs within the Gunnison Basin in the mid-late 1960s (Blue Mesa and Morrow) and mid-1970s (Crystal). Several projects associated with CRSP were constructed in this same general timeframe to provide additional water storage and resulted in the loss of an unquantified, but likely small, amount of sagebrush habitat. These projects provide water storage and, to a certain extent, facilitate agricultural activities that maintain the fragmentation and habitat lost historically throughout the range of Gunnison sage-grouse.

In summary, a substantial amount of sagebrush habitat within the range of the Gunnison sage-grouse had been lost prior to 1960. The majority of the remaining habitat is highly fragmented, although to a lesser extent in the Gunnison Basin than in the remainder of the species habitat.

Current Distribution and Population Estimates

The historic and current geographic ranges of Gunnison's and greater sage-grouse were quantitatively analyzed to determine the species' response to habitat loss and detrimental land uses (Wisdom *et al.*, in press, 2009, entire). A broad spectrum of biotic, abiotic, and anthropogenic conditions were found to be significantly different between extirpated and occupied ranges (Wisdom *et al.*, in press, 2009, p. 1.). Sagebrush area is one of the best landscape predictors of sage-grouse persistence (Wisdom *et al.*, in press, 2009, p. 17 and references therein). Because of the loss and fragmentation of habitat within its range, no expansive, contiguous areas that could be considered strongholds (areas of occupied range where the risk of extirpation appears low) are evident for Gunnison sage-grouse (Wisdom *et al.*, in press, 2009, p. 24). We do not know the minimum amount of sagebrush habitat needed by Gunnison sage-grouse to ensure long-term persistence. However, based on Wisdom *et al.*, in press, we do know that landscapes containing large and contiguous sagebrush patches and sagebrush patches in close proximity increase the likelihood of sage-grouse persistence.

Gunnison sage-grouse currently occur in seven widely scattered and isolated populations in Colorado and Utah, occu2pying 3,795 km^2 (1,511mi^2) (GSRSC 2005, pp. 36-37; CDOW 2009b, p. 1). The seven populations are Gunnison Basin, San Miguel Basin, Monticello–Dove Creek, Pĩnon Mesa, Crawford, Cerro Summit–Cimarron–Sims Mesa, and Poncha Pass (Figure 1). A comparative summary of the land ownership and recent population estimates among these seven populations is presented in Table 1 and Table 2, respectively. Population trends over the last nine years indicate that six of the populations are in decline. The Gunnison Basin population, while showing variation over the years, has been relatively stable through the period (CDOW 2009a p. 2). Six of the

populations are very small and fragmented (all with less than 40,500 ha (100,000 acres) of habitat likely used by grouse and less than 50 males counted on leks) (CDOW 2009a, p. 5). The San Miguel population, the second largest, comprises six fragmented subpopulations.

Figure 1. Locations of Current Gunnison Sage-grouse Populations.

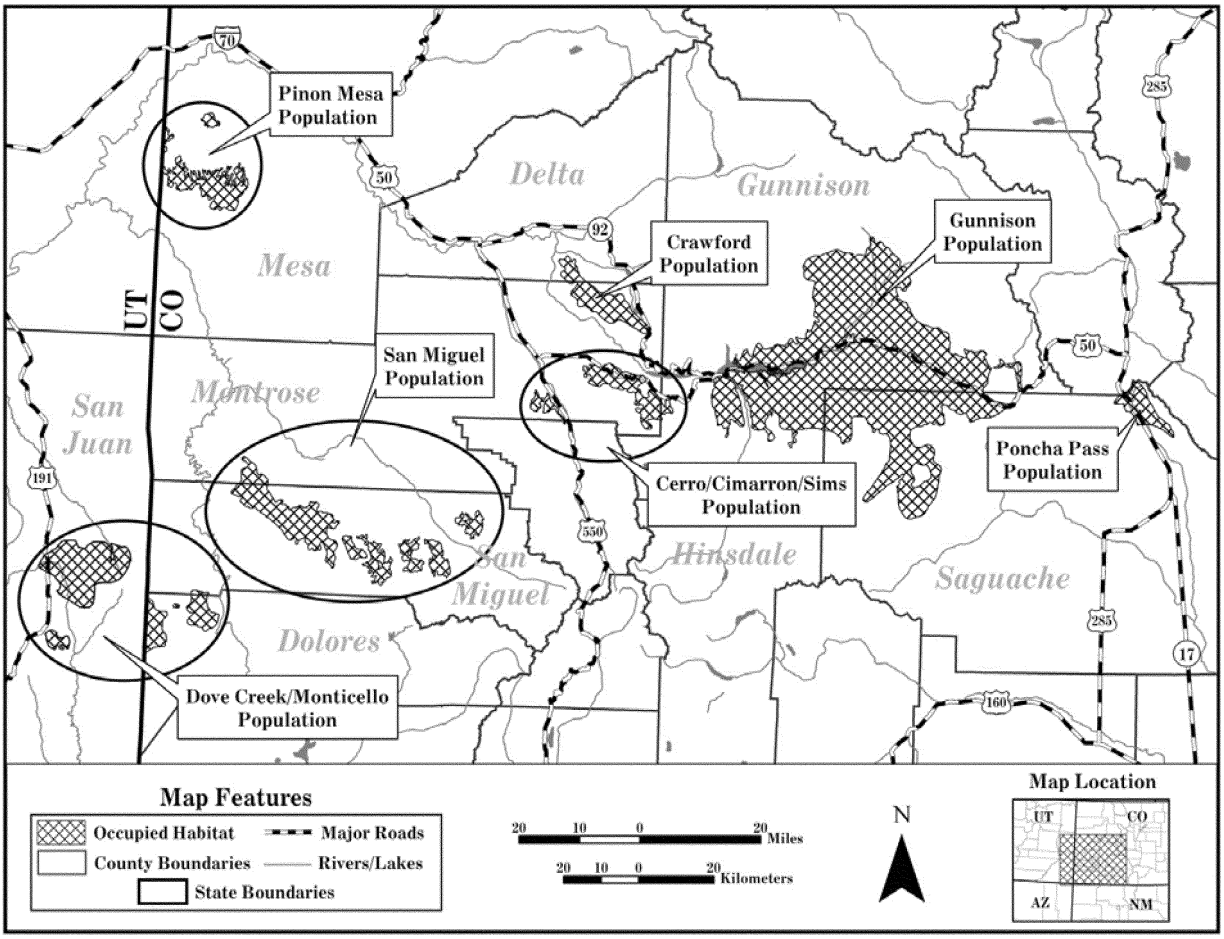

TABLE 1. PERCENT SURFACE OWNERSHIP OF TOTAL GUNNISON SAGE-GROUSE OCCUPIED[A] HABITAT (FROM GSRSC[B] 2005, PP. D-3-D-6; CDOW[C] 2009B, P. 1)

			Gunnison Sage-grouse Occupied Habitat Management and Ownership						
Population	hectares	acres	BLM[d]	NPS[e]	USFS[f]	CDOW	CO State Land Board	State of UT	Private
			%	%	%	%	%	%	%
Gunnison Basin	239,953	592,936	51	2	14	3	<1	0	29
San Miguel Basin	41,022	101,368	36[g]	0	1	11	3[g]	0	49[g]
Monticello–Dove Creek (Combined)	45,275	111,877	7	0	0	3	0	<1	90
Dove Creek	16,706	41,282	11	0	0	8	0	0	81
Monticello	28,569	70,595	4	0	0	0	0	1	95
Piñon Mesa	15,744	38,904	28	0	2	19	0	0	51
Cerro Summit–Cimarron–Sims Mesa	15,039	37,161	13	<1	0	11	0	0	76
Crawford	14,170	35,015	63	12	0	2	0	0	23

TABLE 1. PERCENT SURFACE OWNERSHIP OF TOTAL GUNNISON SAGE-GROUSE OCCUPIED[A] HABITAT (FROM GSRSC[B] 2005, PP. D-3-D-6; CDOW[C] 2009B, P. 1)—Continued

Population	hectares	acres	Gunnison Sage-grouse Occupied Habitat Management and Ownership						
			BLM[d]	NPS[e]	USFS[f]	CDOW	CO State Land Board	State of UT	Private
			%	%	%	%	%	%	%
Poncha Pass	8,262	20,415	48	0	26	0	2	0	23
Rangewide	379,464	937,676	42	2	10	5	<1	<1	41

[a]Occupied Gunnison sage-grouse habitat is defined as areas of suitable habitat known to be used by Gunnison sage-grouse within the last 10 years from the date of mapping, and areas of suitable habitat contiguous with areas of known use, which have no barriers to grouse movement from known use areas (GSRSC 2005, p. 54).
[b]Gunnison Sage-grouse Rangewide Steering Committee
[c]Colorado Division of Wildlife
[d]Bureau of Land Management
[e]National Park Service
[f]United States Forest Service
[g]Estimates reported in San Miguel Basin Gunnison Sage-grouse Conservation Plan (2009 p. 28) vary by up to 2 percent in these categories from those reported here. We consider these differences insignificant.

TABLE 2. GUNNISON SAGE-GROUSE POPULATION ESTIMATES BY YEAR DERIVED FROM THE FORMULA PRESENTED IN THE GUNNISON SAGE-GROUSE RANGEWIDE CONSERVATION PLAN (GSRSC[A] 2005, PP. 44-45) APPLIED TO HIGH MALE COUNTS ON LEKS (CDOW[B] 2009A, P. 2).

Population	Estimated Population									
	Year									
	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Gunnison Basin	3,493	3,027	2,453	2,443	4,700	5,205	4,616	3,669	3,817	3,655
San Miguel Basin	392	383	250	255	334	378	324	216	162	123
Monticello–Dove Creek (Combined)	363	270	186	162	196	191	245	245	191	n/a[c]
Monticello	231	172	147	152	162	118	216	216	182	n/a[c]
Dove Creek	132	98	39	10	34	74	29	29	10	44
Piñon Mesa	152	132	123	142	167	152	123	108	78	74
Cerro Summit–Cimarron–Sims Mesa	59	39	29	39	25	49	34	10	39	5
Crawford	137	206	118	128	191	201	113	103	78	20
Poncha Pass	25	44	34	39	44	44	25	25	20	15
Totals	4,621	4,101	3,194	3,208	5,656	6,220	5,480	4,376	4,386	n/a[c]

[a]Gunnison Sage-grouse Rangewide Steering Committee
[b]Colorado Division of Wildlife
[c]2010 lek count data for the Monticello group was not available at the time of publication

Gunnison Basin Population – The Gunnison Basin is an intermontane basin that includes parts of Gunnison and Saguache Counties, Colorado. The current Gunnison Basin population is distributed across approximately 240,000 ha (593,000 ac), roughly centered on the town of Gunnison. Elevations in the area range from 2,300 to 2,900 m (7,500 to 9,500 ft). Approximately 70 percent of the land area is managed by Federal agencies (67 percent) and CDOW (3 percent), and the remaining 30 percent comprises primarily private lands. Big sagebrush (*Artemesia tridentata*) dominates the upland vegetation and has a highly variable growth form depending on local site conditions. In 2009, 83 leks were surveyed for breeding activity in the Gunnison Basin, and 42 of these leks were active (at least two males in attendance during at least two of four 10–day count periods), 6 inactive

(inactive for at least 5 consecutive years), 9 historic (inactive for at least 10 consecutive years), and 26 were of unknown status (variability in counts resulted in lek not meeting requirements for active, inactive, or historic) (CDOW 2009d, pp. 28-30). Approximately 45 percent of leks in the Gunnison Basin occur on private land and 55 percent on public land, primarily BLM (GSRSC 2005, p. 75). The 2010 population estimate for the Gunnison Basin was 3,655 (CDOW 2010a, p. 2). Rogers (1964, p. 20) stated that Gunnison County was one of five counties containing the majority of sage-grouse in Colorado in 1961. The vast majority (87 percent) of Gunnison sage-grouse are now found only in the Gunnison Basin population.

San Miguel Basin Population – The San Miguel Basin population is in Montrose and San Miguel Counties in Colorado, and is composed of six small subpopulations using different areas—(Dry Creek Basin, Hamilton Mesa, Miramonte Reservoir, Gurley Reservoir, Beaver Mesa, and Iron Springs) occupying a total of approximately 41,000 ha (101,000 ac). Some of these six areas are used year-round by sage-grouse, and others are used seasonally. The overall acreage figure for this population is heavily skewed by the large percentage (approximately 62 percent) of land in the Dry Creek Basin (San Miguel Basin Gunnison Sage-grouse Working Group 2009, p. 28). The Dry Creek Basin area contains some of the poorest habitat and smallest grouse populations in the San Miguel population (San Miguel Basin Gunnison sage-grouse Conservation Plan 2009, pp. 28, 36). Gunnison sage-grouse in the San Miguel Basin move widely between these areas (Apa 2004, p. 29; Stiver and Gibson 2005, p. 12). The area encompassed by this population is believed to have once served as critical migration corridors between populations to the north (Cerro Summit–Cimarron–Sims Mesa) and to the south (Monticello-Dove Creek) (San Miguel Basin Gunnison Sage-grouse Working Group 2009, p. 9).

Sagebrush habitat in the Dry Creek Basin area is patchily distributed, and the understory is either lacking in grass and forb diversity or nonexistent. Where irrigation is possible, private lands in the southeast portion of Dry Creek Basin are cultivated. Sagebrush habitat on private land has been heavily thinned or removed entirely (GSRSC 2005, p. 96). Gunnison sage-grouse use the Hamilton Mesa area (1,940 ha (4,800 ac)) in the summer, but use of Hamilton Mesa during other seasons is unknown. Gunnison sage-grouse occupy approximately 4,700 ha (11,600 ac) around Miramonte Reservoir (GSRSC 2005, p. 96). Sagebrush stands there are generally contiguous with a mixed grass and forb understory. Occupied habitat at the Gurley Reservoir area (3,305 ha (7,500 ac)) is heavily fragmented by urban development, and the understory is a mixed grass and forb community. Farming attempts in the early 20th century led to the removal of much of the sagebrush, although agricultural activities are now restricted primarily to the seasonally irrigated crops (hay meadows), and sagebrush has reestablished in most of the failed pastures. However, grazing pressure and competition from introduced grasses have kept the overall sagebrush representation low (GSRSC 2005, pp. 96-97). Sagebrush stands in the Iron Springs and Beaver Mesa areas (2,590 ha and 3,560 ha (6,400 ac and 8,800 ac respectively)) are contiguous with a mixed grass understory. The Beaver Mesa area has numerous scattered patches of oakbrush (*Quercus gambelii*). Rogers (1964, p. 9) reported that all big sagebrush-dominated habitats in San Miguel and Montrose Counties were historically used by Gunnison sage-grouse.

The 2010 population estimate for the entire San Miguel Basin was 123 individuals on nine leks (CDOW 20010, p. 3). With the exception of 2007, CDOW has been translocating Gunnison sage-grouse from the Gunnison Basin to Dry Creek Basin on a yearly basis since the spring of 2006 (CDOW 2009a, p. 133). In the spring of 2006, six individuals were released near the Desert Lek. An additional two individuals were released in the fall. Nine individuals were translocated in the spring of 2008. An additional 30 individuals were translocated in the fall of 2009. A 40 to 50 percent mortality rate has been observed within the first year after release, compared to an average annual mortality rate of approximately 20 percent for radiomarked adult sage-grouse (CDOWa 2009, p. 9).

Monticello–Dove Creek Population – This population is divided into two disjunct subpopulations of Gunnison sage-grouse. Currently, the largest group is near the town of Monticello, in San Juan County, Utah. Gunnison sage-grouse in this subpopulation inhabit a broad plateau on the northeast side of the Abajo Mountains, with fragmented patches of sagebrush interspersed with large grass pastures and agricultural fields. The Utah Division of Wildlife Resources (UDWR) estimated population numbers between 583 and 1,050 individuals in 1972 and between 178 and 308 individuals in 2002 (UDWR 2009, 29.21 p. 1). The UDWR estimates that Gunnison sage-grouse currently occupy about 24,000 ha (60,000 ac) in the Monticello area. The 2009 population estimate for Monticello was 182 individuals with three active and one inactive leks (UDWR 2009, p. 5).

The Dove Creek subpoulation is located primarily in western Dolores County, Colorado, north and west of Dove Creek, although a small portion of occupied habitat extends north into San Miguel County. Habitat north of Dove Creek is characterized as mountain shrub habitat, dominated by oakbrush interspersed with sagebrush. The area west of Dove Creek is dominated by sagebrush, but the habitat is highly fragmented. Lek counts in the Dove Creek area were over 50 males in 1999, suggesting a population of about 245 birds, but declined to 2 males in 2009 (CDOW 2009a, p. 71), suggesting a population of 10 birds. A new lek was found in 2010, and the 2010 population estimate was 44 individuals on 2 leks (CDOW 2010, p. 1). Low sagebrush canopy cover, as well as low grass height, exacerbated by drought, may have led to nest failure and subsequent population declines (Connelly *et al.* 2000a, p. 974; Apa 2004, p. 30). Rogers (1964, p. 9) reported that all sagebrush-dominated habitats in Dolores and Montezuma Counties within Gunnison sage-grouse range in Colorado were historically used by Gunnison sage-grouse.

Pīnon Mesa Population – The Pīnon Mesa population occurs on the northwest end of the Uncompahgre Plateau in Mesa County, about 35 km (22 mi) southwest of Grand Junction, Colorado. The 2010 population estimate for Pīnon Mesa was 74 (CDOW 2010, p. 2). Of the ten known leks, only four were active in 2009 (CDOW, 2009a, p. 3). The Pīnon Mesa area may have additional leks, but the high percentage of private land, a lack of roads, and heavy snow cover during spring make locating additional leks difficult. Gunnison sage-grouse likely occurred historically in all suitable sagebrush habitat in the Pīnon Mesa area, including the Dominguez Canyon area of the Uncompaghre Plateau, southeast of Pīnon Mesa proper (Rogers 1964, p. 114). Their current distribution has been substantially reduced from historic levels to 15,744 ha (38,904 ac) (GSRSC 2005, p. 87).

Crawford Population – The Crawford population of Gunnison sage-grouse is in Montrose County, Colorado, about 13 km (8 mi) southwest of the town of Crawford and north of the Gunnison River. Basin big sagebrush (*Artemisia tridentata tridentata*) and black

sagebrush (*A. nova*) dominate the mid-elevation uplands (GSRSC 2005, p. 62). The 2010 population estimate for Crawford was 20 individuals (CDOW 2010, p. 1) in 14,170 ha (35,015 ac) of occupied habitat. Four active leks are currently in the Crawford population on BLM lands in sagebrush habitat adjacent to an 11-km (7-mi) stretch of road. This area represents the largest contiguous sagebrush-dominated habitat within the Crawford boundary (GSRSC 2005, p. 64).

Cerro Summit–Cimarron–Sims Mesa Population – This population is divided into two geographically separated subpopulations, both in Montrose County, Colorado. The Cerro Summit–Cimarron subpopulation is centered about 24 km (15 mi) east of Montrose. The habitat consists of 15,039 ha (37,161 ac) of patches of sagebrush habitat fragmented by oakbrush and irrigated pastures. Five leks are currently known in the Cerro Summit–Cimarron group, but only one individual was observed on one lek in 2010 resulting in a population estimate of 5 individuals for the population (CDOW 2010, p. 1). Rogers (1964, p. 115) noted a small population of sage-grouse in the Cimarron River drainage, but did not report population numbers. He noted that lek counts at Cerro Summit in 1959 listed four individuals.

The Sims Mesa area, about 11 km (7 mi) south of Montrose, consists of small patches of sagebrush that are heavily fragmented by pinyon-juniper, residential and recreational development, and agriculture. The one known lek in Sims Mesa has lacked Gunnison sage-grouse attendance for the last six years, which indicates this population is likely extirpated (CDOW 2009a, p. 43). In 2000, the CDOW translocated six Gunnison sage-grouse from the Gunnison Basin to Sims Mesa (Nehring and Apa 2000, p. 12). Rogers (1964, p. 95) recorded eight males in a lek count at Sims Mesa in 1960. We do not know if sage-grouse move between the Cerro Summit–Cimarron and Sims Mesa subpopulations.

Poncha Pass Population – The Poncha Pass Gunnison sage-grouse population is located in Saguache County, approximately 16 km (10 mi) northwest of Villa Grove, Colorado. This population was established through the reintroduction of 30 birds from the Gunnison Basin in 1971 and 1972 during efforts to reintroduce the species to the San Luis Valley (GSRSC 2005, p. 94). The known population distribution is in 8,262 ha (20,415 ac) of sagebrush habitat from the summit of Poncha Pass extending south for about 13 km (8 mi) on either side of U.S. Highway 285. Sagebrush in this area is continuous with little fragmentation; sagebrush habitat quality throughout the area is adequate to support the species (Nehring and Apa 2000 p. 25). San Luis Creek runs through the area, providing a year-round water source and lush, wet meadow riparian habitat for brood-rearing.

A high male count of 3 males was made in 2010 (CDOW 2009a, p. 121), resulting in an estimated population size of 15 for the Poncha Pass population (CDOW 2010, p. 3). The only current lek is located on BLM-administered land. In 1992, a CDOW effort to simplify hunting restrictions inadvertently opened the Poncha Pass area to sage-grouse hunting, and at least 30 grouse were harvested from this population. Due to declining population numbers since the 1992 hunt, CDOW translocated 24 additional birds from the Gunnison Basin (Nehring and Apa 2000, p. 11). In 2001 and 2002, an additional 20 and 7 birds, respectively, were moved to Poncha Pass by the CDOW (GSRSC 2005, p. 94). Translocated females have bred successfully (Apa 2004, pers. comm.), and display activity resumed on the historic lek in spring 2001.

Summary of Information Pertaining to the Five Factors

Section 4 of the Act (16 U.S.C. 1533), and implementing regulations (50 CFR 424), set forth procedures for adding species to the Federal Lists of Endangered and Threatened Wildlife and Plants. Under section 4(a)(1) of the Act, a species may be determined to be endangered or threatened based on any of the following five factors: (1) The present or threatened destruction, modification, or curtailment of its habitat or range; (2) overutilization for commercial, recreational, scientific, or educational purposes; (3) disease or predation; (4) the inadequacy of existing regulatory mechanisms; or (5) other natural or manmade factors affecting its continued existence. In making this finding, information pertaining to the Gunnison sage-grouse, in relation to the five factors provided in section 4(a)(1) of the Act, is discussed below.

In considering what factors might constitute threats to a species, we must look beyond the exposure of the species to a factor to evaluate whether the species may respond to the factor in a way that causes actual impacts to the species. If there is exposure to a factor and the species responds negatively, the factor may be a threat and we attempt to determine how significant a threat it is. The threat is significant if it drives, or contributes to, the risk of extinction of the species such that the species warrants listing as endangered or threatened as those terms are defined in the Act.

The Gunnison Basin contains 87 percent of the current rangewide Gunnison sage-grouse population and 62 percent of the area occupied by the species. The remaining six populations cumulatively and individually have substantially smaller population sizes and occupy substantially less habitat than the Gunnison Basin population (see Table 2).

A. The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range

Sagebrush habitats within the range of Gunnison sage-grouse are becoming increasingly fragmented as a result of various changes in land uses and the expansion in the density and distribution of invasive plant species (Oyler-McCance *et al.* 2001, pp. 329-330; Schroeder *et al.* 2004, p. 372). Habitat fragmentation is the separation or splitting apart of previously contiguous, functional habitat components of a species. Fragmentation can result from direct habitat losses that leave the remaining habitat in non-contiguous patches, or from alteration of habitat areas that render the altered patches unusable to a species (i.e., functional habitat loss). Functional habitat losses include disturbances that change a habitat's successional state or remove one or more habitat functions; physical barriers that preclude use of otherwise suitable areas; or activities that prevent animals from using suitable habitat patches due to behavioral avoidance.

A variety of human developments including roads, energy development, and other factors that cause habitat fragmentation have contributed to or been associated with Gunnison and greater sage-grouse extirpation (Wisdom *et al.* in press, p. 18). Based on a quantitative analysis of environmental factors most closely associated with extirpation, no strongholds (areas where the risk of Gunnison sage-grouse extirpation is low) exist (Wisdom *et al.* in press, p. 26). Estimating the impact of habitat fragmentation on sage-grouse is complicated by time lags in response to habitat changes (Garton *et al.,* in press, p. 71), particularly since these relatively long-lived birds will continue to return to altered breeding areas (leks, nesting areas, and early brood-rearing areas) due to strong site fidelity despite nesting or productivity failures (Rogers 1964, pp. 35-40; Wiens and Rotenberry 1985, p. 666; Young 1994, p. 42; Lyon

2000, p. 20, Connelly *et al.* 2004, p. 45; Holloran and Anderson 2005, p. 747).

Habitat fragmentation can have an adverse effect on Gunnison sage-grouse populations. Many of the factors that result in fragmentation may be exacerbated by the effects of climate change, which may influence long-term habitat and population trends. The following sections examine factors that can contribute to habitat fragmentation to determine whether they threaten Gunnison sage-grouse and their habitat.

Historic Modification of Gunnison Sage-grouse Habitat

The historic and current distribution of the Gunnison sage-grouse closely matches the distribution of sagebrush. Potential Gunnison sage-grouse range is estimated to have been 5,536,358 ha (13,680,640 ac) historically (GSRSC 2005, p. 32). Gunnison sage-grouse currently occupy approximately 379,464 ha (937,676 ac) in southwestern Colorado and southeastern Utah (CDOW 2009b, p. 1; GSRSC 2005, p. 81), an area that represents approximately 7 percent of the species' potential historic range. The following describes the factors affecting Gunnison sage-grouse and Gunnison sage-grouse habitat within the current range of the species.

The onset of EuroAmerican settlement in the late 1800s resulted in significant alterations to sagebrush ecosystems throughout North America (West and Young 2000, pp. 263-265; Miller *et al.* in press, p. 6), primarily as a result of urbanization, agricultural conversion, and irrigation projects. Areas that supported basin big sagebrush (*Artemisia tridentata* ssp. *tridentata*) were among the first sagebrush community types converted to agriculture because their typical soils and topography are well suited for agriculture (Rogers 1964, p. 13).

In southwestern Colorado, Oyler-McCance *et al.* (2001, p. 326) found that, between 1958 and 1993, 20 percent (155,673 ha (384,676 ac)) of sagebrush was lost in Colorado, and 37 percent of sagebrush plots examined were fragmented. In another analysis, it was estimated that approximately 342,000 ha (845,000 ac) of sagebrush, or 13 percent of the pre-EuroAmerican settlement sagebrush extent, were lost in Colorado, which includes both greater sage-grouse and Gunnison sage-grouse habitat (Boyle and Reeder 2005, p. 3-3). However, the authors noted that the estimate of historic sagebrush area used in their analyses was conservative, possibly resulting in a substantial underestimate of historic sagebrush losses (Boyle and Reeder 2005, p. 3-4). Within the range of Gunnison sage-grouse, the principal areas of sagebrush loss were in the Gunnison Basin, San Miguel Basin, and areas near Dove Creek, Colorado. The authors point out that the rate of loss in the Gunnison Basin was lower than other areas of sagebrush distribution in Colorado. The Gunnison Basin contains approximately 250,000 ha (617,000 ac) of sagebrush; this area partially comprises other habitat types such as riparian areas and patches of non-sagebrush vegetation types, including aspen forest, mixed-conifer forest, and oakbrush (Boyle and Reeder 2005, p. 3-3). Within the portion of the Gunnison Basin currently occupied by Gunnison sage-grouse, 170,000 ha (420,000 ac) comprises exclusively sagebrush vegetation types, as derived from Southwest Regional Gap Analsis Project (SWReGAP) landcover data (multi-season satellite imagery acquired between 1999 and 2001) (USGS 2004, entire).

Conversion to Agriculture

While sage-grouse may forage on agricultural croplands, they avoid landscapes dominated by agriculture (Aldridge *et al.* 2008, p. 991). Influences resulting from agricultural activities extend into adjoining sagebrush, and include increased predation and reduced nest success due to predators associated with agriculture (Connelly *et al.* 2004, p. 7-23). Agricultural conversion can provide some limited benefits for sage-grouse. Some crops, such as alfalfa (*Medicago sativa*) and young bean sprouts (*Phaseolus* spp.), are eaten or used for cover by Gunnison sage-grouse (Braun 1998, pers. comm.). However, crop monocultures do not provide adequate year-round food or cover (GSRSC 2005, pp. 22-30).

Current Agriculture in All Gunnison Sage-grouse Population Areas – The following estimates of land area dedicated to agriculture (including grass/forb pasture) were derived from SWReGAP landcover data (USGS 2004, entire). Habitat conversion to agriculture is most prevalent in the Monticello–Dove Creek population area where approximately 23,220 ha (57,377 ac) or 51 percent of Gunnison sage-grouse occupied range is currently in agricultural production. In the Gunnison Basin, approximately 20,754 ha (51,285 ac) or 9 percent of the occupied range is currently in agricultural production. Approximately 6,287 ha (15,535 ac) or 15 percent of the occupied range in the San Miguel Basin is currently in agricultural production. In the Cerro Summit–Cimarron–Sims Mesa population, approximately 14 percent (5,133 ha (2,077 ac)) of the occupied range is currently in agricultural production. Habitat conversion due to agricultural activities is limited in the Crawford, Pĩnon Mesa, and Poncha Pass populations, with 3 percent or less of the occupied range currently in agricultural production in each of the population areas.

Other than in Gunnison County, total area of harvested cropland has declined over the past two decades in all counties within the occupied range of Gunnison sage-grouse (USDA NASS 2010, entire). Information on the amount of land area devoted to cropland was not available for Gunnison County, most likely because the majority of agricultural land use in the county is for hay production. However, total area in hay production has correspondingly declined in Gunnison County over the past two decades (USDA NASS 2009, p. 1). Because of this long-term trend in reduced land area devoted to agriculture, we do not expect a significant amount of Gunnison sage-grouse habitat to be converted to agricultural purposes in the future.

Conservation Reserve Program – The loss of Gunnison sage-grouse habitat to conversion to agriculture has been mitigated somewhat by the Conservation Reserve Program (CRP). The CRP is administered by the United States Department of Agriculture (USDA) Farm Service Agency (FSA) and provides incentives to agricultural landowners to convert certain cropland to more natural vegetative conditions. Except in emergency situations, CRP-enrolled lands are not hayed or grazed.

Lands within the occupied range of Gunnison sage-grouse enrolled into the CRP are limited to Dolores and San Miguel counties in Colorado, and San Juan County in Utah (USDA FSA 2010, entire). From 2000 to 2008, CRP-enrollment averaged 10,622 ha (26,247 ac) in Dolores County, 1,350 ha (3,337 ac) in San Miguel County, and 14,698 ha (36,320 ac) in San Juan County (USDA FSA 2010, entire). These CRP enrolled areas potentially constitute approximately 56 percent of the Monticello–Dove Creek population and 3 percent of the San Miguel population; however, we are unsure of the proportion of these CRP lands that are within Gunnison sage-grouse habitat. Approximately 735 ha (1,816 ac) of leases on these CRP-enrolled lands expired on September 30, 2009, and 10,431 ha (25,778 ac) are due to expire on September 30, 2010 (UDWR 2009, p. 7).

In San Juan County, Gunnison sage-grouse use CRP lands in proportion to their availability (Lupis *et al.* 2006, p. 959). The CRP areas are used by grouse primarily as brood-rearing habitat, but

these areas vary greatly in plant diversity and forb abundance, and generally lack any shrub cover (Lupis *et al.* 2006, pp. 959-960). In response to a severe drought, four CRP parcels totaling 1,487 ha (3,674 ac) in San Juan County, UT, were emergency grazed for a duration of 1 to 2 months in the summer of 2002 (Lupis 2006, p. 959).

Largely as a result of agricultural conversion, sagebrush patches in the Monticello–Dove Creek subpopulation area have progressively become smaller and more fragmented, which has limited the amount of available nesting and winter habitat (GSRSC 2005, pp. 82, 276). Overall, the CRP has protected a portion of the Monticello–Dove Creek population from more intensive agricultural use and development. However, the overall value of CRP lands is limited because they largely lack sagebrush cover required by Gunnison sage-sage grouse throughout most of the year. The CRP was renewed under the Food, Conservation, and Energy Act of 2008. A new CRP sign-up for individual landowners is not anticipated until 2012 and the extent to which existing CRP lands will be re-enrolled is unknown (UDWR 2009, p. 4).

Summary of Conversion to Agriculture

Throughout the range of Gunnison sage-grouse there is a declining trend in the amount of land area devoted to agriculture. Therefore, although we expect a large proportion of land currently in agricultural production to remain so indefinitely, we do not expect significant additional, future habitat conversion to agriculture within the range of Gunnison sage-grouse. The loss of sagebrush habitat from 1958 to 1993 was estimated to be approximately 20 percent throughout the range of Gunnison sage-grouse (Oyler-McCance *et al.* 2001, p. 326). The exception is the Monticello–Dove Creek population where more than half of the occupied range is currently in agriculture or other land uses incompatible with Gunnison sage-grouse conservation. This habitat loss is being somewhat mitigated by the current enrollment of lands in the CRP. Even so, this relative scarcity of sagebrush cover indicates a high risk of population extirpation (Wisdom *et al.* in press, p. 19) for this population. Because of its limited extent, we do not consider the conversion of sagebrush habitats to agriculture alone to be a current or future significant threat to Gunnison sage-grouse and its habitat. However, we recognize lands already converted to agriculture are located throughout all Gunnison sage-grouse populations and are, therefore, contributing to the fragmentation of remaining habitat.

Water Development

Water Development in All Population Areas – Irrigation projects have resulted in loss of sage-grouse habitat (Braun 1998, p. 6). Reservoir development in the Gunnison Basin flooded 3,700 ha (9,200 ac), or 1.5 percent of likely sage-grouse habitat (McCall 2005, pers. comm.). Three other reservoirs inundated approximately 2 percent of habitat in the San Miguel Basin population area (Garner 2005, pers. comm.). We are unaware of any plans for additional reservoir construction. Because of the small amount of Gunnison sage-grouse habitat lost to water development projects and the unlikelihood of future projects, we do not consider water development alone to be a current or future significant threat to the Gunnison sage-grouse. However, we expect these existing reservoirs to be maintained indefinitely, thus acting as another source of fragmentation of Gunnison sage-grouse habitat.

Residential Development

Human population growth in the rural Rocky Mountains is driven by the availability of natural amenities, recreational opportunities, aesthetically desirable settings, grandiose viewscapes, and perceived remoteness (Riebsame 1996, p. 396, 402; Theobald 1996, p. 408; Gosnell and Travis 2005, pp. 192-197; Mitchell *et al.* 2002, p. 6; Hansen *et al.* 2005, pp. 1899-1901). This human population growth is occurring throughout much of the range of Gunnison sage-grouse. The human population in all counties within the range of Gunnison sage-grouse averaged a 70 percent increase since 1980 (Colorado Department of Local Affairs (CDOLA) 2009a, pp. 2-3). The year 2050 projected human population for the Gunnison River basin (an area that encompasses the majority of the current range of Gunnison sage-grouse) is expected to be 2.3 times greater than the 2005 population (CWCB 2009, p. 15). The population of Gunnison County, an area that supports over 80 percent of all Gunnison sage-grouse, is predicted to more than double to approximately 31,100 residents by 2050 (CWCB 2009, p. 53).

The increase in residential and commercial development associated with the expanding human population is different from historic land use patterns (Theobald 2001, p. 548). The allocation of land for resource-based activities such as agriculture and livestock production is decreasing as the relative economic importance of these activities diminishes (Theobald 1996, p. 413; Sammons 1998, p. 32; Gosnell and Travis 2005, pp. 191-192). Currently, agribusiness occupations constitute approximately 3 percent of the total job base in Gunnison County (CDOLAb 2009, p. 4). Recent conversion of farm and ranch lands to housing development has been significant in Colorado (Odell and Knight 2001, p. 1144). Many large private ranches in the Rocky Mountains, including the Gunnison Basin, are being subdivided into both high-density subdivisions and larger, scattered ranchettes with lots typically greater than 14 ha (35 ac), which encompass a large, isolated house (Riebsame 1996, p. 399; Theobald 1996, p. 408).

The resulting pattern of residential development is less associated with existing town sites or existing subdivisions, and is increasingly exurban in nature (Theobald *et al.* 1996, pp. 408, 415; Theobald 2001, p. 546). Exurban development is described as low-density growth outside of urban and suburban areas (Clark *et al.* 2009, p. 178; Theobald 2004, p.140) with less than one housing unit per 1 ha (2.5 ac) (Theobald 2003, p. 1627; Theobald 2004, p. 139). The resulting pattern is one of increased residential lot size and the diffuse scattering of residential lots in previously rural areas with a premium placed on adjacency to federal lands and isolated open spaces (Riebsame *et al.* 1996, p. 396, 398; Theobald 1996, pp. 413, 417; Theobald 2001, p. 546; Brown *et al.* 2005, p. 1858). The residential subdivision that results from exurban development causes landscape fragmentation (Gosnell and Travis 2005, p. 196) primarily through the accumulation of roads, buildings, (Theobald 1996, p. 410; Mitchell *et al.* 2002, p. 3) and other associated infrastructure such as power lines, and pipelines. In the East River Valley of Gunnison County, residential development in the early 1990s increased road density by 17 percent (Theobald *et al.* 1996, p. 410). The habitat fragmentation resulting from this development pattern is especially detrimental to Gunnison sage-grouse because of their dependence on large areas of contiguous sagebrush (Patterson 1952, p. 48; Connelly *et al.* 2004, p. 4-1; Connelly *et al.* in press a, p. 10; Wisdom *et al.* in press, p. 4).

Residential Development in the Gunnison Basin Population Area – Nearly three quarters (approximately 71 percent) of the Gunnison Basin population of Gunnison sage-grouse occurs within Gunnison County, with the remainder occurring in Saguache

County. Within Gunnison County, approximately 30 percent of the occupied range of this species occurs on private lands. We performed a GIS analysis of parcel ownership data that was focused on the spatial and temporal pattern of human development within occupied Gunnison sage-grouse habitat. Some of our analyses were limited to the portion of occupied habitat in Gunnison County because parcel data was only available for Gunnison County and not for Saguache County. The cumulative number of human developments has increased dramatically in Gunnison County, especially since the early 1970s (USFWS 2010a, p. 1). The number of new developments averaged approximately 70 per year from the late 1800s to 1969, increasing to approximately 450 per year from 1970 to 2008 (USFWS 2010a, pp. 2-5). Furthermore, there has been an increasing trend toward development away from major roadways (primary and secondary paved roads) into areas that had previously undergone very limited development in occupied Gunnison sage-grouse habitat (USFWS 2010b, p. 7). Between 1889 and 1968, there were approximately 51 human developments located more than 1.6 km (1 mi) from a major road in currently occupied Gunnison sage-grouse habitat. Between 1969 and 2008, this number increased to approximately 476 developments (USFWS 2010b, p. 7).

In order to assess the impacts of existing residential development, we relied on two evaluations of Gunnison sage-grouse response and habitat availability in relation to development. The first was a landscape-scale spatial model predicting Gunnison sage-grouse nesting probability in the Gunnison Basin (Aldridge *et al.* 2010, entire). The model indicated that Gunnison sage-grouse select nest sites in areas with moderate shrub cover, and avoid residential development within a radius of 1.5 km (0.9 mi) (Aldridge *et al.* 2010, p. 18). The model was applied to the entire Gunnison Basin population area to predict the likelihood of Gunnison sage-grouse nesting based on data from the western portion (Aldridge *et al.* 2010, p. 16). We used Aldridge *et al.* (2010)'s radius of 1.5 km (0.9 mi) avoidance distance to calculate the indirect effects likely from the current level of development within occupied Gunnison sage-grouse habitat in Gunnison County. We found that 49 percent of the land area within the range of Gunnison sage-grouse has at least one housing unit within a radius of 1.5 km (0.9 mi) (USFWS 2010b, p. 7). This residential development is currently compromising the likelihood of use by Gunnison sage-grouse for nesting habitat in these areas.

Furthermore, since early brood-rearing habitat is often in close proximity to nest sites (Connelly *et al.* 2000a, p. 971), the functional loss of nesting habitat is closely linked with the loss of early brood-rearing habitat. Limitations in the quality and quantity of nesting and early brood-rearing habitat are particularly problematic because Gunnison sage-grouse population dynamics are most sensitive during these life-history stages (GSRSC 2005, p. G-15). We recognize that the potential percentages of habitat loss mentioned above, whether direct or functional, will not necessarily correspond to the same percentage loss in sage-grouse numbers. The recent efforts to conserve Gunnison sage-grouse and their habitat within the Basin provide protection for the foreseeable future for several areas of high-quality habitat (see discussion in Factor D). Nonetheless, given the large landscape-level needs of this species, we expect this current level of habitat loss, degradation, and fragmentation, from residential development, as described above, to substantially limit the probability of persistence of Gunnison sage-grouse in the Gunnison Basin.

We also calculated a "lower" development impact scenario using the smaller impact footprint hypothesized by the GSRSC (2005, pp. 160-161). This analysis assumed that residential density in excess of one housing unit per 1.3 km^2 (0.5 mi^2) could cause declines in Gunnison sage-grouse populations. Within Gunnison County, 18 percent of the land area within the range of Gunnison sage-grouse currently has a residential density greater than one housing unit per 1.3 km^2 (0.5 mi^2) (USFWS 2010b, p. 8). Therefore, according to the GSRSC estimate of potential residential impacts, human residential densities in the Gunnison Basin population area are such that we expect they are limiting the Gunnison sage-grouse population in at least 18 percent of the population area.

We expect the density and distribution of human residences to expand in the future. Based on our GIS analysis, we estimate that approximately 20,236 ha (50,004 ac) of private lands on approximately 1,190 parcels not subject to conservation easements currently lack human development in occupied Gunnison sage-grouse habitat in Gunnison County (USFWS 2010b, p. 11). These lands are scattered throughout occupied Gunnison sage-grouse habitat in the Gunnison Basin. We used the 20,236 ha (50,004 ac) as an initial basis to assess the potential impacts of future development. A lack of parcel data availability from surrounding counties precluded expanding this analysis beyond Gunnison County; however, the analysis area constitutes 71 percent of the Gunnison Basin population area. Approximately 93 percent of occupied Gunnison sage-grouse habitat in Gunnison County consists of parcels greater than 14.2 ha (35 ac), allowing exemptions from some county land development regulations. Applying a 1.7 percent average annual population increase under a "middle" growth scenario (CWCB 2009, p. 56) and an average 2.29 persons per household (CDOLA 2009b, p. 6) to the 2008 Gunnison County human population estimate results in the potential addition of nearly 7,000 housing units to the county by 2050.

Currently, approximately two-thirds of the human population in Gunnison County occurs within the currently mapped occupied range of Gunnison sage-grouse. Assuming this pattern will continue, two-thirds of the population increase will occur within occupied Gunnison sage-grouse habitat. The above projection could potentially result in the addition of approximately 4,630 housing units and the potential for 25,829 ha (63,824 ac) of new habitat loss, whether direct or functional, on parcels that currently have no development. Based on the estimated area of impact determined by Aldridge *et al.* (2010), this potential functional habitat loss constitutes an additional impact of 15 percent of the current extent of the Gunnison Basin population area (USFWS 2010b, p. 14). When combined with the existing loss, whether direct or functional, of 49 percent of Gunnison sage-grouse nesting habitat, the total amount of habitat subject to the indirect effects of residential development now and in the foreseeable future increases to 64 percent.

Using the same methodology as discussed above, but applying the estimated area of impact determined by GSRSC (2005, p. F-3), results in a future potential functional habitat loss of 9 percent. When combined with the existing loss, whether direct or functional, of 18 percent of Gunnison sage-grouse habitat, an estimated 27 percent of habitat will be functionally lost for Gunnison sage-grouse under this minimum impact scenario. We believe that impacts to Gunnison sage-grouse implicit in even the lower or more conservative estimates of direct and

functional habitat loss are limiting the persistence of the species.

We also anticipate increased housing density in many areas of occupied Gunnison sage-grouse habitat because the anticipated number of new housing units will exceed the number of undeveloped parcels by nearly four times (USFWS 2010b, p. 16). Some of this anticipated development and subsequent functional habitat loss will undoubtedly occur on parcels that currently have existing human development, which could lessen the effects to Gunnison sage-grouse. However, the above calculation of an increase in future housing units is likely an underestimate because it does not take into account the expected increase in second home development (CDOLA 2009b, p. 7), which could increase negative effects to Gunnison sage-grouse. The U.S. Census Bureau only tallies the inhabitants of primary residences in population totals. This methodology results in an underestimate of the population, particularly in amenity communities, because of the increased number of part-time residents inhabiting second homes and vacation homes in these areas (Riebsame 1996, p. 397; Theobald 2001, p. 550, Theobald 2004, p. 143). In Gunnison County, approximately 90 percent of vacant housing units were seasonal-use units (CDOLA 2009c, p. 1). The housing vacancy rate, which is computed by dividing the number of vacant housing units by the total housing units, was 42.5 percent in Gunnison County over the last two decades (CDOLA 2009d, p. 2).

We expect some development to be moderated by the establishment of additional voluntary landowner conservation easements such as those currently facilitated by the CDOW and land trust organizations. While conservation easements can minimize the overall impacts to Gunnison sage-grouse, because less than 5 percent of occupied Gunnison sage-grouse habitat in the Gunnison Basin has been placed in conservation easements to date, we do not expect the amount of land potentially placed in future easements will significantly offset the overall affects of human development.

Our analyses, based on the evaluations of impacts to Gunnison sage-grouse discussed above, result in estimates of existing functional habitat loss of 18 to 49 percent of the Gunnison Basin population area. Future estimates of functional habitat loss result in an increase of 9 to 15 percent, for a cumulative total of 27 and 64 percent loss of the Gunnison Basin population area. We believe that impacts within these ranges limit the persistence of Gunnison sage-grouse.

Residential Development in All Other Population Areas – In 2004, within the Crawford Population area, approximately 951 ha (2,350 ac), or 7 percent of the occupied Gunnison sage-grouse habitat, was subdivided into 48 parcels ranging in size from 14.2 ha (35 ac) to 28.3 ha (70 ac) (CDOW 2009a, p. 59). Local landowners and the National Park Service (NPS) have ongoing efforts to protect portions of the subdivided area through conservation easements. Residential subdivision continues to occur in the northern part of the Poncha Pass population area, and the CDOW considers this to be the highest priority threat to this population (CDOW 2009a, p. 124). The rate of residential development in the San Miguel Basin population increased between 2005 and 2008 but slowed in 2009 (CDOW 2009a, p. 135). However, a 429 ha (1,057 ac) parcel north of Miramonte Reservoir is currently being developed as a retreat. The CDOW reports that potential impacts to Gunnison sage-grouse resulting from the development may be reduced by possibly placing a portion of the property into a conservation easement and the relocation of a proposed major road to avoid occupied habitat (CDOW 2009a, p. 136). No recent or planned residential developments are known for the Cerro Summit–Cimarron–Sims Mesa population area (CDOW 2009a, p. 45), Monticello–Dove Creek population area (CDOW 2009a, p. 73), or Pīnon Mesa population area (CDOW 2009a, p. 109). The remaining limited amounts of habitat, the fragmented nature of this remaining habitat, and the anticipated increases in exurban development within each of the six smaller populations pose a significant threat to these six populations.

Summary of Residential Development

Because Gunnison sage-grouse are dependent on expansive, contiguous areas of sagebrush habitat to meet their life-history needs, the development patterns described above have resulted in the direct and functional loss of sagebrush habitat and have negatively affected the species by limiting already scarce habitat, especially within the six smaller populations. The collective influences of fragmentation and disturbance from human activities around residences and associated roads reduce the effective habitat around these areas, making them inhospitable to Gunnison sage-grouse (Aldridge *et al.* 2010, pp. 24-25; Knick, *et al.* 2009, in press, p. 25 and references therein; Aldridge and Boyce 2007, p.520). Human population growth that results in a dispersed exurban development pattern throughout sagebrush habitats will reduce the likelihood of sage-grouse persistence in these areas. Human populations are increasing throughout the range of Gunnison sage-grouse, and we expect this trend to continue. Given the current demographic trends described above, we believe the rate of residential development in Gunnison sage-grouse habitat will continue at least through 2050, and likely longer. The resulting habitat loss and fragmentation from residential development is a significant threat to Gunnison sage-grouse now and in the foreseeable future.

Fences

The effects of fencing on sage-grouse include direct mortality through collisions, creation of raptor and corvid (Family Corvidae: crows, ravens, magpies, etc.) perch sites, the potential creation of predator corridors along fences (particularly if a road is maintained next to the fence), incursion of exotic species along the fencing corridor, and habitat fragmentation (Call and Maser 1985, p. 22; Braun 1998, p. 145; Connelly *et al.* 2000a, p. 974; Beck *et al.* 2003, p. 211; Knick *et al.* 2003, p. 612; Connelly *et al.* 2004, p. 1-2). Corvids are significant sage-grouse nest predators and were responsible for more than 50 percent of nest predations in Nevada (Coates 2007, pp. 26-30). Sage-grouse frequently fly low and fast across sagebrush flats, and fences can create a collision hazard resulting in direct mortality (Call and Maser 1985, p. 22). Not all fences present the same mortality risk to sage-grouse. Mortality risk appears to be dependent on a combination of factors including design of fencing, landscape topography, and spatial relationship with seasonal habitats (Christiansen 2009). This variability in fence mortality rate and the lack of systematic fence monitoring make it difficult to determine the magnitude of impacts to sage-grouse populations; however, in some cases the level of mortality is likely significant to localized areas within populations. Fences directly kill greater sage grouse (Call and Maser 1985, p. 22; Christiansen 2009, pp. 1-2); we assume that Gunnison sage-grouse are also killed by fences but do not have species-specific data. Although the effects of direct strike mortality on populations are not fully analyzed, fences are ubiquitous across the landscape. Fence collisions continue to be identified as a source of mortality for Gunnison and greater sage-grouse and we expect this source of mortality to continue into the foreseeable future (Braun 1998, p. 145;

Connelly *et al.* 2000a, p. 974; Oyler-McCance *et al.* 2001, p. 330; Connelly *et al.* 2004, p. 7-3).

Fence posts create perching places for raptors and corvids, which may increase their ability to prey on sage-grouse (Braun 1998, p. 145; Oyler-McCance *et al.* 2001, p. 330; Connelly *et al.* 2004, p. 13-12). We anticipate that the effect on sage-grouse populations through the creation of new raptor perches and predator corridors into sagebrush habitats is similar to that of powerlines discussed below (Braun 1998, p. 145; Connelly *et al.* 2004, p. 7-3). Fences and their associated roads also facilitate the spread of invasive plant species that replace sagebrush plants upon which sage-grouse depend (Braun 1998, p. 145; Connelly *et al.* 2000a, p. 973; Gelbard and Belnap 2003, p. 421; Connelly *et al.* 2004, p. 7-3). Greater sage-grouse avoidance of habitat adjacent to fences, presumably to minimize the risk of predation, effectively results in habitat fragmentation even if the actual habitat is not removed (Braun 1998, p. 145). Because of similarities in behavior and habitat use, we believe the response of Gunnison sage-grouse is similar to that observed in greater sage-grouse.

At least 1,540 km (960 mi) of fence are on BLM lands within the Gunnison Basin (Borthwick 2005a, pers. comm.; BLM 2005a, 2005e) and an unquantified amount of fence on land owned or managed by other landowners. Fences are present within all other Gunnison sage-grouse population areas, but we have no quantitative information on the amount or types of fencing in these areas.

Summary of Fences

While fences contribute to habitat fragmentation and increase the potential for loss of individual grouse through collisions or enhanced predation, such effects have been ongoing since the first agricultural conversions occurred in sage-grouse habitat. We expect that the majority of existing fences will remain on the landscape indefinitely. However, because we do not expect a major increase in the number of fences, particularly 3-wire range fencing, we do not believe fencing, on its own, is a significant threat to Gunnison sage-grouse at the species level. In the smaller Gunnison sage-grouse populations, the impacts of fencing could become another source of mortality that cumulatively affects the species. We also recognize that fences are located throughout all Gunnison sage-grouse populations and are, therefore, contributing to the fragmentation of remaining habitat.

Roads

Impacts from roads may include direct habitat loss, direct mortality, barriers to migration corridors or seasonal habitats, facilitation of predation and spread of invasive vegetative species, and other indirect influences such as noise (Forman and Alexander 1998, pp. 207-231). Greater sage-grouse mortality resulting from collisions with vehicles does occur, but mortalities are typically not monitored or recorded (Patterson 1952, p. 81). Therefore, we are unable to determine the importance of this factor on sage-grouse populations. We have no information on the number of direct mortalities of Gunnison sage-grouse resulting from vehicles or roads; however, because of similarities in their habitat and habitat use, we expect similar effects as those observed in greater sage-grouse. Roads within Gunnison sage-grouse habitats have been shown to impede movement of local populations between the resultant patches, with road avoidance presumably being a behavioral means to limit exposure to predation (Oyler-McCance *et al.* 2001, p. 330).

The presence of roads increases human access and resulting disturbance effects in remote areas (Forman and Alexander 1998, p. 221; Forman 2000, p. 35; Connelly *et al.* 2004, pp. 7-6 to 7-25). In addition, roads can provide corridors for predators to move into previously unoccupied areas. For some mammalian species known to prey on sage-grouse, such as red fox (*Vulpes vulpes*), raccoons (*Procyon lotor*), and striped skunks (*Mephitis mephitis*), dispersal along roads has greatly increased their distribution (Forman and Alexander 1998, p. 212; Forman 2000, p. 33; Frey and Conover 2006, pp. 1114-1115). Corvids also use linear features such as primary and secondary roads as travel routes, expanding their movements into previously unused regions (Knight and Kawashima 1993, p. 268; Connelly *et al.* 2004, p. 12-3). Corvids are significant sage-grouse nest predators and were responsible for more than 50 percent of nest predations in Nevada (Coates 2007, pp. 26-30). Ravens were documented following roads in oil and gas fields while foraging (Bui 2009, p. 31).

The expansion of road networks contributes to exotic plant invasions via introduced road fill, vehicle transport, and road maintenance activities (Forman and Alexander 1998, p. 210; Forman 2000, p. 32; Gelbard and Belnap 2003, p. 426; Knick *et al.* 2003, p. 619; Connelly *et al.* 2004, p. 7-25). Invasive species are not limited to roadsides, but also encroach into surrounding habitats (Forman and Alexander 1998, p. 210; Forman 2000, p. 33; Gelbard and Belnap 2003, p. 427). In their study of roads on the Colorado Plateau of southern Utah, Gelbard and Belnap (2003, p. 426) found that improving unpaved four-wheel drive roads to paved roads resulted in increased cover of exotic plant species within the interior of adjacent plant communities. This effect was associated with road construction and maintenance activities and vehicle traffic, and not with differences in site characteristics. The incursion of exotic plants into native sagebrush systems can negatively affect Gunnison sage-grouse through habitat losses and conversions (see further discussion below in Invasive Plants).

Additional indirect effects of roads may result from birds' behavioral avoidance of road areas because of noise, visual disturbance, pollutants, and predators moving along a road. The landscape-scale spatial model predicting Gunnison sage-grouse nest site selection showed strong avoidance of areas with high road densities of roads classed 1 through 4 (primary paved highways through primitive roads with 2-wheel drive sedan clearance) within 6.4 km (4 mi)) of nest sites (Aldridge *et al.* 2010 p. 18). The occurrence of Gunnison sage-grouse nest sites also decreased with increased proximity to primary and secondary paved highways (roads classes 1 and 2) (Aldridge *et al.* 2010, p. 27). Male greater sage-grouse lek attendance was shown to decline within 3 km (1.9 mi) of a methane well or haul road with traffic volume exceeding one vehicle per day (Holloran 2005, p. 40). Male sage-grouse depend on acoustical signals to attract females to leks (Gibson and Bradbury 1985, p. 82; Gratson 1993, p. 692). If noise interferes with mating displays, and thereby female attendance, younger males will not be drawn to the lek and eventually leks will become inactive (Amstrup and Phillips 1977, p. 26; Braun 1986, pp. 229-230).

In a study on the Pinedale Anticline in Wyoming, greater sage-grouse hens that bred on leks within 3 km (1.9 mi) of roads associated with oil and gas development traveled twice as far to nest as did hens that bred on leks greater than 3 km (1.9 mi) from roads. Nest initiation rates for hens bred on leks close to roads also were lower (65 versus 89 percent), affecting population recruitment (33 versus 44 percent) (Lyon 2000, p. 33; Lyon and Anderson 2003, pp. 489-490). Lyon and Anderson (2003, p. 490) suggested that roads may be the primary impact of oil and gas

development to sage-grouse, due to their persistence and continued use even after drilling and production have ceased. Lek abandonment patterns suggested that daily vehicular traffic along road networks for oil wells can impact greater sage-grouse breeding activities (Braun *et al.* 2002, p. 5). We believe the effects of vehicular traffic on Gunnison sage-grouse, regardless of its purpose (e.g., in support of energy production or local commuting and recreation), are similar to those observed in greater sage-grouse.

Aldridge *et al.* (2008, p. 992) did not find road density to be an important factor affecting greater sage-grouse persistence or rangewide patterns in sage-grouse extirpation. However, the authors did not consider the intensity of human use of roads in their modeling efforts. They also indicated that their analyses may have been influenced by inaccuracies in spatial road data sets, particularly for secondary roads (Aldridge *et al.* 2008, p. 992). Historic range where greater and Gunnison sage grouse have been extirpated has a 25 percent higher density of roads than occupied range (Wisdom *et al.* in press, p. 18). Wisdom *et al.*'s (in press) greater and Gunnison sage-grouse rangewide analysis supports the findings of numerous local studies showing that roads can have both direct and indirect impacts on sage-grouse distribution and individual fitness (reproduction and survival) (e.g., Lyon and Anderson 2003 p. 490 , Aldridge and Boyce 2007, p. 520).

Recreational activities including off highway vehicles (OHV), all-terrain vehicles (ATV), motorcycles, mountain biking and other mechanized methods of travel have been recognized as a potential direct and indirect threat to Gunnison sage-grouse and their habitat (BLM 2009, p. 36). In Colorado, the number of annual off highway vehicle (OHV) registrations has increased from 12,000 in 1991 to 131,000 in 2007 (BLM 2009, p. 37). Four wheel drive, OHV, motorcycle, specialty vehicle, and mountain bike use is expected to increase in the future based on increased population in general and increased population density in the area (as discussed above). Numerous off-road routes and access points to habitat used by Gunnison sage-grouse combined with increasing capabilities for mechanized travel and increased human population further contribute to habitat fragmentation.

Roads in the Gunnison Basin Population Area – On BLM lands in the Gunnison Basin there are currently 2,050 km (1,274 mi) of roads within 6.4 km (4 mi) of Gunnison sage-grouse leks. Eighty-seven percent of all Gunnison sage-grouse nests were located less than 6.4 km (4 mi) from the lek of capture (Apa 2004, p. 21). However, the BLM proposes to reduce road length to 1,157 km (719 mi) (BLM 2010, p. 147). Currently, 1,349 km (838 mi) of roads accessible to 2-wheel drive passenger cars exist in occupied Gunnison sage-grouse habitat in the Gunnison Basin. Four-wheel-drive vehicle roads, as well as motorcycle, mountain bike, horse, and hiking trails are heavily distributed throughout the range of Gunnison sage-grouse (BLM 2009, pp. 27, 55, 86), which further increases the overall density of roads and their direct and indirect effects on Gunnison sage-grouse. User-created roads and trails have increased since 2004 (BLM 2009, p. 33), although we do not know the percentage increase.

Using a spatial dataset of roads in the Gunnison Basin we performed GIS analyses on the potential effects of roads to Gunnison sage-grouse and their habitat. To account for secondary effects from invasive weed spread from roads (see discussion below in Invasive Plants), we applied a 0.7 km (0.4 mi) buffer (Bradley and Mustard 2006, p. 1146) to all roads in the Gunnison Basin. Results of these analyses indicate that approximately 85 percent of occupied habitat in the Gunnison Basin has an increased likelihood of current or future road-related invasive weed invasion. When all roads in the Gunnison basin are buffered by 6.4 km (4 mi) or 9.6 km (6 mi) to account for nesting avoidance (Aldridge *et al.* 2010, p. 27) and secondary effects from mammal and corvid foraging areas (Knick *et al* in press, p. 113), respectively, all occupied habitat in the Gunnison Basin is indirectly affected by roads.

Roads in All Other Population Areas – Approximately 140 km (87 mi), 243 km (151 mi), and 217 km (135 mi) of roads (all road classes) occur on BLM lands within the Cerro Summit–Cimarron–Sims Mesa, Crawford, and San Miguel Basin population areas, respectively, all of which are managed by the BLM (BLM 2009, p. 71). We do not have information on the total length of roads within the Monticello–Dove Creek, Pīnon Mesa, or Poncha Pass Gunnison sage-grouse populations. However, several maps provided by the BLM show that roads are widespread and common throughout these population areas (BLM 2009, pp. 27, 55, 86).

Summary of Roads

As described above in the 'Residential Development' section, the human population is increasing throughout the range of Gunnison sage-grouse (CDOLA 2009a, pp. 2-3; CWCB 2009, p. 15), and we have no data indicating this trend will be reversed. Gunnison sage-grouse are dependent on large contiguous and unfragmented landscapes to meet their life-history needs (GSRSC 2005, pp. 26-30), and the existing road density throughout much of the range of Gunnison sage-grouse has negatively affected the species. The collective influences of fragmentation and disturbance from roads reduce the effective habitat around these areas making them inhospitable to sage-grouse (Aldridge *et al.* 2010, pp. 24-25; Aldridge and Boyce 2007, p. 520; Knick *et al.* 2009, in press, p. 25 and references therein). Given the current human demographic and economic trends described above in the Residential Development section, we believe that increased road use and increased road construction associated with residential development will continue at least through 2050, and likely longer. The resulting habitat loss, degradation, and fragmentation from roads is a significant threat to Gunnison sage-grouse now and in the foreseeable future.

Powerlines

Powerlines can directly affect greater sage-grouse by posing a collision and electrocution hazard (Braun 1998, pp. 145-146; Connelly *et al.* 2000a, p. 974), and can have indirect effects by decreasing lek recruitment (Braun *et al.* 2002, p. 10), increasing predation (Connelly *et al.* 2004, p. 13-12), fragmenting habitat (Braun 1998, p. 146), and facilitating the invasion of exotic annual plants (Knick *et al.* 2003, p. 612; Connelly *et al.* 2004, p. 7-25). Proximity to powerlines is associated with Gunnison and greater sage-grouse extirpation (Wisdom *et al.* in press, p. 20). Due to the potential spread of invasive species and predators as a result of powerline construction and maintenance, the impact from a powerline is greater than its actual footprint. We believe the effects to Gunnison sage-grouse are similar to those observed in greater sage-grouse and that the impact from a powerline is greater than its footprint.

In areas where the vegetation is low and the terrain relatively flat, power poles provide an attractive hunting and roosting perch, as well as nesting stratum for many species of raptors and corvids (Steenhof *et al.* 1993, p. 27; Connelly *et al.* 2000a, p. 974; Manville 2002, p. 7; Vander Haegen *et al.* 2002, p. 503). Power poles increase a raptor's range of vision, allow for greater speed during attacks on prey, and serve as

territorial markers (Steenhof *et al.* 1993, p. 275; Manville 2002, p. 7). Raptors may actively seek out power poles where natural perches are limited. For example, within 1 year of construction of a 596-km (3–2 -mi) transmission line in southern Idaho and Oregon, raptors and common ravens began nesting on the supporting poles (Steenhof *et al.* 1993, p. 275). Within 10 years of construction, 133 pairs of raptors and ravens were nesting along this stretch (Steenhof *et al.* 1993, p. 275). Raven counts increased by approximately 200 percent along the Falcon-Gondor transmission line corridor in Nevada within 5 years of construction (Atamian *et al.* 2007, p. 2). The increased abundance of raptors and corvids within occupied greater and Gunnison sage-grouse habitats can result in increased predation. Ellis (1985, p. 10) reported that golden eagle (*Aquila chryrsaetos*) predation on sage-grouse on leks increased from 26 to 73 percent of the total predation after completion of a transmission line within 200 meters (m) (220 yards (yd)) of an active sage-grouse lek in northeastern Utah. The lek was eventually abandoned, and Ellis (1985, p. 10) concluded that the presence of the powerline resulted in changes in sage-grouse dispersal patterns and caused fragmentation of the habitat. Golden eagles are found throughout the range of Gunnison sage-grouse (USGS 2010, p. 1), and golden eagles were found to be the dominant species recorded perching on power poles in Utah in Gunnison sage-grouse habitat (Prather and Messmer 2009, p. 12).

Leks within 0.4 km (0.25 mi) of new powerlines constructed for coalbed methane development in the Powder River Basin of Wyoming had significantly lower growth rates, as measured by recruitment of new males onto the lek, compared to leks further from these lines, presumably resulting from increased raptor predation (Braun *et al.* 2002, p. 10). Within their analysis area, Connelly *et al.* (2004, p. 7-26) assumed a 5 to 6.9-km (3.1 to 4.3-mi) radius buffer around the perches, based on the average foraging distance of these corvids and raptors, and estimated that the area potentially influenced by additional perches provided by powerlines was 672,644 to 837,390 km^2 (259,641 to 323,317 mi^2), or 32 to 40 percent of their assessment area. The actual impact on an area would depend on corvid and raptor densities within the area (see discussion in Factor C, below).

The presence of a powerline may fragment sage-grouse habitats even if raptors are not present. The use of otherwise suitable habitat by sage-grouse near powerlines increased as distance from the powerline increased for up to 600 m (660 yd) (Braun 1998, p. 8). Based on those unpublished data, Braun (1998, p. 8) reported that the presence of powerlines may limit Gunnison and greater sage-grouse use within 1 km (0.6 mi) in otherwise suitable habitat. Similar results were recorded for other grouse species. For example, lesser and greater prairie-chickens (*Tympanuchus pallidicinctus* and *T. cupido*, respectively) avoided otherwise suitable habitat near powerlines (Pruett *et al.* 2009, p. 6). Additionally, both species also crossed powerlines less often than nearby roads, which suggests that powerlines are a particularly strong barrier to movement (Pruett *et al.* 2009, p. 6).

Sage-grouse also may avoid powerlines as a result of the electromagnetic fields present (Wisdom *et al.* in press, p. 19). Electromagnetic fields have been demonstrated to alter the behavior, physiology, endocrine systems and immune function in birds, with negative consequences on reproduction and development (Fernie and Reynolds 2005, p. 135). Birds are diverse in their sensitivities to electromagnetic field exposures, with domestic chickens being very sensitive. Many raptor species are less affected (Fernie and Reynolds 2005, p. 135). No studies have been conducted specifically on sage-grouse. Therefore, we do not know the impact to the Gunnison sage-grouse from electromagnetic fields.

Linear corridors through sagebrush habitats can facilitate the spread of invasive species, such as cheatgrass (*Bromus tectorum*) (Gelbard and Belnap 2003, pp. 424-426; Knick *et al.* 2003, p. 620; Connelly *et al.* 2004, p. 1-2). However, we were unable to find any information regarding the amount of invasive species incursion as a result of powerline construction.

Powerlines in the Gunnison Basin Population Area – On approximately 121,000 ha (300,000 ac) of BLM land in the Gunnison Basin, 36 rights-of-way for power facilities, power lines, and transmission lines have resulted in the direct loss of 350 ha (858 ac) of occupied habitat (Borthwick 2005b, pers comm.). As discussed above, the impacts of these lines likely extend beyond their actual footprint. We performed a GIS analysis of transmission line location in relation to overall habitat area and Gunnison sage-grouse lek locations in the Gunnison Basin Population area to obtain an estimate of the potential effects in the Basin. Results of these analyses indicate that 68 percent of the Gunnison Basin population area is within 6.9 km (4.3 mi) of an electrical transmission line and is potentially influenced by avian predators utilizing the additional perches provided by transmission lines. This area contains 65 of 109 active leks (60 percent) in the Gunnison Basin population. These results suggest that potential increased predation resulting from transmission lines have the potential to affect a substantial portion of the Gunnison Basin population.

Powerlines in All Other Population Areas – A transmission line runs through the Dry Creek Basin group in the San Miguel Basin population, and the Beaver Mesa group has two transmission lines. None of the transmission lines in the San Miguel Basin have raptor proofing, nor do most distribution lines (Ferguson 2005, pers comm.) so their use by raptors and corvids as perch sites for hunting and use for nest sites is not discouraged. One major electric transmission line runs east-west in the northern portion of the current range of the Monticello group (San Juan County Gunnison Sage-grouse Working Group (GSWG) 2005, p. 17). Powerlines do not appear to be present in sufficient density to pose a significant threat to Gunnison sage-grouse in the Pinon Mesa population at this time. One transmission line parallels Highway 92 in the Crawford population, and distribution lines run from there to homes on the periphery of the current range (Ferguson 2005, pers. comm.).

Summary of Powerlines

The projected human population growth rate in and near most Gunnison sage-grouse populations is high (see discussion under Residential Development). As a result, we expect an associated increase in distribution powerlines. Powerlines are likely negatively affecting Gunnison sage-grouse as they contribute to habitat loss and fragmentation and facilitation of predators of Gunnison sage-grouse. Given the current demographic and economic trends described above, we believe that existing powerlines and anticipated distribution of powerlines associated with residential development will continue at least through 2050, and likely longer. The resulting habitat loss and fragmentation from powerlines, and the effects of avian predators that use them, is a significant threat to Gunnison sage-grouse now and in the foreseeable future.

Fire

The nature of historical fire patterns in sagebrush communities, particularly in Wyoming big sagebrush (*Artemisia*

tridentata var. *wyomingensis)*, is not well understood, and a high degree of variability likely occurred (Miller and Eddleman 2000, p. 16; Zouhar *et al.* 2008, p. 154; Baker in press, p. 16). In general, mean fire return intervals in low-lying, xeric (dry) big sagebrush communities range from more than 100 to 350 years, and return intervals decrease from 50 to more than 200 years in more mesic (wet) areas, at higher elevations, during wetter climatic periods, and in locations associated with grasslands (Baker 2006, p. 181; Mensing *et al.* 2006, p. 75; Baker, in press, pp. 15-16; Miller *et al.*, in press, p. 35).

Mountain big sagebrush (*Artemisia tridenata* var. *vaseyana)*, the most important and widespread sagebrush species for Gunnison sage-grouse, is killed by fire and can require decades to recover. In nesting and wintering sites, fire causes direct loss of habitat due to reduced cover and forage (Call and Maser 1985, p. 17). While there may be limited instances where burned habitat is beneficial, these gains are lost if alternative sagebrush habitat is not readily available (Woodward 2006, p. 65).

Herbaceous understory vegetation plays a critical role throughout the breeding season as a source of forage and cover for Gunnison sage-grouse females and chicks. The response of herbaceous understory vegetation to fire varies with differences in species composition, pre-burn site condition, fire intensity, and pre- and post-fire patterns of precipitation. In general, when not considering the synergistic effects of invasive species, any beneficial short-term flush of understory grasses and forbs is lost after only a few years and little difference is apparent between burned and unburned sites (Cook *et al.* 1994, p. 298; Fischer *et al.* 1996, p. 196; Crawford 1999, p. 7; Wrobleski 1999, p. 31; Nelle *et al.* 2000, p. 588; Paysen *et al.* 2000, p. 154; Wambolt *et al.* 2001, p. 250).

In addition to altering plant community structure, fires can influence invertebrate food sources (Schroeder *et al.* 1999, p. 5). However, because few studies have been conducted and the results of those available vary, the specific magnitude and duration of the effects of fire on insect communities is still uncertain.

A clear positive response of Gunnison or greater sage-grouse to fire has not been demonstrated (Braun 1998, p. 9). The few studies that have suggested fire may be beneficial for greater sage-grouse were primarily conducted in mesic areas used for brood-rearing (Klebenow 1970, p. 399; Pyle and Crawford 1996, p. 323; Gates 1983, *in* Connelly *et al.* 2000c, p. 90; Sime 1991, *in* Connelly *et al.* 2000a, p. 972). In this type of habitat, small fires may maintain a suitable habitat mosaic by reducing shrub encroachment and encouraging understory growth. However, without available nearby sagebrush cover, the utility of these sites is questionable, especially within the six small Gunnison sage-grouse populations where fire could further degrade and fragment the remaining habitat. Sagebrush loss as a result of fire is likely to have proportionally more individual bird and population level impacts as the amount of sagebrush declines within each of the remaining populations. As the amount of sagebrush remaining within a population declines, the greater the potential impact is to that population.

The invasion of the exotic cheatgrass increases fire frequency within the sagebrush ecosystem (Zouhar *et al.* 2008, p. 41; Miller *et al.* in press, p. 39). Cheatgrass readily invades sagebrush communities, especially disturbed sites, and changes historical fire patterns by providing an abundant and easily ignitable fuel source that facilitates fire spread. While sagebrush is killed by fire and is slow to reestablish, cheatgrass recovers within 1 to 2 years of a fire event (Young and Evans 1978, p. 285). This annual recovery leads to a readily burnable fuel source and ultimately a reoccurring fire cycle that prevents sagebrush reestablishment (Eiswerth *et al.* 2009, p. 1324). The extensive distribution and highly invasive nature of cheatgrass poses substantial increased risk of fire and permanent loss of sagebrush habitat, as areas disturbed by fire are highly susceptible to further invasion and ultimately habitat conversion to an altered community state. For example, Link *et al.* (2006, p. 116) show that risk of fire increases from approximately 46 to 100 percent when ground cover of cheatgrass increases from 12 to 45 percent or more. We do not have a reliable estimate of the amount of area occupied by cheatgrass in the range of Gunnison sage-grouse. However, cheatgrass is found at numerous locations throughout the Gunnison Basin (BLM 2009, p. 60).

Fire in the Gunnison Basin Population Area – Six prescribed burns have occurred on BLM lands in the Gunnison Basin since 1984, totaling approximately 409 ha (1,010 ac) (BLM 2009, p. 35). The fires created large sagebrush-free areas that were further degraded by poor post-burn livestock management (BLM 2005a, p. 13). As a result, these areas are no longer suitable as Gunnison sage-grouse habitat. Approximately 8,470 ha (20,930 ac) of prescribed burns occurred on Forest Service lands in the Gunnison Basin since 1983 (USFS 2009, p. 1). A small wildfire on BLM lands near Hartman Rocks burned 8 ha (20 ac) in 2007 (BLM 2009, p. 35). The total area of occupied Gunnison sage-grouse habitat burned in recent decades is approximately 8,887 ha (21,960 ac), which constitutes 1.5 percent of the occupied Gunnison sage-grouse habitat area. Cumulatively, this equates to a relatively small amount of habitat burned over a period of nearly three decades. This information suggests that there has not been a demonstrated change in fire cycle in the Gunnison Basin population area to date.

Fire in All Other Population Areas – Two prescribed burns conducted in 1986 (105 ha (260 ac)) and 1992 (140 ha (350 ac)) on BLM land in the San Miguel Basin on the north side of Dry Creek Basin had negative impacts on sage-grouse. The burns were conducted for big game forage improvement, but the sagebrush died and was largely replaced with weeds (BLM 2005b, pp. 7-8). The Burn Canyon fire in the Dry Creek Basin and Hamilton Mesa areas burned 890 ha (2,200 ac) in 2000. Three fires have occurred in Gunnison sage-grouse habitat since 2004 on lands managed by the BLM in the Crawford, Cerro Summit–Cimarron–Sims Mesa, and San Miguel Basin population areas. There have been no fires since 2004 on lands managed by the BLM within the Monticello–Dove Creek population. Because these fires were mostly small in size, we do not believe they resulted in substantial impacts to Gunnison sage-grouse.

Several wildfires near or within the Pĩnon Mesa population area have occurred in the past 20 years. One fire burned a small amount of occupied Gunnison sage-grouse habitat in 1995, and several fires burned in potential Gunnison sage-grouse habitat. Individual burned areas ranged from 3.6 ha (9 ac) to 2,160 ha (5,338 ac). A wildfire in 2009 burned 1,053 ha (2,602 ac), predominantly within vacant or unknown Gunnison sage-grouse habitat (suitable habitat for sage-grouse that is separated from occupied habitats that has not been adequately inventoried, or without recent documentation of grouse presence) near the Pĩnon Mesa population. Since 2004, a single 2.8 ha (7 ac) wildfire occurred in the Cerro Summit–Cimarron–Sims Mesa population area, and two prescribed fires, both less than 12 ha (30 ac), were implemented in the San Miguel population area. There was no fire activity within occupied Gunnison sage-grouse habitat in the last two decades in

the Poncha Pass population area (CDOW 2009a, pp. 125-126) or the Monticello–Dove Creek population area (CDOW 2009a, p. 75; UDWR 2009, p. 5).

Summary of Fire

Fires can cause the proliferation of weeds and can degrade suitable sage-grouse habitat, which may not recover to suitable conditions for decades, if at all (Pyke in press, pp. 18-19). Recent fires in Gunnison sage-grouse habitat were mostly small in size and did not result in substantial impacts to Gunnison sage-grouse, and there has been no obvious change in fire cycle in any Gunnison sage-grouse population area. Therefore, we do not consider fire to be a significant threat to Gunnison sage-grouse or its habitat at this time. It is not currently possible to predict the extent or location of future fire events. However, existing data indicates that climate change has the potential to alter changes in the distribution and extent of cheatgrass and sagebrush and associated fire frequencies. The best available data indicates that fire frequency may increase in the foreseeable future (which we consider to be indefinite) because of increases in cover of cheatgrass (Zouhar *et al.* 2008, p. 41; Miller *et al.* in press, p. 39; Whisenant 1990, p. 4) and the projected effects of climate change (Miller *et al.* in press, p. 47; Prevey *et al.* 2009, p. 11) (see Invasive Plants and Climate Change discussions below). Therefore, fire is likely to become an increasingly significant threat to the Gunnison sage-grouse in the foreseeable future.

Invasive Plants

For the purposes of this finding, we define invasive plants as those that are not native to an ecosystem and that have a negative impact on Gunnison sage-grouse habitat. Invasive plants alter native plant community structure and composition, productivity, nutrient cycling, and hydrology (Vitousek 1990, p. 7) and may cause declines in native plant populations through competitive exclusion and niche displacement, among other mechanisms (Mooney and Cleland 2001, p. 5446). Invasive plants reduce and, in cases where monocultures of them occur, eliminate vegetation that sage-grouse use for food and cover. Invasive plants do not provide quality sage-grouse habitat. Sage-grouse depend on a variety of native forbs and the insects associated with them for chick survival, and sagebrush, which is used exclusively throughout the winter for food and cover.

Along with replacing or removing vegetation essential to sage-grouse, invasive plants fragment existing sage-grouse habitat. They can create long-term changes in ecosystem processes, such as fire-cycles (see discussion under Fire above) and other disturbance regimes that persist even after an invasive plant is removed (Zouhar *et al.* 2008, p. 33). A variety of nonnative annuals and perennials are invasive to sagebrush ecosystems (Connelly *et al.* 2004, pp. 7-107 and 7-108; Zouhar *et al.* 2008, p. 144). Cheatgrass is considered most invasive in *Artemisia tridentata* ssp. *wyomingensis* communities (Connelly *et al.* 2004, p. 5-9). Other invasive plants found within the range of Gunnison sage-grouse that are reported to take over large areas include: spotted knapweed (*Centaurea maculosa*), Russian knapweed (*Acroptilon repens*), oxeye daisy (*Leucanthemum vulgare)*, yellow toadflax (*Linaria vulgaris)*, and field bindweed (*Convolvulus arvensis)* (BLM 2009, p. 28, 36; Gunnison Watershed Weed Commission (GWWC) 2009, pp. 4-6). Although not yet reported to create large expanses in the range of Gunnison sage-grouse, the following weeds are also known from the species' range and do cover large expanses in other parts of western North America: diffuse knapweed (*Centaurea diffusa*), whitetop (*Cardaria draba*), jointed goatgrass (*Aegilops cylindrica*), and yellow starthistle (*Centaurea solstitialis*). Other invasive plant species present within the range of Gunnison sage-grouse that are problematic yet less likely to overtake large areas include: Canada thistle (*Cirsium arvense)*, musk thistle (*Carduus nutans*), bull thistle (*Cirsium vulgare*), houndstongue (*Cynoglossum officinale*), black henbane (*Hyoscyamus niger),* common tansy *(Tanacetum vulgare*), and absinth wormwood (*Artemisia biennis*) (BLM 2009, p. 28, 36; GWWC 2009, pp. 4-6).

Cheatgrass impacts sagebrush ecosystems by potentially shortening fire intervals from several decades, depending on the type of sagebrush plant community and site productivity, to as low as 3 to 5 years, perpetuating its own persistence and intensifying the role of fire (Whisenant 1990, p. 4). Connelly *et al.* (2004, p. 7-5) suggested that cheatgrass shortens fire intervals to less than 10 years. As discussed under the discussion of climate change below, temperature increases may increase the competitive advantage of cheatgrass in higher elevation areas where its current distribution is limited (Miller *et al.* in press, p. 47). Decreased summer precipitation reduces the competitive advantage of summer perennial grasses, reduces sagebrush cover, and subsequently increases the likelihood of cheatgrass invasion (Bradley 2009, pp. 202-204; Prevey *et al.* 2009, p. 11). This could increase the susceptibility of sagebrush areas in Utah and Colorado to cheatgrass invasion (Bradley 2009, p. 204).

A variety of restoration and rehabilitation techniques are used to treat invasive plants, but they can be costly and are mostly unproven and experimental at a large scale. In the last approximately 100 years, no broad-scale cheatgrass eradication method has been developed. Habitat treatments that either disturb the soil surface or deposit a layer of litter increase cheatgrass establishment in the Gunnison Basin when a cheatgrass seed source is present (Sokolow 2005, p. 51). Therefore, researchers recommend using habitat treatment tools, such as brush mowers, with caution and suggest that treated sites should be monitored for increases in cheatgrass emergence (Sokolow 2005, p. 49).

Invasive Plants in the Gunnison Basin Population Area – Quantifying the total amount of Gunnison sage-grouse habitat impacted by invasive plants is difficult due to differing sampling methodologies, incomplete sampling, inconsistencies in species sampled, and varying interpretations of what constitutes an infestation (Miller *et al.,* in press, p. 19). Cheatgrass has invaded areas in Gunnison sage-grouse range, supplanting sagebrush habitat in some areas. However, we do not have a reliable estimate of the amount of area occupied by cheatgrass in the range of Gunnison sage-grouse. While not ubiquitous, cheatgrass is found at numerous locations throughout the Gunnison Basin (BLM 2009, p. 60). Cheatgrass infestation within a particular area can range from a small number of individuals scattered sparsely throughout a site, to complete or near-complete understory domination of a site. Cheatgrass has increased throughout the Gunnison Basin in the last decade and is becoming increasingly detrimental to sagebrush community types (BLM 2009, p. 7). Currently in the Gunnison Basin, cheatgrass attains site dominance most often along roadways; however, other highly disturbed areas have similar cheatgrass densities. Cheatgrass is currently present in almost every grazing allotment in Gunnison sage-grouse occupied habitat and other invasive plant species, such as Canada thistle, black henbane, spotted knapweed, Russian knapweed, Kochia, bull thistle, musk thistle, oxeye daisy, yellow toadflax and field bindweed, are found in riparian areas and roadsides

throughout the Gunnison Basin (BLM 2009, p. 7).

Although disturbed areas most often contain the highest cheatgrass densities, cheatgrass can readily spread into less disturbed and even undisturbed habitat. A strong indicator for future cheatgrass locations is the proximity to current locations (Bradley and Mustard 2006, p. 1146) as well as summer, annual, and spring precipitation, and winter temperature (Bradley 2009, p. 196). Although we lack the information to make a detailed determination on the actual extent or rate of increase, given its invasive nature, we believe cheatgrass and its negative influence on Gunnison sage-grouse will increase in the Gunnison Basin in the future because of potential exacerbation from climate change interactions and the limited success of broad-scale control efforts.

Invasive Plants in All Other Population Areas – Cheatgrass is present throughout much of the current range in the San Miguel Basin (BLM 2005c, p. 62005d), but is most abundant in the Dry Creek Basin group (CDOW 2005a, p. 101), which comprises 62 percent of the San Miguel Basin population. It is present in the five Gunnison sage-grouse subpopulations east of Dry Creek Basin although at much lower densities and does not currently pose a serious threat to Gunnison sage-grouse (CDOW 2005a, p. 101). Invasive species are present at low levels in the Monticello group (San Juan County GSGWG 2005, p. 20). However, there is no evidence that they are affecting the population. Cheatgrass dominates 10–15 percent of the sagebrush understory in the current range of the Pĩnon Mesa population (Lambeth 2005, pers comm.). It occurs in the lower elevation areas below Pĩnon Mesa that were formerly Gunnison sage-grouse range. Cheatgrass invaded two small prescribed burns in or near occupied habitat conducted in 1989 and 1998 (BLM 2005d, p. 62005a), and continues to be a concern with new ground-disturbing projects. Invasive plants, especially cheatgrass, occur primarily along roads, other disturbed areas, and isolated areas of untreated vegetation in the Crawford population. The threat of cheatgrass may be greater to sage-grouse than all other nonnative species combined and could be a significant limiting factor when and if disturbance is used to improve habitat conditions, unless mitigated (BLM 2005c, p. 6). No current estimates of the extent of weed invasion are available (BLM 2005c, p. 82005d).

Within the Pĩnon Mesa Gunnison sage-grouse population area, 520 ha (1,284 ac) of BLM lands are currently mapped with cheatgrass as the dominant species (BLM 2009, p. 3). This is not a comprehensive inventory of cheatgrass occurrence, as it only includes areas where cheatgrass dominates the plant community and does not include areas where the species is present at lower densities. Cheatgrass distribution has not been comprehensively mapped for the Monticello–Dove Creek population area; however, cheatgrass is beginning to be assessed on a site-specific and project-level basis. No significant invasive plant occurrences are currently known in the Poncha Pass population area.

Summary of Invasive Plants

Invasive plants negatively impact Gunnison sage-grouse primarily by reducing or eliminating native vegetation that sage-grouse require for food and cover, resulting in habitat loss and fragmentation. Although invasive plants, especially cheatgrass, have affected some Gunnison sage-grouse habitat, the impacts do not currently appear to be threatening individual populations or the species rangewide. However, invasive plants continue to expand their range, facilitated by ground disturbances such as fire, grazing, and human infrastructure. Climate change will likely alter the range of individual invasive species, increasing fragmentation and habitat loss of sagebrush communities. Even with treatments, given the history of invasive plants on the landscape, and our continued inability to control such species, we anticipate invasive plants will persist and will likely continue to spread throughout the range of the species. Therefore, invasive plants and associated fire risk will be on the landscape for the foreseeable future. Although currently not a significant threat to the Gunnison sage-grouse at the species level, we anticipate invasive species to become an increasingly significant threat to the species in the foreseeable future, particularly when considered in conjunction with future climate projections and potential changes in sagebrush plant community composition and dynamics.

Pĩnon-Juniper Encroachment

Pĩnon-juniper woodlands are a native habitat type dominated by Pĩnon pine (*Pinus edulis*) and various juniper species (*Juniperus* spp.) that can encroach upon, infill, and eventually replace sagebrush habitat. Pĩnon-juniper extent has increased 10-fold in the Intermountain West since EuroAmerican settlement, causing the loss of many bunchgrass and sagebrush-bunchgrass communities (Miller and Tausch 2001, pp. 15-16). Pĩnon-juniper woodlands have also been expanding throughout portions of the range of Gunnison sage-grouse (BLM 2009, pp. 14, 17, 25). Pĩnon-juniper expansion has been attributed to the reduced role of fire, the introduction of livestock grazing, increases in global carbon dioxide concentrations, climate change, and natural recovery from past disturbance (Miller and Rose 1999, pp. 555-556; Miller and Tausch 2001, p. 15; Baker, in press, p. 24). In addititon, Gambel oak invasion as a result of fire suppression also has been identified as a potential threat to Gunnison sage-grouse (CDOW 2002, p. 139).

Similar to powerlines, trees provide perches for raptors, and as a consequence, Gunnison sage-grouse avoid areas with Pĩnon-juniper (Commons *et al.* 1999, p. 239). The number of male Gunnison sage-grouse on leks in southwest Colorado doubled after Pĩnon-juniper removal and mechanical treatment of mountain sagebrush and deciduous brush (Commons *et al.* 1999, p. 238).

Pĩnon-Juniper Encroachment in All Population Areas – We have no information indicating that the Gunnison Basin population area is currently undergoing significant Pĩnon-juniper encroachment. A significant portion of the Pĩnon Mesa population is undergoing Pĩnon-juniper encroachment. Approximately 9 percent (1,140 ha [3,484 ac]) of occupied habitat in the Pĩnon Mesa population area have Pĩnon-juniper coverage, while 7 percent (4,414 ha [10,907 ac)] of vacant or unknown and 13 percent (7,239 ha [17,888 ac]) of potential habitat (unoccupied habitats that could be suitable for occupation of sage-grouse if practical restoration were applied) have encroachment (BLM 2009, p. 17).

Some areas on lands managed by the BLM are known to be undergoing Pĩnon-juniper invasion. However, the extent of the area affected has not been quantified (BLM 2009, p. 74; BLM 2009, p. 9). Approximately 9 percent of the 1,300 ha (3,200 ac) of the current range in the Crawford population is classified as dominated by Pĩnon-juniper (GSRSC 2005, p. 264). However, BLM (2005d, p. 8) estimates that as much as 20 percent of the population area is occupied by Pĩnon-juniper. Pĩnon and juniper trees have been encroaching in peripheral habitat on Sims Mesa, and to a lesser extent on Cerro Summit, but not to the point where it is a serious threat to the Cerro Summit–Cimarron–Sims Mesa population area (CDOW 2009a, p. 47). Pĩnon and juniper trees are reported to be encroaching throughout the current

range in the Monticello group, based on a comparison of historical versus current aerial photos, but no quantification or mapping of the encroachment has occurred (San Juan County GSWG 2005, p. 20). A relatively recent invasion of Pĩnon and juniper trees between the Dove Creek and Monticello groups appears to be contributing to their isolation from each other (GSRSC 2005, p. 276).

Within the range of Gunnison sage-grouse, approximately 5,341 ha (13,197 ac) of Pĩnon-juniper have been treated with various methods designed to remove Pĩnon and juniper trees since 2005, and nearly half of which occurred in the Pĩnon Mesa population (CDOW 2009c, entire). Mechanical treatment of areas experiencing Pĩnon-juniper encroachment continues to be one of the most successful and economical habitat treatments for the benefit of Gunnison sage-grouse.

Summary of Pĩnon-Juniper Encroachment

Most Gunnison sage-grouse population areas are experiencing low to moderate levels of Pĩnon-juniper encroachment; however, Pĩnon-juniper encroachment in the Pĩnon Mesa population has been significant. The encroachment of Pĩnon-juniper into sagebrush habitats contributes to the fragmentation of Gunnison sage-grouse habitat. However, Pĩnon-juniper treatments, particularly when completed in the early stages of encroachment when the sagebrush and forb understory is still intact, have the potential to provide an immediate benefit to sage-grouse. Approximately 5,341 ha (13,197 ac) of Pĩnon-juniper encroachment within the range of Gunnison sage-grouse has been treated. We expect Pĩnon-juniper encroachment and corresponding treatment efforts to continue into the foreseeable future, which we consider to be indefinite for this threat. Although Pĩnon-juniper encroachment is contributing to habitat fragmentation in a limited area, the level of encroachment is not sufficient to pose a significant threat to Gunnison sage-grouse at a population or rangewide level either now or in the foreseeable future. Pĩnon-juniper encroachment may become an increasingly significant threat to the Gunnison sage-grouse if mechanical treatment of areas experiencing Pĩnon-juniper encroachment declines, and if suitable habitat continues to be lost due to other threats such as residential and associated infrastructure development.

Domestic Grazing and Wild Ungulate Herbivory

At least 87 percent of occupied Gunnison sage-grouse habitat on Federal lands is currently grazed by domestic livestock (USFWS 2010c, entire). We lack information on the proportion of Gunnison sage-grouse habitat on private lands that is currently grazed. Excessive grazing by domestic livestock during the late 1800s and early 1900s, along with severe drought, significantly impacted sagebrush ecosystems (Knick *et al.* 2003, p. 616). Although current livestock stocking rates in the range of Gunnison sage-grouse are substantially lower than historical levels (Laycock *et al.* 1996, p. 3), long-term effects from this overgrazing, including changes in plant communities and soils, persist today (Knick *et al.* 2003, p.116).

Although livestock grazing and associated land treatments have likely altered plant composition, increased topsoil loss, and increased spread of exotic plants, the impacts on Gunnison sage-grouse are not clear. Few studies have directly addressed the effect of livestock grazing on sage-grouse (Beck and Mitchell 2000, pp. 998-1000; Wamboldt *et al.* 2002, p. 7; Crawford *et al.* 2004, p. 11), and little direct experimental evidence links grazing practices to Gunnison sage-grouse population levels (Braun 1987, pp. 136-137, Connelly and Braun 1997, p. 7-9). Rowland (2004, p. 17-18) conducted a literature review and found no experimental research that demonstrates grazing alone is responsible for reduction in sage-grouse numbers.

Despite the obvious impacts of grazing on plant communities within the range of the species, the GSRSC (2005, p. 114) could not find a direct correlation between historic grazing and reduced Gunnison sage-grouse numbers. While implications on population-level impacts from grazing can be made based on impacts of grazing on individuals, no studies have documented (positively or negatively) the actual impacts of grazing at the population level.

Sage-grouse need significant grass and shrub cover for protection from predators, particularly during nesting season, and females will preferentially choose nesting sites based on these qualities (Hagen *et al.* 2007, p. 46). In particular, nest success in Gunnison sage-grouse habitat is related to greater grass and forb heights and shrub density (Young 1994, p. 38). The reduction of grass heights due to livestock grazing in sage-grouse nesting and brood-rearing areas has been shown to negatively affect nesting success when cover is reduced below the 18 cm (7 in.) needed for predator avoidance (Gregg *et al.* 1994, p. 165). Based on measurements of cattle foraging rates on bunchgrasses both between and under sagebrush canopies, the probability of foraging on under-canopy bunchgrasses depends on sagebrush size and shape and, consequently, the effects of grazing on nesting habitats might be site specific (France *et al.* 2008, pp. 392-393).

Several authors have noted that grazing by livestock could reduce the suitability of breeding and brood-rearing habitat, negatively affecting sage-grouse populations (Braun 1987, p. 137; Dobkin 1995, p. 18; Connelly and Braun 1997, p. 231; Beck and Mitchell 2000, pp. 998-1000). Domestic livestock grazing reduces water infiltration rates and the cover of herbaceous plants and litter, compacts the soil, and increases soil erosion (Braun 1998, p. 147; Dobkin *et al.* 1998, p. 213). These impacts change the proportion of shrub, grass, and forb components in the affected area, and facilitate invasion of exotic plant species that do not provide suitable habitat for sage-grouse (Mack and Thompson 1982, p. 761; Miller and Eddleman 2000, p. 19; Knick *et al.*, in press, p. 41).

Livestock may compete directly with sage-grouse for rangeland resources. Cattle are grazers, feeding mostly on grasses, but they will make seasonal use of forbs and shrub species like sagebrush (Vallentine 1990, p. 226), a primary source of nutrition for sage-grouse. A sage-grouse hen's nutritional condition affects nest initiation rate, clutch size, and subsequent reproductive success (Barnett and Crawford 1994, p. 117; Coggins 1998, p. 30). Other effects of direct competition between livestock and sage-grouse depend on condition of the habitat and the grazing practices. Thus, the effects vary across the range of Gunnison sage-grouse. For example, poor livestock management in mesic sites results in a reduction of forbs and grasses available to sage-grouse chicks, thereby affecting chick survival (Aldridge and Brigham 2003, p. 30). Chick survival is one of the most important factors in maintaining Gunnison sage-grouse population viability (GSRSC 2005, p. 173).

Livestock can trample sage-grouse and its habitat. Although the effect of trampling at a population level is unknown, outright nest destruction has been documented, and the presence of livestock can cause sage-grouse to abandon their nests (Rasmussen and Griner 1938, p. 863; Patterson 1952, p. 111; Call and Maser 1985, p. 17; Holloran and Anderson 2003, p. 309; Coates 2007, p. 28). Coates (2007, p. 28) documented nest abandonment

following partial nest depredation by a cow. In general, all recorded encounters between livestock and grouse nests resulted in hens flushing from nests, which could expose the eggs to predation. Visual predators like ravens likely use hen movements to locate sage-grouse nests (Coates 2007, p. 33). Livestock also may trample sagebrush seedlings, thereby removing a source of future sage-grouse food and cover (Connelly *et al.* 2004, pp. 7-31). Trampling of soil by livestock can reduce or eliminate biological soil crusts making these areas susceptible to cheatgrass invasion (Mack 1981, pp. 148-149; Young and Allen 1997, p. 531).

Livestock grazing may have positive effects on sage-grouse under some habitat conditions. Evans (1986, p. 67) found that sage-grouse used grazed meadows significantly more during late summer than ungrazed meadows because grazing had stimulated the regrowth of forbs. Greater sage-grouse sought out and used openings in meadows created by cattle grazing in northern Nevada (Klebenow 1981, p. 121). Also, both sheep and goats have been used to control invasive weeds (Mosley 1996 *in* Connelly *et al.* 2004, pp. 7-49; Merritt *et al.* 2001, p. 4; Olsen and Wallander 2001, p. 30) and woody plant encroachment (Riggs and Urness 1989, p. 358) in sage-grouse habitat.

Sagebrush plant communities are not adapted to domestic grazing disturbance. Grazing changed the functioning of systems into less resilient, and in some cases, altered communities (Knick *et al.*, in press, p. 39). The ability to restore or rehabilitate areas depends on the condition of the area relative to the ability of a site to support a specific plant community (Knick *et al.*, in press, p. 39). For example, if an area has a balanced mix of shrubs and native understory vegetation, a change in grazing management can restore the habitat to its potential historic species composition (Pyke, in press, p. 11). Wambolt and Payne (1986, p. 318) found that rest from grazing had a better perennial grass response than other treatments. Active restoration would be required where native understory vegetation is much reduced (Pyke, in press, p. 15). But, if an area has soil loss or invasive species, returning the site to the native historical plant community may be impossible (Daubenmire 1970, p. 82; Knick *et al.*, in press, p. 39; Pyke, in press, p. 17). Aldridge *et al.* (2008, p. 990) did not find any relationship between sage-grouse persistence and livestock densities. However, the authors noted that livestock numbers do not necessarily correlate with range condition. They concluded that the intensity, duration, and distribution of livestock grazing are more influential on rangeland condition than the livestock density values used in their modeling efforts (Aldridge *et al.* 2008, p. 990). Currently, there is little direct evidence linking grazing practices to population levels of Gunnison or greater sage-grouse. Although grazing has not been examined at large spatial scales, as discussed above, we do know that grazing can have negative impacts to individuals, nests, breeding productivity, and sagebrush and, consequently, to sage-grouse at local scales.

Public Lands Grazing in the Gunnison Basin Population Area – Our analysis of grazing is focused on BLM lands because nearly all of the information available to us regarding current grazing management within the range of Gunnison sage-grouse was provided by the BLM. However, this information is pertinent to over 40 percent of the land area currently occupied by Gunnison sage-grouse. A summary of domestic livestock grazing management on BLM and USFS lands in occupied Gunnison sage-grouse habitat is provided in Table 3. The BLM manages approximately 122,376 ha (301,267 ac), or 51 percent of the area currently occupied by Gunnison sage-grouse in the Gunnison Basin, and approximately 98 percent of this area is actively grazed. The USFS manages approximately 34,544 ha (85,361 ac) or 14 percent of the occupied portion of the Gunnison Basin population area. In 2009, within the occupied range in the Gunnison Basin population, 13 of 62 (21 percent) active BLM grazing allotments and 3 of 35 (9 percent) of USFS grazing allotments had Gunnison sage-grouse habitat objectives incorporated into the allotment management plans or Records of Decision for permit renewals (USFWS 2010c, pp. 1-2). Habitat objectives for Gunnison sage-grouse within allotment management plans were designed such that they provide good habitat for the species when allotments are managed in accordance with the objectives. In 2009, 57 percent of the area of occupied habitat in active BLM grazing allotments (45 percent of the entire Gunnison Basin population area) had a recently completed land health assessment (LHA), and 94 percent of the area in occupied habitat in active allotments was deemed by the BLM as not meeting LHA objectives specific to Gunnison sage-grouse. The remainder of the LHA-monitored allotments were deemed to be meeting objectives or as "unknown". LHAs are assessments of the on-the-ground condition and represent the best available information on the status of the habitat. We are uncertain of habitat conditions on the remaining 55 percent of BLM lands in the Gunnison Basin. Based on the assumption that the same proportion of these lands are also not meeting LHA objectives results in an estimate of 94 percent of BLM lands in the Gunnison Basin not meeting LHA objectives specific to Gunnison sage-grouse habitat. This analysis indicates that, without taking into account habitat conditions on private lands and other Federal and State lands, up to 48 percent of the entire Gunnison Basin population area is not providing optimal habitat conditions for Gunnison sage-grouse.

The fact that most grazing allotments are not meeting LHA objectives indicates that grazing is a factor that is likely contributing to Gunnison sage-grouse habitat degradation. In addition, grazing has negatively impacted several Gunnison sage grouse treatments (projects aimed at improving habitat condition) in the Gunnison Basin (BLM 2009, p. 34). Although these areas are generally rested for 2 years after treatment, several have been heavily used by cattle shortly after the treatment, and the effectiveness of the treatments decreased (BLM 2009, p. 34) and reduced the potential benefits of the treatments.

TABLE 3. SUMMARY OF DOMESTIC LIVESTOCK GRAZING MANAGEMENT ON BLM AND USFS LANDS IN OCCUPIED HABITAT FOR EACH OF THE GUNNISON SAGE-GROUSE POPULATIONS (FROM USFWS[A] 2010C, COMPILATION OF DATA PROVIDED BY BLM[B] AND USFS[C]).

Population	Number of Active USFS Allotments	Number of Active BLM Allotments	Percent		
			Active Allotments with GUSG[d] Objectives	BLM Allotments with Completed LHA[e]	Assessed BLM Allotments Meeting LHA Objectives
Gunnison	34	62	21	66	22
San Miguel Basin	*no data*	13	0	77	40
Monticello–Dove Creek:					
Dove Creek	*n/a*	3	0	0	0
Monticello	*n/a*[f]	6	100	83	80
Piñon Mesa	*no data*	15	53	27	100
Cerro Summit–Cimarron–Sims Mesa	*n/a*[f]	10	10	50	40
Crawford[g]	*n/a*[f]	7	71	100	86
Poncha Pass	*no data*	8	13	100	100
Rangewide Averages			34	63	59

[a]United States Fish and Wildlife Service
[b]Bureau of Land Management
[c]United States Forest Service
[d]Gunnison sage-grouse
[e]Land Health Assessments
[f]No United States Forest Service Land in occupied habitat in this population area.
[f]Includes allotments on National Park Service lands but managed by the Bureau of Land Management.

Public Lands Grazing in All Other Population Areas – The BLM manages approximately 36 percent of the area currently occupied by Gunnison sage-grouse in the San Miguel Basin, and approximately 79 percent of this area is actively grazed. Within the occupied range in the San Miguel population, no active BLM grazing allotments have Gunnison sage-grouse habitat objectives incorporated into the allotment management plans or Records of Decision for permit renewals (USFWS 2010c, p. 9). In 2009, 10 of 15 (77 percent) active allotments had LHAs completed in the last 15 years; 4 of 10 allotments (40 percent) were deemed by the BLM to meet LHA objectives. Gunnison sage-grouse habitat within the 60 percent of allotments not meeting LHA objectives and the 5 allotments with no LHAs completed are likely being adversely impacted by grazing. Therefore, it appears that grazing in a large portion of this population area is a factor that is likely contributing to Gunnison sage-grouse habitat degradation.

The BLM manages 11 percent of the occupied habitat in the Dove Creek group, and 41 percent of this area is actively grazed. Within the occupied range in the Dove Creek group of the Monticello–Dove Creek population, no active BLM grazing allotments have Gunnison sage-grouse habitat objectives incorporated into the allotment management plans or Records of Decision for permit renewals (USFWS 2010c, p. 3). In 2009, no active allotments in occupied habitat had completed LHAs. Gunnison sage-grouse are not explicitly considered in grazing management planning, and the lack of habitat data limits our ability to determine the impact to the habitat on public lands.

The BLM manages on 4 percent of the occupied habitat in the Monticello group, and 83 percent of this area is grazed. Within the occupied range in the Monticello group, 6 of 6 active BLM grazing allotments have Gunnison sage-grouse habitat objectives incorporated into the allotment management plans or Records of Decision for permit renewals (USFWS 2010c, p. 6). In 2009, 88 percent of the area of occupied habitat in active allotments had a recently completed LHA. Approximately 60 percent of the area in occupied habitat in active allotments were deemed by the BLM to meet LHA objectives. This information suggests that grazing the majority of lands managed by the BLM is not likely significantly contributing to Gunnison sage-grouse habitat degradation in the Monticello population group.

The BLM manages 28 percent of occupied habitat in the Pĩnon Mesa population area, and approximately 97 percent of this area is grazed. Over 50 percent of occupied habitat in this population area is privately owned and, while grazing certainly occurs on these lands, we have no information on its extent. Within the occupied range in the Pĩnon Mesa population, 8 of 15 (53 percent) active BLM grazing allotments have Gunnison sage-grouse habitat objectives incorporated into the allotment management plans or Records of Decision for permit renewals (USFWS 2010c, p. 5). In 2009, 23 percent of the area of occupied Gunnison sage-grouse habitat in active allotments in the Pĩnon Mesa population area had LHAs completed in the last 15 years, and all of these were deemed by the BLM to meet LHA objectives. Therefore, for the portion of the Pĩnon Mesa population area for which we have information, it appears that grazing is not likely significantly contributing to Gunnison sage-grouse habitat degradation.

The BLM manages on 13 percent of the occupied habitat in the Cerro Summit–Cimarron–Sims Mesa population area, and 83 percent of this area is grazed. Within the occupied

range in the Cerro Summit–Cimarron–Sims Mesa population, 1 of 10 (10 percent) active BLM grazing allotments have Gunnison sage-grouse habitat objectives incorporated into the allotment management plans or Records of Decision for permit renewals (USFWS 2010c, p. 7). In 2009, 5 of the 10 active allotments had LHAs completed in the last 15 years and 3 (60 percent) of these were deemed by the BLM as not meeting LHA objectives. Therefore, for the small portion of the Cerro Summit–Cimarron–Sims Mesa population area for which we have information, it appears that grazing is a factor that is likely contributing to some Gunnison sage-grouse habitat degradation.

Lands administered by the BLM and NPS comprise over 75 percent of occupied habitat in the Crawford population, and 96 percent of this area is actively grazed. Grazing allotments on NPS lands in this area are administered by the BLM. Within occupied range in the Crawford population, 1 of 7 (14 percent) active BLM grazing allotments have Gunnison sage-grouse habitat objectives incorporated into the allotment management plans or Records of Decision for permit renewals (USFWS 2010c, p. 8). In 2009, all of the active allotments had LHAs completed in the last 15 years, and 86 percent were deemed by the BLM to meet LHA objectives. Seasonal forage utilization levels were below 30 percent in most Crawford Area allotments, although a small number of allotments had nearly 50 percent utilization (BLM 2009x, p. 68). Based on this information, it appears that grazing is not likely significantly contributing to Gunnison sage-grouse habitat degradation in the majority of the Crawford population area.

The BLM manages nearly half of occupied habitat in the Poncha Pass population area, and approximately 98 percent of this area is actively grazed. Within the occupied range in the Poncha Pass population, 1 of 8 (13 percent) active BLM grazing allotments have Gunnison sage-grouse habitat objectives incorporated into the allotment management plans or Records of Decision for permit renewals (USFWS 2010c, p. 4). In 2009, all active allotments in occupied habitat had completed LHAs, and all were meeting LHA objectives. Based on this information it appears that grazing is not likely significantly contributing to Gunnison sage-grouse habitat degradation in the majority of the Poncha Pass population area.

Non-federal Lands Grazing in All Population Areas –Livestock grazing on private and other non-federal lands, where present, has the potential to impact Gunnison sage-grouse, but we lack sufficient information to make an assessment. Table 1 summarizes the percentage of land area potentially available to grazing within each of the populations.

As discussed earlier, some private lands are enrolled in the CRP program and provide some benefits to Gunnison sage-grouse. The CRP land in the Monticello group has provided a considerable amount of brood-rearing habitat because of its forb component. Grazing of CRP land in Utah occurred in 2002 under emergency Farm Bill provisions due to drought and removed at least some of the grass and forb habitat component thus likely negatively affecting Gunnison sage-grouse chick survival. Radio-collared males and non-brood-rearing females exhibited temporary avoidance of grazed fields during and after grazing (Lupis *et al.* 2006, pp. 959-960), although one hen with a brood continued to use a grazed CRP field. This indicates that when CRP lands are grazed, negative impacts to their habitat and behavior may result. Since we have very little information on the status of Gunnison sage-grouse habitat on non-federal lands, we cannot assess whether the impacts that are occurring rise to the level of being a threat.

Wild Ungulate Herbivory in All Population Areas – Overgrazing by deer and elk may cause local degradation of habitats by removal of forage and residual hiding and nesting cover. Hobbs *et al.* (1996, pp. 210-213) documented a decline in available perennial grasses as elk densities increased. Such grazing could negatively impact nesting cover for sage-grouse. The winter range of deer and elk overlaps the year-round range of the Gunnison sage-grouse. Excessive but localized deer and elk grazing has been documented in the Gunnison Basin (BLM 2005a, pp. 17-18; Jones 2005, pers. comm.).

Grazing by deer and elk occurs in all Gunnison sage-grouse population areas. Although we have no information indicating that competition for resources is limiting Gunnison sage-grouse in the Gunnison Basin, BLM observed that certain mountain shrubs were being browsed heavily by wild ungulates (BLM 2009, p. 34). Subsequent results of monitoring in mountain shrub communities indicated that drought and big game were having large impacts on the survivability and size of mountain mahogany (*Cercocarpus utahensis*), bitterbrush (*Purshia tridentata*), and serviceberry (*Amelanchier alnifolia*) in the Gunnison Basin (Jupuntich *et al.* 2010, pp. 7-9). The authors raised concerns that observed reductions in shrub size and vigor will reduce drifting snow accumulation, resulting in decreased moisture availability to grasses and forbs during the spring melt. Reduced grass and forb growth could negatively impact Gunnison sage-grouse nesting and early brood-rearing habitat.

Grazing Summary

Livestock management and domestic grazing have the potential to seriously degrade Gunnison sage-grouse habitat. Grazing can adversely impact nesting and brood-rearing habitat by decreasing vegetation available for concealment from predators. Grazing also has been shown to compact soils, decrease herbaceous abundance, increase erosion, and increase the probability of invasion of exotic plant species.

The impacts of livestock operations on Gunnison sage-grouse depend upon stocking levels and season of use. We recognize that not all livestock grazing result in habitat degradation and many livestock operations within the range of Gunnison sage-grouse are employing innovative grazing strategies and conservation actions (Gunnison County Stockgrowers 2009, entire). However, available information suggests that LHA objectives specific to Gunnison sage-grouse are not being met on more than 50 percent of BLM-managed occupied Gunnison sage-grouse habitat in the Gunnison Basin, San Miguel Basin, and the Cerro Summit–Cimarron–Sims Mesa population areas. Cumulatively, the BLM-managed portion of these populations constitutes approximately 33 percent of the entire range of the species. Reduced habitat quality, as reflected in unmet LHA objectives is likely to negatively impact Gunnison sage-grouse, particularly nesting and early brood-rearing habitat, and chick survival is one of the most important factors in maintaining Gunnison sage-grouse population viability (GSRSC 2005, p. 173).

We know that grazing can have negative impacts to sagebrush and consequently to Gunnison sage-grouse at local scales. Available data indicates that impacts to sagebrush are occurring on a significant portion of the range of the species. Given the widespread nature of grazing within the range of Gunnison sage-grouse, the potential for population-level impacts is highly likely. Further, we expect grazing to persist throughout the range of Gunnison sage-grouse for the foreseeable future. Effects of domestic livestock grazing are likely being exacerbated by intense browsing of

woody species by wild ungulates in portions of the Gunnison Basin. We conclude that habitat degradation that can result from improper grazing is a significant threat to Gunnison sage-grouse now and in the foreseeable future.

Nonrenewable Energy Development

Energy development on Federal (BLM and USFS) lands is regulated by the BLM and can contain conservation measures for wildlife species (see Factor D for a more thorough discussion). The BLM (1999, p. 1) classified the area encompassing all Gunnison sage-grouse habitat for its gas and oil potential. Three of the populations have areas with high (San Miguel Basin, Monticello group) or medium (Crawford) oil and gas potential. San Miguel County, where much oil and gas activity has occurred in the last few years, ranked 9 out of 39 in Colorado counties producing natural gas in 2009 (Colorado Oil and Gas Conservation Commission 2010, p. 1) and 29 of 39 in oil production in 2009 (Colorado Oil and Gas Conservation commission 2010, p. 2).

Energy development impacts sage-grouse and sagebrush habitats through direct habitat loss from well pad construction, seismic surveys, roads, powerlines and pipeline corridors, and indirectly from noise, gaseous emissions, changes in water availability and quality, and human presence. The interaction and intensity of effects could cumulatively or individually lead to habitat fragmentation (Suter 1978, pp. 6-13; Aldridge 1998, p. 12; Braun 1998, pp. 144-148; Aldridge and Brigham 2003, p. 31; Knick *et al.* 2003, pp. 612, 619; Lyon and Anderson 2003, pp. 489-490; Connelly *et al.* 2004, pp. 7-40 to 7-41; Holloran 2005, pp. 56-57; Holloran 2007 *et al.*,, pp. 18-19; Aldridge and Boyce 2007, pp. 521-522; Walker *et al.* 2007a, pp. 2652-2653; Zou *et al.* 2006, pp. 1039-1040; Doherty *et al.* 2008, p. 193; Leu and Hanser, in press, p. 28). Increased human presence resulting from oil and gas development can impact sage-grouse either through avoidance of suitable habitat, or disruption of breeding activities (Braun *et al.* 2002, pp. 4-5; Aldridge and Brigham 2003, pp. 30-31; Aldridge and Boyce 2007, p. 518; Doherty *et al.* 2008, p. 194).

The development of oil and gas resources requires surveys for economically recoverable reserves, construction of well pads and access roads, subsequent drilling and extraction, and transport of oil and gas, typically through pipelines. Ancillary facilities can include compressor stations, pumping stations, electrical generators and powerlines (Connelly *et al.* 2004, p. 7-39; BLM 2007, p. 2-110). Surveys for recoverable resources occur primarily through noisy seismic exploration activities. These surveys can result in the crushing of vegetation. Well pads vary in size from 0.10 ha (0.25 ac) for coal-bed natural gas wells in areas of level topography to greater than 7 ha (17.3 ac) for deep gas wells and multiwell pads (Connelly *et al.* 2004, pp. 7-39; BLM 2007, pp. 2-123). Pads for compressor stations require 5–7 ha (12.4–17.3 ac) (Connelly *et al.* 2004, pp. 7-39).

The amount of direct habitat loss within an area is ultimately determined by well densities and the associated loss from ancillary facilities. Roads associated with oil and gas development were suggested to be the primary impact to greater sage-grouse due to their persistence and continued use even after drilling and production ceased (Lyon and Anderson 2003, p. 489). Declines in male greater sage-grouse lek attendance were reported within 3 km (1.9 mi) of a well or haul road with a traffic volume exceeding one vehicle per day (Holloran 2005, p. 40). Because of reasons discussed previously, we believe the effects to Gunnison sage-grouse are similar to those observed in greater sage-grouse. Sage-grouse also may be at increased risk for collision with vehicles simply due to the increased traffic associated with oil and gas activities (Aldridge 1998, p. 14; BLM 2003, p. 4-222).

Habitat fragmentation resulting from oil and gas development infrastructure, including access roads, may have greater effects on sage-grouse than the associated direct habitat losses. Energy development and associated infrastructure works cumulatively with other human activity or development to decrease available habitat and increase fragmentation. Greater sage-grouse leks had the lowest probability of persisting (40–50 percent) in a landscape with less than 30 percent sagebrush within 6.4 km (4 mi) of the lek (Walker *et al.* 2007a, p. 2652). These probabilities were even less in landscapes where energy development also was a factor.

Nonrenewable Energy Development in All Population Areas – Approximately 33 percent of the Gunnison Basin population area ranked as low oil and gas potential with the remainder having no potential for oil and gas development (GSRSC 2005, p. 130). Forty-three gas wells occur on private lands within the occupied range of the Gunnison sage-grouse. Of these, 27 wells occur in the San Miguel population, 8 in the Gunnison Basin population, 6 in the Dove Creek group of the Monticello–Dove Creek population, and 1 in each of the Crawford and Cerro Summit–Cimarron–Sims Mesa populations (derived from Colorado Oil and Gas Commission 2010, GIS dataset).

No federally leased lands exist within the Gunnison Basin population area (BLM and USFS 2010). The Monticello group is in an area of high energy potential (GSRSC 2005, p. 130); however, less than two percent of the population area contains Federal leases upon which production is occurring, and no producing leases occur in currently occupied Gunnison sage-grouse habitat (BLM Geocommunicator, 2010). No oil and gas wells or authorized Federal leases are within the Pĩnon Mesa population area (BLM 2009, p. 1; BLM Geocommunicator), and no potential for oil or gas exists in this area except for a small area on the eastern edge of the largest habitat block (BLM 1999, p. 1; GSRSC 2005, p. 130). The Crawford population is in an area with high to medium potential for oil and gas development (GSRSC 2005, p. 130). A single authorized Federal lease (BLM Geocommunicator) constitutes less than 1 percent of the Crawford population area.

Energy development is occurring primarily in the San Miguel Basin Gunnison sage-grouse population area in Colorado. The entire San Miguel Basin population area has high potential for oil and gas development (GSRSC 2005, p. 130). Approximately 13 percent of occupied habitat area within the San Miguel Basin population has authorized Federal leases; of that, production is occurring on approximately 5 percent (BLM National Integrated Lands System (NILS) p. 1). Currently, 25 gas wells are active within occupied habitat of the San Miguel Basin, and an additional 18 active wells occur immediately adjacent to occupied habitat (San Miguel County 2009, p. 1). All of these wells are in or near the Dry Creek group. The exact locations of any future drill sites are not known, but because the area is small, they will likely lie within 3 km (2 mi) of one of only three leks in this group (CDOW 2005a, p. 108).

Although the BLM has deferred (temporarily withheld from recent lease sales) oil and gas parcels nominated for leasing in occupied Gunnison sage-grouse habitat in Colorado since 2005, we expect energy development in the San Miguel Basin on public and private lands to continue over the next 20 years based on the length of development and production projects described in existing project and management plans. Current impacts from gas development may exacerbate Gunnison sage-grouse imperilment in the Dry Creek group

because this area contains some of the poorest habitat and smallest grouse populations within the San Miguel population (San Miguel Basin Gunnison sage-grouse Working Group, 2009 pp. 28 and 36).

The San Miguel Basin population area is the only area within the Gunnison sage-grouse range with a high potential for oil and gas development. However, the immediate threat to Gunnison sage-grouse is limited because the BLM is deferring leases until they can be considered within Land Use Plans (BLM 2009, p. 78). We anticipate energy development activities to continue over the next 20 years. However, because nonrenewable energy activities are limited to a small portion of the range, primarily the Dry Creek portion of the San Miguel Basin population of Gunnison sage-grouse, we do not consider nonrenewable energy development to be a significant threat to the species.

Renewable Energy – Geothermal, Solar, Wind

Geothermal energy production is similar to oil and gas development in that it requires surface exploration, exploratory drilling, field development, and plant construction and operation. Wells are drilled to access the thermal source and could take from 3 weeks to 2 months of drilling occurring on a continuous basis (Suter 1978, p. 3), which may cause disturbance to sage-grouse. The ultimate number of wells, and therefore potential loss of habitat, depends on the thermal output of the source and expected production of the plant (Suter 1978, p. 3). Pipelines are needed to carry steam or superheated liquids to the generating plant, which is similar in size to a coal- or gas-fired plant, resulting in further habitat destruction and indirect disturbance. Direct habitat loss occurs from well pads, structures, roads, pipelines and transmission lines, and impacts would be similar to those described previously for oil and gas development. The development of geothermal energy requires intensive human activity during field development and operation. Geothermal development could cause toxic gas release. The type and effect of these gases depends on the geological formation in which drilling occurs (Suter 1978, pp. 7-9). The amount of water necessary for drilling and condenser cooling may be high. Local water depletions may be a concern if such depletions result in the loss of brood-rearing habitat.

Renewable Energy in the Gunnison Basin Population Area – Approximately 87 percent of the occupied range of Gunnison sage-grouse is within a region of known geothermal potential (BLM Geocommunicator 2010, p. 1). We were unable to find any information on the presence of active geothermal energy generation facilities; however, we are aware of three current applications for geothermal leases within the range of Gunnison sage-grouse. All of the applications are located in the same general vicinity on private, BLM, USFS, and Colorado State Land Board lands near Tomichi Dome and Waunita Hot Springs in southeastern Gunnison County. The cumulative area of the geothermal lease application parcels is approximately 4,061 ha (10,035 ac), of which approximately 3,802 ha (9,395 ac) is occupied Gunnison sage-grouse habitat, or approximately 2 percent of the Gunnison Basin population area. One active lek and two inactive leks are located within the lease application parcels. In addition, six active leks and four inactive leks are within 6.4 km (4 mi) of the lease application parcels indicating that over 80 percent of Gunnison sage-grouse seasonal use occurs within the area associated with these leks (GSRSC 2005, p. J-4). There are 74 active leks in the Gunnison Basin population, so approximately 10 percent of active leks may be affected. A significant amount of high-quality Gunnison sage-grouse nesting habitat exists on and near the lease application parcels (Aldridge *et al.* 2010, in press). This potential geothermal development would likely negatively impact Gunnison sage-grouse through the direct loss of habitat and the functional loss of habitat resulting from increased human activity in the area; however, we cannot determine the potential extent of the impact at this time because the size and location of potential geothermal energy generation infrastructure and potential resource protection conditions are unknown at this time.

Renewable Energy in All Other Population Areas – We could find no information on the presence of existing, pending, or authorized wind energy sites, solar energy sites, nor any solar energy study areas within the range of Gunnison sage-grouse. A 388-ha (960-ac) wind energy generation facility is authorized on BLM lands in San Juan County, UT. However, the authorized facility is approximately 12.9 km (8 mi) from the nearest lek in the Monticello group of the Monticello–Dove Creek Gunnison sage-grouse population. Therefore, we conclude that wind and solar energy development are not a significant threat to the Gunnison sage-grouse and we do not expect these activities to become significant threats in the foreseeable future.

The only existing or proposed renewable energy project we are aware of is located in the Gunnison Basin. A portion of the Gunnison Basin population will likely be adversely affected by proposed geothermal development if it is implemented. Because of the current preliminary status of geothermal development, we lack the specific project details to evaluate the extent to which this activity will affect the population's overall viability. Therefore, we do not consider renewable energy development to be a threat to the Gunnison sage-grouse at this time. Geothermal energy development could become a future threat to the species, but we do not know to what extent future geothermal energy development will occur. Future geothermal development could be encouraged by a new Colorado State law, signed April 30, 2010, that will facilitate streamlining of the State permitting process.

Summary of Nonrenewable and Renewable Energy Development

The San Miguel Basin population area is the only area within the Gunnison sage-grouse range with a high potential for oil and gas development. However, the immediate threat to Gunnison sage-grouse is limited because the BLM is temporarily deferring leases until they can be considered within Land Use Plans. We anticipate energy development activities to continue over the next 20 years. Although we recognize that the Dry Creek portion of the San Miguel Basin population may be impacted by nonrenewable energy development, we do not consider nonrenewable energy development to be a significant threat to the species now or in the foreseeable future, because its current and anticipated extent is limited throughout the range of Gunnison sage-grouse. Similarly, we do not consider renewable energy development to be a significant threat to Gunnison sage-grouse now or in the foreseeable future. However, geothermal energy development could increase in the future and could (depending on the level of development and minimization and mitigation measures) substantially influence the overall long-term viability of the Gunnison Basin population.

Climate Change

According to the Intergovernmental Panel on Climate Change (IPCC), "Warming of the climate system in recent decades is unequivocal, as is now evident from observations of increases in global average air and ocean

temperatures, widespread melting of snow and ice, and rising global sea level" (IPCC 2007, p. 1). Average Northern Hemisphere temperatures during the second half of the 20th century were very likely higher than during any other 50–year period in the last 500 years and likely the highest in at least the past 1,300 years (IPCC 2007, p. 30). Over the past 50 years cold days, cold nights, and frosts have become less frequent over most land areas, and hot days and hot nights have become more frequent. Heat waves have become more frequent over most land areas, and the frequency of heavy precipitation events has increased over most areas (IPCC 2007, p. 30). For the southwestern region of the United States, including western Colorado, warming is occurring more rapidly than elsewhere in the country (Karl *et al.* 2009, p. 129). Annual average temperature in west-central Colorado increased 3.6 °C (2 °F) over the past 30 years, but high variability in annual precipitation precludes the detection of long-term trends (Ray *et al.* 2008, p. 5).

Under high emission scenarios, future projections for the southwestern United States show increased probability of drought (Karl *et al.* 2009, pp. 129-134) and the number of days over 32 °C (90 °F) could double by the end of the century (Karl *et al.* 2009, p. 34). Climate models predict annual temperature increase of approximately 2.2 °C (4 °F) in the southwest by 2050, with summers warming more than winters (Ray *et al.* 2008, p. 29). Projections also show declines in snowpack across the West, with the most dramatic declines at lower elevations (below 2,500 m (8,200 ft)) (Ray *et al.*, p. 29).

Localized climate projections are problematic for mountainous areas because current global climate models are unable to capture this topographic variability at local or regional scales (Ray *et al.* 2008, pp. 7, 20). To obtain climate projections specific to the range of Gunnison sage-grouse, we requested a statistically downscaled model from the National Center for Atmospheric Research for a region covering western Colorado. The resulting projections indicate the highest probability scenario is that average summer (June through September) temperature could increase by 2.8 °C (5.1 °F), and average winter (October through March) temperature could increase by 2.2 °C (4.0 °F) by 2050 (University Corporation for Atmospheric Research (UCAR) 2009, pp. 1-15). Annual mean precipitation projections for Colorado are unclear; however, multi-model averages show a shift towards increased winter precipitation and decreased spring and summer precipitation (Ray *et al.* 2008, p. 34; Karl *et al.* 2009, p. 30). Similarly, the multi-model averages show the highest probability of a five percent increase in average winter precipitation and a five percent decrease in average spring-summer precipitation in 2050 (UCAR 2009, p. 15).

While it is unclear at this time whether or not the year 2050 predicted changes in precipitation and temperature will be of significant magnitude to alter sagebrush plant community composition and dynamics, we believe climate change is likely to alter fire frequency, community assemblages, and the ability of nonnative species to proliferate. Increasing temperature as well as changes in the timing and amount of precipitation will alter the competitive advantage among plant species (Miller *et al.* in press, p. 44), and may shift individual species and ecosystem distributions (Bachelet *et al.* 2001, p. 174). For sagebrush, spring and summer precipitation comprises the majority of the moisture available to the species; thus, the interaction between reduced precipitation in the spring-summer growing season and increased summer temperatures will likely decrease growth of mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*). This could result in a significant long-term reduction in the distribution of sagebrush communities (Miller *et al.* in press, pp. 41-45). In the Gunnison Basin, increased summer temperature was strongly correlated with reduced growth of mountain big sagebrush (Poore *et al.* 2009, p. 558). Based on these results and the likelihood of increased winter precipitation falling as rain rather than snow, Poore *et al.* (2009, p. 559) predict decreased growth of mountain big sagebrush, particularly at the lower elevation limit of the species. Because Gunnison sage-grouse are sagebrush obligates, loss of sagebrush would result in a reduction of suitable habitat and negatively impact the species. The interaction of climate change with other stressors likely has impacted and will impact the sagebrush steppe ecosystem within which Gunnison sage-grouse occur.

Temperature increases may increase the competitive advantage of cheatgrass in higher elevation areas where its current distribution is limited (Miller *et al.* in press, p. 47). Decreased summer precipitation reduces the competitive advantage of summer perennial grasses, reduces sagebrush cover, and subsequently increases the likelihood of cheatgrass invasion (Prevey *et al.* 2009, p. 11). This impact could increase the susceptibility of areas within Gunnison sage-grouse range to cheatgrass invasion (Bradley 2009, p. 204), which would reduce the overall cover of native vegetation, reduce habitat quality, and potentially decrease fire return intervals, all of which would negatively affect the species.

Summary of Climate Change

Climate change predictions are based on models with assumptions, and there are uncertainties regarding the magnitude of associated climate change parameters such as the amount and timing of precipitation and seasonal temperature changes. There is also uncertainty as to the magnitude of effects of predicted climate parameters on sagebrush plant community dynamics. These factors make it difficult to predict the effects of climate change on Gunnison sage-grouse. We recognize that climate change has the potential to alter Gunnison sage-grouse habitat by facilitating an increase in the distribution of cheatgrass and concurrently increase the potential for wildfires, which would have negative effects on Gunnison sage-grouse. However, based on the best available information on climate change projections into the next 40 years, we do not consider climate change to be a significant threat to the Gunnison sage-grouse at this time. Existing data indicates that climate change has the potential to alter changes in the distribution and extent of cheatgrass and sagebrush and associated fire frequencies and therefore is likely to become an increasingly important factor affecting Gunnison sage-grouse and its habitat in the foreseeable future.

Summary of Factor A

Gunnison sage-grouse require large, contiguous areas of sagebrush for long-term persistence, and thus are affected by factors that occur at the landscape scale. Broad-scale characteristics within surrounding landscapes influence habitat selection, and adult Gunnison sage-grouse exhibit a high fidelity to all seasonal habitats, resulting in low adaptability to habitat changes. Fragmentation of sagebrush habitats has been cited as a primary cause of the decline of Gunnison and greater sage-grouse populations (Patterson 1952, pp. 192-193; Connelly and Braun 1997, p. 4; Braun 1998, p. 140; Johnson and Braun 1999, p. 78; Connelly *et al.* 2000a, p. 975; Miller and Eddleman 2000, p. 1; Schroeder and Baydack 2001, p. 29; Johnsgard 2002, p. 108; Aldridge and Brigham 2003, p. 25; Beck *et al.* 2003, p. 203; Pedersen *et al.* 2003, pp. 23-24; Connelly *et al.* 2004, p. 4-15; Schroeder *et al.* 2004, p. 368; Leu *et al.* in press,

p. 19). Documented negative effects of fragmentation include reduced lek persistence, lek attendance, population recruitment, yearling and adult annual survival, female nest site selection, and nest initiation rates, as well as the loss of leks and winter habitat (Holloran 2005, p. 49; Aldridge and Boyce 2007, pp. 517-523; Walker *et al.* 2007a, pp. 2651-2652; Doherty *et al.* 2008, p. 194).

We examined several factors that result in habitat loss and fragmentation. Historically, losses of sagebrush habitats occurred due to conversion for agricultural croplands; however, this trend has slowed or slightly reversed in recent decades. Currently, direct and functional loss of habitat due to residential and road development in all populations, including the largest population in the Gunnison Basin, is the principal threat to Gunnison sage-grouse. Functional habitat loss also contributes to habitat fragmentation as sage-grouse avoid areas due to human activities, including noise, even when sagebrush remains intact. The collective disturbance from human activities around residences and roads reduces the effective habitat around these areas, making them inhospitable to Gunnison sage-grouse. Human populations are increasing in Colorado and throughout the range of Gunnison sage-grouse. This trend is expected to continue at least through 2050. The resulting habitat loss and fragmentation will continue to negatively affect Gunnison sage-grouse and its habitat.

Other threats from human infrastructure such as fences and powerlines may not individually threaten the Gunnison sage-grouse. However, the cumulative presence of all these features, particularly when considered in conjunction with residential and road development, does constitute a significant threat to Gunnison sage-grouse as they collectively contribute to habitat loss and fragmentation. This impact is particularly of consequence in light of the decreases in Gunnison sage-grouse population sizes observed in the six smallest populations. These infrastructure components are associated with overall increases in human populations and thus we expect them to continue to increase in the foreseeable future.

Several issues discussed above, such as fire, invasive species, and climate change, may not individually threaten the Gunnison sage-grouse. However, the documented synergy among these issues result in a high likelihood that they will threaten the species in the future. Nonnative invasive plants, including cheatgrass and other noxious weeds, continue to expand their range, facilitated by ground disturbances such as fire, grazing, and human infrastructure. Invasive plants negatively impact Gunnison sage-grouse primarily by reducing or eliminating native vegetation that sage-grouse require for food and cover, resulting in habitat loss (both direct and functional) and fragmentation. Cheatgrass is present at varying levels in nearly all Gunnison sage-grouse population areas, but there has not yet been a demonstrated change in fire cycle in the range of Gunnison sage-grouse. However, climate change may alter the range of invasive plants, intensifying the proliferation of invasive plants to the point that they and their effects on Gunnison sage-grouse habitat will likely become a threat to the species. Even with aggressive treatments, invasive plants will persist and will likely continue to spread throughout the range of Gunnison sage-grouse in the foreseeable future.

Livestock management has the potential to degrade sage-grouse habitat at local scales by causing the loss of nesting cover and decreases in native vegetation, and by increasing the probability of incursion of invasive plants. Given the widespread nature of grazing within the range of Gunnison sage-grouse, the potential for population-level impacts is highly likely. Effects of domestic livestock grazing are likely being exacerbated by intense browsing of woody species by wild ungulates in portions of the Gunnison Basin. We conclude that habitat degradation that can result from improper grazing is a significant threat to Gunnison sage-grouse now and in the foreseeable future.

Threats identified above, particularly residential development and associated infrastructure such as fences, roads, and powerlines, are cumulatively causing significant habitat fragmentation that is negatively affecting Gunnison sage-grouse. We have evaluated the best available scientific information available on the present or threatened destruction, modification or curtailment of the Gunnison sage-grouse's habitat or range. Based on the current and anticipated habitat threats identified above, and their cumulative effects as they contribute to the overall fragmentation of Gunnison sage-grouse habitat, we have determined that the present or threatened destruction, modification, or curtailment of Gunnison sage-grouse habitat poses a significant threat to the species throughout its range.

The species is being impacted by several other factors, but their significance is not at a level that they cause the species to become threatened or endangered in the foreseeable future. We do not consider nonrenewable energy development to be a significant threat to the species because its current and anticipated extent is limited throughout the range of Gunnison sage-grouse. Similarly, we do not consider renewable energy development to be a significant threat to the Gunnison sage-grouse at this time. However, geothermal energy development could increase in the future. Pĩnon-juniper encroachment does not pose a significant threat to Gunnison sage-grouse at a population or rangewide level because of its limited distribution throughout the range of Gunnison sage-grouse and the observed effectiveness of treatment projects.

A review of a database compiled by the CDOW that included local, State, and Federal ongoing and proposed Gunnison sage-grouse conservation actions (CDOW 2009c, entire) revealed a total of 224 individual conservation efforts. Of these 224 efforts, a total of 165 efforts have been completed and were focused on habitat improvement or protection. These efforts resulted in the treatment of 9,324 ha (23,041 ac), or approximately 2.5 percent of occupied Gunnison sage-grouse habitat. A monitoring component was included in 75 (45 percent) of these 165 efforts, although we do not have information on the overall effectiveness of these efforts. Given the limited collective extent of these efforts, they do not ameliorate the effects of habitat fragmentation at a sufficient scale range-wide to effectively reduce or eliminate the most significant threats to the species. We recognize ongoing and proposed conservation efforts by all entities across the range of the Gunnison sage-grouse, and all parties should be commended for their conservation efforts. Our review of conservation efforts indicates that the measures identified are not adequate to address the primary threat of habitat fragmentation at this time in a manner that effectively reduces or eliminates the most significant contributors (e.g., residential development) to this threat. All of the conservation efforts are limited in size and the measures provided to us were simply not implemented at the scale (even when considered cumulatively) that would be required to effectively reduce the threats to the species across its range. Although the ongoing conservation efforts are a positive step toward the conservation of the Gunnison sage-grouse, and some have likely reduced the severity of some threats to the species (e.g., Pĩnon-juniper invasion), on the whole we find

that the conservation efforts in place at this time are not sufficient to offset the degree of threat posed to the species by the present and threatened destruction, modification, or curtailment of its habitat.

B. Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

Hunting

Hunting for Gunnison sage-grouse does not currently occur. Hunting was eliminated in the Gunnison Basin in 2000 due to concerns with meeting Gunnison sage-grouse population objectives (CSGWG 1997, p. 66). Hunting has not occurred in the other Colorado populations of Gunnison sage-grouse since 1995 when the Pĩnon Mesa area was closed (GSRSC 2005, p. 122). Utah has not allowed hunting of Gunnison sage-grouse since 1989 (GSRSC 2005, p. 82).

Both Colorado and Utah will only consider hunting of Gunnison sage-grouse if populations can be sustained (GSRSC 2005, pp. 5, 8, 229). The Gunnison Basin Plan calls for a minimum population of 500 males counted on leks before hunting would occur again (CSGWG 1997, p. 66). The minimum population level has been exceeded in all years since 1996, except 2003 and 2004 (CDOW 2009d, p. 18-19). However, the sensitive State regulatory status and potential political ramifications of hunting the species has precluded the States from opening a hunting season. If hunting does ever occur again, harvest will likely be restricted to only 5 to 10 percent of the fall population, and will be structured to limit harvest of females to the extent possible (GSRSC 2005, p. 229). However, the ability of these measures to be implemented is in question, as adequate means to estimate fall population size have not been developed (Reese and Connelly in press, p. 21) and limiting female harvest may not be possible (WGFD 2004, p. 4; WGFD 2006, pp. 5, 7). Despite these questions, we believe that the low level of hunting that could be allowed in the future would not be a significant threat to the Gunnison sage-grouse.

One sage-grouse was known to be illegally harvested in 2001 in the Poncha Pass population (Nehring 2010, pers. comm.), but based on the best available information we do not believe that illegal harvest has contributed to Gunnison sage-grouse population declines in either Colorado or Utah. We do not anticipate hunting to be opened in the Gunnison Basin or smaller populations for many years, if ever. Consequently, we do not consider hunting to be a significant threat to the species now or in the foreseeable future.

Lek Viewing

The Gunnison sage-grouse was designated as a new species in 2000 (American Ornithologists' Union 2000, pp. 847-858), which has prompted increased interest by bird watchers to view the species on their leks (Pfister 2010, pers. comm.). Daily human disturbances on sage-grouse leks could cause a reduction in mating, and some reduction in total production (Call and Maser 1985, p. 19). Human disturbance, particularly if additive to disturbance by predators, could reduce the time a lek is active, as well as reduce its size by lowering male attendance (Boyko *et al.* 2004, *in* GSRSC 2005, p. 125). Smaller lek sizes have been hypothesized to be less attractive to females, thereby conceivably reducing the numbers of females mating. Disturbance during the peak of mating also could result in some females not breeding (GSRSC 2005, p. 125). Furthermore, disturbance from lek viewing might affect nesting habitat selection by females (GSRSC 2005, p. 126), as leks are typically close to areas in which females nest. If females move to poorer quality habitat farther away from disturbed leks, nest success could decline. If chronic disturbance causes sage-grouse to move to a new lek site away from preferred and presumably higher quality areas, both survival and nest success could decline. Whether any or all of these have significant population effects would depend on timing and degree of disturbance (GSRSC 2005, p. 126).

Throughout the range of Gunnison sage-grouse, public viewing of leks is limited by a general lack of knowledge in the public of lek locations, seasonal road closures in some areas, and difficulty in accessing many leks. Furthermore, 52 of 109 active Gunnison sage-grouse leks occur on private lands, which further limits access by the public. The BLM closed a lek in the Gunnison Basin to viewing in the late 1990s due to declining population counts, which were perceived as resulting from recreational viewing, although no scientific studies were conducted (BLM 2005a, p. 13; GSRSC 2005, pp. 124, 126). The Waunita lek east of Gunnison is the only lek in Colorado designated by the CDOW for public viewing (CDOW 2009a, p. 86). Since 1998, a comparison of male counts on the Waunita lek versus male counts on other leks in the Doyleville zone show that the Waunita lek's male counts generally follow the same trend as the others (CDOW 2009d, pp. 31-32). In fact, in 2008 and 2009 the Waunita lek increased in the number of males counted along with three other leks, while seven leks decreased in the Doyleville zone (CDOW 2009d, pp. 31-32). These data suggest that lek viewing on the Waunita lek has not impacted the Gunnison sage-grouse. Two lek-viewing tours per year are organized and led by UDWR on a privately owned lek in the Monticello population. The lek declined in males counted in 2009, but 2007 and 2008 had the highest counts for several years, suggesting that lek viewing is also not impacting that lek. Data collected by CDOW on greater sage-grouse viewing leks also indicates that controlled lek visitation has not impacted greater sage-grouse at the viewed leks (GSRSC 2005, p. 124).

A lek viewing protocol has been developed and has largely been followed on the Waunita lek, likely reducing impacts to sage-grouse using the lek (GSRSC 2005, p. 125). During 2004-2009, the percentage of individuals or groups of people in vehicles following the Waunita lek viewing protocol in the Gunnison Basin ranged from 71–92 percent (CDOW 2009a, p. 86, 87; Magee *et al.* 2009, p. 7, 10). Violations of the protocol, such as showing up after the sage-grouse started to display and creating noise, caused one or more sage-grouse to flush from the lek (CDOW 2009a, pp. 86, 87). Despite the protocol violations, the percentage of days from 2004 to 2009 that grouse were flushed by humans was relatively low, ranging from 2.5 percent to 5.4 percent (Magee *et al.* 2009, p.10). Nonetheless, the lek viewing protocol is currently being revised to make it more stringent and to include considerations for photography, research, and education related viewing (CDOW 2009a, p. 86). Maintenance of this protocol should preclude lek viewing from becoming a threat to this lek.

The CDOW and UDWR will continue to coordinate and implement lek counts to determine population levels. We expect annual lek viewing and lek counts to continue indefinitely. However, all leks counted will receive lower disturbance from counters than the Waunita lek received from public viewing, so we do not consider lek counts and viewing a threat to the Gunnison sage-grouse now or in the foreseeable future.

Scientific Research

Gunnison sage-grouse have been the subject of scientific research studies, some of which included the capture and handling of the species. Most of the research has been conducted in the Gunnison Basin population, San Miguel

Basin population, and Monticello portion of the Monticello–Dove Creek population. Between zero and seven percent mortality of handled adults or juveniles and chicks has occurred during recent Gunnison sage-grouse studies where trapping and radio-tagging was done (Apa 2004, p. 19; Childers 2009, p. 14; Lupis 2005, p. 26; San Miguel Basin Working Group 2009, p. A-10). Additionally, one radio-tagged hen was flushed off a nest during subsequent monitoring and did not return after the second day, resulting in loss of 10 eggs (Ward 2007, p. 52). The CDOW does not believe that these losses or disturbance have any significant impacts on the sage-grouse (CDOW 2009a, p. 29).

Some of the radio-tagged sage-grouse have been translocated from the Gunnison Basin to other populations. Over a 5–year period (2000–2002 and 2006–2007), 68 sage-grouse were translocated from the Gunnison Basin to the Poncha Pass and San Miguel Basin populations (CDOW 2009a, p. 9). These experimental translocations were conducted to determine translocation techniques and survivorship in order to increase both size of the receiving populations and to increase genetic diversity in populations outside of the Gunnison Basin. However, the translocated grouse experienced 40–50 percent mortality within the first year after release, which is double the average annual mortality of non-translocated sage-grouse (CDOW 2009a, p. 9). Greater sage-grouse translocations have not appeared to fare any better. Over 7,200 greater sage-grouse were translocated between 1933 and 1990, but only five percent of the translocation efforts were considered to be successful in producing sustained, resident populations at the translocation sites (Reese and Connelly 1997, pp. 235-238, 240). More recent translocations from 2003 to 2005 into Strawberry Valley, Utah, resulted in a 40 percent annual mortality rate (Baxter *et al.* 2008, p. 182). We believe the lack of success of translocations found in greater sage-grouse is applicable to Gunnison sage-grouse since the two species exhibit similar behavior and life-history traits, and are managed accordingly.

Because the survival rate for translocated sage-grouse has not been as high as desired, the CDOW started a captive-rearing program in 2009 to study whether techniques can be developed to captively rear and release Gunnison sage-grouse and enhance their survival (CDOW 2009a, pp. 9-12). The Gunnison Sage-grouse Rangewide Steering Committee conducted a review of captive-rearing attempts for both greater sage-grouse and other gallinaceous birds and concluded that survival will be very low, unless innovative strategies are developed and tested (GSRSC 2005, pp. 181-183). However, greater sage-grouse have been captively reared, and survival of released chicks was similar to that of wild chicks (CDOW 2009a, p. 10). Consequently, the CDOW decided to try captive rearing. Of 40 Gunnison sage-grouse eggs taken from the wild, only 11 chicks (about 25 percent) survived through October 2009. Although chick survival was low, the CDOW believes they have gained valuable knowledge on Gunnison sage-grouse rearing techniques. As techniques improve, the CDOW intends to develop a captive-breeding manual (CDOW 2009a, p. 11). Although adults or juveniles have been captured and moved out of the Gunnison Basin, as well as eggs, the removal of the grouse only accounts for a very small percentage of the total population of the Gunnison Basin sage-grouse population (about 1 percent).

The CDOW has a policy regarding trapping, handling, and marking techniques approved by their Animal Use and Care Committee (San Miguel Basin Working Group 2009, p. A-10, Childers 2009, p. 13). Evaluation of research projects by the Animal Use and Care Committee and improvement of trapping, handling, and marking techniques over the last several years has resulted in fewer mortalities and injuries. In fact, in the San Miguel Basin, researchers have handled over 200 sage-grouse with no trapping mortalities (San Miguel Basin Working Group (SMBWG) 2009, p. A-10). The CDOW has also drafted a sage-grouse trapping and handling protocol, which is required training for people handling Gunnison sage-grouse, to minimize mortality and injury of the birds (CDOW 2002, pp. 1-4 in SMBWG 2009, pp. A-22-A-25). Injury and mortality does occasionally occur from trapping, handling, marking, and flushing off nests. However, research-related mortality is typically below three percent of handled birds and equates to one half of one percent or less of annual population estimates (Apa 2004, p. 19; Childers 2009, p. 14; Lupis 2005, p. 26; San Miguel Basin Working Group 2009, p. A-10).

Research needs may gradually dwindle over the years but annual or occasional research is expected to occur for at least 50 years constituting the foreseeable future for this potential threat. Short-term disturbance effects to individuals occur as does injury and mortality, but we do not believe these effects cause a threat to the Gunnison sage-grouse population as a whole. Based on the available information, we believe scientific research on Gunnison sage-grouse has a relatively minor impact that does not rise to the level of a threat to the species now or is it expected to do so in the foreseeable future.

Summary of Factor B

We have no evidence suggesting that hunting, when it was legal, resulted in overutilization of Gunnison sage-grouse. If hunting is allowed again, future hunting may result in additive mortality due to habitat degradation and fragmentation, despite harvest level restrictions and management intended to limit impacts to hens. Nonetheless, we do not expect hunting to be reinstated in the foreseeable future. Illegal hunting has been documented only once in Colorado and is not considered a threat to the species. Lek viewing has not affected the Gunnison sage-grouse, and lek viewing protocols designed to reduce disturbance have generally been followed. CDOW is currently revising their lek viewing protocol to make it more stringent and to include considerations for photography, research, and education-related viewing. Mortality from scientific research is low (2 percent) and is not considered a threat. We know of no overutilization for commercial or educational purposes. Thus, based on the best scientific and commercial data available, we have concluded that overutilization for commercial, recreational, scientific, or educational purposes does not constitute a significant threat to the Gunnison sage-grouse.

C. Disease or Predation

Disease

No research has been published about the types or pathology of diseases in Gunnison sage-grouse. However, multiple bacterial and parasitic diseases have been documented in greater sage-grouse (Patterson 1952, pp. 71-72; Schroeder *et al.* 1999, p. 14, 27). Some early studies have suggested that greater sage-grouse populations are adversely affected by parasitic infections (Batterson and Morse 1948, p. 22). However, the role of parasites or infectious diseases in population declines of greater sage-grouse is unknown based on the few systematic surveys conducted (Connelly *et al.* 2004, p. 10-3). No parasites have been documented to cause mortality in Gunnison sage-grouse, but the protozoan, *Eimeria* spp., which causes coccidiosis, has been reported to cause

death in greater sage-grouse (Connelly *et al.* 2004, p. 10-4). Infections tend to be localized to specific geographic areas, and no cases of greater sage-grouse mortality resulting from coccidiosis have been documented since the early 1960s (Connelly *et al.* 2004, p. 10-4).

Parasites have been implicated in greater sage-grouse mate selection, with potentially subsequent effects on the genetic diversity of this species (Boyce 1990, p.263; Deibert 1995, p. 38). These relationships may be important to the long-term ecology of greater sage-grouse, but they have not been shown to be significant to the immediate status of populations (Connelly *et al.* 2004, p. 10-6). Although diseases and parasites have been suggested to affect isolated sage-grouse populations (Connelly *et al.* 2004, p. 10-3), we have no evidence indicating that parasitic diseases are a threat to Gunnison sage-grouse populations.

Greater sage-grouse are subject to a variety of bacterial, fungal, and viral pathogens. The bacterium *Salmonella* sp. has caused a single documented mortality in the greater sage-grouse and studies have shown that infection rates in wild birds are low (Connelly *et al.* 2004, p. 10-7). The bacteria are apparently contracted through exposure to contaminated water supplies around livestock stock tanks (Connelly *et al.* 2004, p. 10-7). Other bacteria found in greater sage-grouse include *Escherichia coli*, botulism (*Clostridium* spp.), avian tuberculosis (*Mycobacterium avium*), and avian cholera (*Pasteurella multocida*). These bacteria have never been identified as a cause of mortality in greater sage-grouse and the risk of exposure and hence, population effects, is low (Connelly *et al.* 2004, p. 10-7 to 10-8). We have no reason to expect that mortality and exposure risk are different in Gunnison sage-grouse; therefore, we do not believe these bacteria to be a threat to the species.

West Nile virus was introduced into the northeastern United States in 1999 and has subsequently spread across North America (Marra *et al.* 2004, p.394). In sagebrush habitats, West Nile virus transmission is primarily regulated by environmental factors, including temperature, precipitation, and anthropogenic water sources, such as stock ponds and coal-bed methane ponds that support the mosquito vectors (Reisen *et al.* 2006, p. 309; Walker and Naugle in press, pp. 10-12). The virus persists largely within a mosquito-bird-mosquito infection cycle (McLean 2006, p. 45). However, direct bird-to-bird transmission of the virus has been documented in several species (McLean 2006, pp. 54, 59) including the greater sage-grouse (Walker and Naugle in press, p. 13; Cornish 2009, pers. comm.). The frequency of direct transmission has not been determined (McLean 2006, p. 54). Cold ambient temperatures preclude mosquito activity and virus amplification, so transmission to and in sage-grouse is limited to the summer (mid-May to mid-September) (Naugle *et al.* 2005, p. 620; Zou *et al.* 2007, p. 4), with a peak in July and August (Walker and Naugle in press, p. 10). Reduced and delayed West Nile virus transmission in sage-grouse has occurred in years with lower summer temperatures (Naugle *et al.* 2005, p. 621; Walker *et al.* 2007b, p. 694). In non-sagebrush ecosystems, high temperatures associated with drought conditions increase West Nile virus transmission by allowing for more rapid larval mosquito development and shorter virus incubation periods (Shaman *et al.* 2005, p. 134; Walker and Naugle in press, p. 11). Additional details on the impacts of West Nile virus on greater sage-grouse can be found in our recent finding (75 FR 13910; March 23, 2010).

Greater sage-grouse congregate in mesic habitats in the mid-late summer (Connelly *et al.* 2000, p. 971), thereby increasing their risk of exposure to mosquitoes. If West Nile virus outbreaks coincide with drought conditions that aggregate birds in habitat near water sources, the risk of exposure to West Nile virus will be elevated (Walker and Naugle in press, p. 11). Greater sage-grouse inhabiting higher elevation sites in summer (similar to the northern portion of the Gunnison Basin) are likely less vulnerable to contracting West Nile virus than birds at lower elevation (similar to Dry Creek Basin of the San Miguel population) as ambient temperatures are typically cooler (Walker and Naugle in press, p. 11).

West Nile Virus has caused population declines in wild bird populations on the local and regional scale (Walker and Naugle in press, p. 7) and has been shown to affect survival rates of greater sage-grouse (Naugle *et al.* 2004, p. 710; Naugle *et al.* 2005, p. 616). Experimental results, combined with field data, suggest that a widespread West Nile virus infection has negatively affected greater sage-grouse (Naugle *et al.* 2004, p. 711; Naugle *et al.* 2005, p. 616). Summer habitat requirements of sage-grouse potentially increase their exposure to West Nile virus. Greater sage-grouse are considered to have a high susceptibility to West Nile virus, with resultant high levels of mortality (Clark *et al.* 2006, p. 19; McLean 2006, p. 54). Data collected on greater sage-grouse suggest that sage-grouse do not develop a resistance to the disease, and death is certain once an individual is exposed (Clark *et al.* 2006, p. 18).

To date, West Nile virus has not been documented in Gunnison sage-grouse despite the presence of West Nile virus-positive mosquitoes in nearly all counties throughout their range (Colorado Department of Public Health 2004, pp. 1-5; U.S. Centers for Disease Control and Prevention 2004, entire). We do not know whether this is a result of the small number of birds that are marked, the relatively few birds that exist in the wild, or unsuitable conditions in Gunnison sage-grouse habitat for the virus to become virulent. West Nile virus activity within the range of Gunnison sage-grouse has been low compared to other parts of Colorado and the western United States. A total of 77 wild bird (other than Gunnison sage-grouse) deaths resulting from West Nile virus have been confirmed from counties within the occupied range of Gunnison sage-grouse since 2002 when reporting began in Colorado (USGS 2009, entire). Fifty-two (68 percent) of these West-Nile-virus-caused bird deaths were reported from Mesa County (where the Pĩnon Mesa population is found). Only San Miguel, Dolores, and Hinsdale Counties had no confirmed avian mortalities resulting from West Nile virus.

Walker and Naugle (in press, p. 27) predict that West Nile virus outbreaks in small, isolated, and genetically depauperate populations could reduce sage-grouse numbers below a threshold from which recovery is unlikely because of limited or nonexistent demographic and genetic exchange from adjacent populations. Thus, a West Nile virus outbreak in any Gunnison sage-grouse population, except perhaps the Gunnison Basin population, could limit the persistence of these populations.

Although West Nile virus is a potential threat, the best available information suggests that it is not currently a significant threat to Gunnison sage-grouse, since West Nile virus has not been documented in Gunnison sage-grouse despite the presence of West Nile virus-positive mosquitoes in nearly all counties throughout their range. No other diseases or parasitic infections are considered to be threatening the Gunnison sage-grouse at this time.

Predation

Predation is the most commonly identified cause of direct mortality for sage-grouse during all life stages (Schroeder *et al.* 1999, p. 9; Connelly *et al.* 2000b, p. 228; Connelly *et al.* in press a, p. 23). However, sage-grouse

have co-evolved with a variety of predators, and their cryptic plumage and behavioral adaptations have allowed them to persist despite this mortality factor (Schroeder *et al.* 1999, p. 10; Coates 2008 p. 69; Coates and Delehanty 2008, p. 635; Hagen in press, p. 3). Until recently, little published information has been available that indicates predation is a limiting factor for the greater sage-grouse (Connelly *et al.* 2004, p. 10-1), particularly where habitat quality has not been compromised (Hagen in press, p. 3). Although many predators will consume sage-grouse, none specialize on the species (Hagen in press, p. 5). Generalist predators have the greatest effect on ground-nesting birds because predator numbers are independent of the density of a single prey source since they can switch to other prey sources when a given prey source (e.g., Gunnison sage-grouse) is not abundant (Coates 2007, p. 4). We believe that the effects of predation observed in greater sage-grouse are applicable to the effects anticipated in Gunnison sage-grouse since overall behavior and life-history traits are similar for the two species.

Major predators of adult sage-grouse include many species including golden eagles (*Aquila chrysaetos*), red foxes (*Vulpes fulva),* and bobcats (*Felis rufus*) (Hartzler 1974, pp. 532-536; Schroeder *et al.* 1999, pp. 10-11; Schroeder and Baydack 2001, p. 25; Rowland and Wisdom 2002, p. 14; Hagen in press, pp. 4-5). Juvenile sage-grouse also are killed by many raptors as well as common ravens (*Corvus corax*), badgers (*Taxidea taxus)*, red foxes, coyotes (*Canis latrans*) and weasels (*Mustela* spp.) (Braun 1995, entire; Schroeder *et al.* 1999, p. 10). Nest predators include badgers, weasels, coyotes, common ravens, American crows (*Corvus brachyrhyncos*) and magpies (*Pica* spp.), elk (*Cervus canadensis*) (Holloran and Anderson 2003, p.309), and domestic cows (*Bovus* spp.) (Coates *et al.* 2008, pp. 425-426). Ground squirrels (*Spermophilus* spp.) also have been identified as nest predators (Patterson 1952, p. 107; Schroeder *et al.* 1999, p. 10; Schroder and Baydack 2001, p. 25), but recent data show that they are physically incapable of puncturing eggs (Holloran and Anderson 2003, p. 309; Coates *et al.* 2008, p. 426; Hagen in press, p. 6). Several other small mammals visited sage-grouse nests in Nevada, but none resulted in predation events (Coates *et al.* 2008, p. 425). The most common predators of Gunnison sage-grouse eggs are weasels, ground squirrels, coyotes, and corvids (Young 1994, p. 37). Most raptor predation of sage-grouse is on juveniles and older age classes (GSRSC 2005, p. 135). Golden eagles were found to be the dominant species recorded perching on power poles in Utah in Gunnison sage-grouse habitat (Prather and Messmer 2009, p. 12). Twenty-two and 40 percent of 111 adult mortalities were the result of avian and mammalian predation, respectively (Childers 2009, p. 7). Twenty-five and 35 percent of 40 chick mortalities were caused by avian and mammalian predation, respectively (Childers 2009, p. 7). A causative agent of mortality was not determined in the remaining depredations observed in the western portion of the Gunnison Basin from 2000 to 2009 (Childers 2009, p. 7).

Adult male Gunnison sage-grouse are very susceptible to predation while on the lek (Schroeder *et al.* 1999, p. 10; Schroeder and Baydack 2001, p. 25; Hagen in press, p. 5), presumably because they are conspicuous while performing their mating displays. Because leks are attended daily by numerous grouse, predators also may be attracted to these areas during the breeding season (Braun 1995, p. 2). Connelly *et al.* (2000b, p. 228) found that among 40 radio-collared males, 83 percent of the mortality was due to predation and 42 percent of those mortalities occurred during the lekking season (March through June). Adult female greater sage-grouse are susceptible to predators while on the nest, but mortality rates are low (Hagen in press, p. 6). Hens will abandon their nest when disturbed by predators (Patterson 1952, p. 110), likely reducing this mortality (Hagen in press, p. 6). Among 77 adult hens, 52 percent of the mortality was due to predation and 52 percent of those mortalities occurred between March and August, which includes the nesting and brood-rearing periods (Connelly *et al.* 2000b, p. 228). Sage-grouse populations are likely more sensitive to predation upon females given the highly negative response of Gunnison sage-grouse population dynamics to adult female reproductive success and chick mortality (GSRSC, 2005, p. 173). Predation of adult sage-grouse is low outside the lekking, nesting, and brood-rearing season (Connelly *et al.* 2000b, p. 230; Naugle *et al.* 2004, p. 711; Moynahan *et al.* 2006, p. 1536; Hagen in press, p. 6).

Estimates of predation rates on juveniles are limited due to the difficulties in studying this age class (Aldridge and Boyce 2007, p. 509; Hagen in press, p. 8). For greater sage-grouse, chick mortality from predation ranged from 10 to 51 percent in 2002 and 2003 on three study sites in Oregon (Gregg *et al.* 2003a, p. 15; 2003b, p. 17). Mortality due to predation during the first few weeks after hatching was estimated to be 82 percent (Gregg *et al.* 2007, p. 648). Survival of juveniles to their first breeding season was estimated to be low (10 percent). It is reasonable, given the sources of adult mortality, to assume that predation is a contributor to the high juvenile mortality rates (Crawford *et al.* 2004, p. 4).

Sage-grouse nests are subject to varying levels of predation. Predation can be total (all eggs destroyed) or partial (one or more eggs destroyed). However, hens abandon nests in either case (Coates, 2007, p. 26). Gregg *et al.* (1994, p. 164) reported that over a 3–year period in Oregon, 106 of 124 nests (84 percent) were preyed upon (Gregg *et al.* 1994, p. 164). Patterson (1952, p.104) reported nest predation rates of 41 percent in Wyoming. Holloran and Anderson (2003, p. 309) reported a predation rate of 12 percent (3 of 26) in Wyoming. Moynahan *et al.* (2007, p. 1777) attributed 131 of 258 (54 percent) nest failures to predation in Montana. Studies have shown that re-nesting rates are low in Gunnison sage-grouse (Young, 1994, p. 44; Childers, 2009, p. 7), suggesting that re-nesting is unlikely to offset losses due to predation. Losses of breeding hens and young chicks to predation potentially can influence overall greater and Gunnison sage-grouse population numbers, as these two groups contribute most significantly to population productivity (GSRSC, 2005, p. 29, Baxter *et al.* 2008, p. 185; Connelly *et al,* in press a, p. 18).

Nesting success of greater sage-grouse is positively correlated with the presence of big sagebrush and grass and forb cover (Connelly *et al.* 2000, p. 971). Females actively select nest sites with these qualities (Schroeder and Baydack 2001, p. 25; Hagen *et al.* 2007, p. 46). Nest predation appears to be related to the amount of herbaceous cover surrounding the nest (Gregg *et al.* 1994, p. 164; Braun 1995, pp. 1-2; DeLong *et al.* 1995, p. 90; Braun 1998; Coggins 1998, p. 30; Connelly *et al.* 2000b, p. 975; Schroeder and Baydack 2001, p. 25; Coates and Delehanty 2008, p. 636). Loss of nesting cover from any source (e.g., grazing, fire) can reduce nest success and adult hen survival. However, Coates (2007, p. 149) found that badger predation was facilitated by nest cover as it attracts small mammals, a badger's primary prey. Similarly, habitat alteration that reduces cover for young chicks can increase their rate of predation (Schroeder and Baydack 2001, p. 27).

In a review of published nesting studies, Connelly *et al.* (in press, p. 14) reported that nesting success was greater in unaltered habitats versus

habitats affected by anthropogenic activities. Where greater sage-grouse habitat has been altered, the influx of predators can decrease annual recruitment into a population (Gregg *et al.* 1994, p. 164; Braun 1995, pp. 1-2; Braun 1998; DeLong *et al.* 1995, p. 91; Schroeder and Baydack 2001, p. 28; Coates 2007, p. 2; Hagen in press, p. 7). Agricultural development, landscape fragmentation, and human populations have the potential to increase predation pressure on all life stages of greater sage-grouse by forcing birds to nest in less suitable or marginal habitats, increasing travel time through altered habitats where they are vulnerable to predation, and increasing the diversity and density of predators (Ritchie *et al.* 1994, p. 125; Schroeder and Baydack 2001, p. 25; Connelly *et al.* 2004, p. 7-23; and Summers *et al.* 2004, p. 523). We believe the aforementioned is also applicable to Gunnison sage-grouse because overall behavior and life-history traits are similar for the two species (Young 1994, p. 4).

Abundance of red fox and corvids, which historically were rare in the sagebrush landscape, has increased in association with human-altered landscapes (Sovada *et al.* 1995, p. 5). In the Strawberry Valley of Utah, low survival of greater sage-grouse may have been due to an unusually high density of red foxes, which apparently were attracted to that area by anthropogenic activities (Bambrough *et al.* 2000). The red fox population has increased within the Gunnison Basin (BLM, 2009, p. 37). Ranches, farms, and housing developments have resulted in the introduction of nonnative predators including domestic dogs (*Canis domesticus*) and cats (*Felis domesticus*) into greater sage-grouse habitats (Connelly *et al.* 2004, p. 12-2). We believe this is also applicable to Gunnison sage-grouse because of the habitat similarities of the two species and similar patterns of human development. Local attraction of ravens to nesting hens may be facilitated by loss and fragmentation of native shrublands, which increases exposure of nests to potential predators (Aldridge and Boyce 2007, p. 522; Bui 2009, p. 32). The presence of ravens was negatively associated with greater sage-grouse nest and brood fate in western Wyoming (Bui 2009, p. 27).

Raven abundance has increased as much as 1,500 percent in some areas of western North America since the 1960s (Coates 2007, p. 5). Breeding bird survey trends from 1966 to 2007 indicate increases throughout Colorado and Utah (USGS, 2009, pp. 1-2). Increases in raven numbers are suggested in the Pĩnon Mesa population, though data have not been collected (CDOW 2009a, p. 110). Human-made structures in the environment increase the effect of raven predation, particularly in low canopy cover areas, by providing ravens with perches (Braun 1998, pp.145-146; Coates 2007, p. 155; Bui 2009, p. 2). Reduction in patch size and diversity of sagebrush habitat, as well as the construction of fences, powerlines and other infrastructure also are likely to encourage the presence of the common raven (Coates *et al.* 2008, p. 426; Bui 2009, p. 4). For example, raven counts have increased by approximately 200 percent along the Falcon-Gondor transmission line corridor in Nevada (Atamian *et al.* 2007, p. 2). Atamian *et al.* (2007, p. 2) found that ravens contributed to lek disturbance events in the areas surrounding the transmission line. However, cause of decline in surrounding sage-grouse population numbers could not be separated from other potential impacts. Holloran (2005, p. 58) attributed increased sage-grouse nest depredation to high corvid abundances, which resulted from anthropogenic food and perching subsidies in areas of natural gas development in western Wyoming. Bui (2009, p. 31) also found that ravens used road networks associated with oil fields in the same Wyoming location for foraging activities. Holmes (2009, pp. 2-4) also found that common raven abundance increased in association with oil and gas development in southwestern Wyoming. Raven abundance was strongly associated with sage-grouse nest failure in northeastern Nevada, with resultant negative effects on sage-grouse reproduction (Coates 2007, p. 130). The presence of high numbers of predators within a sage-grouse nesting area may negatively affect sage-grouse productivity without causing direct mortality. Coates (2007, pp. 85-86) suggested that ravens may reduce the time spent off the nest by female sage-grouse, thereby potentially compromising their ability to secure sufficient nutrition to complete the incubation period.

As more suitable grouse habitat is converted to exurban development, agriculture, or other non-sagebrush habitat types, grouse nesting and brood-rearing become increasingly spatially restricted (Bui 2009, p. 32). As discussed in Factor A, we anticipate a substantial increase in the distribution of residential development throughout the range of Gunnison sage-grouse. This increase will likely cause additional restriction of nesting habitat within the species' range, given removal of sagebrush habitats and the strong selection for sagebrush by the species. Additionally, Gunnison sage-grouse avoid residential development, resulting in functional habitat loss (Aldridge *et al.* 2010, p. 24). Ninety-one percent of nest locations in the western portion of the Gunnison Basin population occur within 35 percent of the available habitat (Aldridge *et al.* 2010, p. 25-26). Unnaturally high nest densities which result from habitat fragmentation or disturbance associated with the presence of edges, fencerows, or trails may increase predation rates by making foraging easier for predators (Holloran 2005, p. C37). Increased nest density could negatively influence the probability of a successful hatch (Holloran and Anderson, 2005, p. 748). The influence of the human footprint in sagebrush ecosystems may be underestimated (Leu and Hanser, in press, pp. 24-25) since it is uncertain how much more habitat sage-grouse (a large landscape-scale species) need for persistence in increasingly fragmented landscapes (Connelly *et al.*, in press, pp. 28-34). Therefore, the influence of ravens and other predators associated with human activities may be underestimated.

Ongoing studies in the San Miguel population suggest that the lack of recruitment in Gunnison sage-grouse is likely due to predation (CDOW 2009a, p. 31). In this area, 6 of 12 observed nests were destroyed by predation, with none of the chicks from the remaining nests surviving beyond two weeks (CDOW 2009a, p. 30). In small and declining populations, small changes to habitat abundance or quality, or in predator abundance, could have large consequences.

Predator removal efforts have sometimes shown short-term gains that may benefit fall populations, but not breeding population sizes (Cote and Sutherland 1997, p. 402; Hagen in press, p. 9; Leu and Hanser in press, p. 27). Predator removal may have greater benefits in areas with low habitat quality, but predator numbers quickly rebound without continual control (Hagen in press, p. 9). Red fox removal in Utah appeared to increase adult greater sage-grouse survival and productivity, but the study did not compare these rates against other non-removal areas, so inferences are limited (Hagen in press, p. 11).

Slater (2003, p. 133) demonstrated that coyote control failed to have an effect on greater sage-grouse nesting success in southwestern Wyoming. However, coyotes may not be an important predator of sage-grouse. In a coyote prey base analysis, Johnson and

Hansen (1979, p. 954) showed that sage-grouse and bird egg shells made up a very small percentage (0.4–2.4 percent) of analyzed scat samples. Additionally, coyote removal can have unintended consequences resulting in the release of smaller predators, many of which, like the red fox, may have greater negative impacts on sage-grouse (Mezquida *et al.* 2006, p. 752).

Removal of ravens from an area in northeastern Nevada caused only short-term reductions in raven populations (less than one year), as apparently transient birds from neighboring sites repopulated the removal area (Coates 2007, p. 151). Additionally, badger predation appeared to partially compensate for decreases due to raven removal (Coates 2007, p. 152). In their review of literature regarding predation, Connelly *et al.* (2004, p. 10-1) noted that only two of nine studies examining survival and nest success indicated that predation had limited a sage-grouse population by decreasing nest success, and both studies indicated low nest success due to predation was ultimately related to poor nesting habitat. Bui (2009, pp. 36-37) suggested removal of anthropogenic subsidies (e.g., landfills, tall structures) may be an important step to reducing the presence of sage-grouse predators. Leu and Hanser (in press, p. 27) also argue that reducing the effects of predation on sage-grouse can only be effectively addressed by precluding these features.

Summary of Predation

Predation has a strong relationship with anthropogenic factors on the landscape, and human presence on the landscape will continue to increase for the foreseeable future.

Gunnison sage-grouse are adapted to minimize predation by cryptic plumage and behavior. Gunnison sage-grouse may be increasingly subject to levels of predation that would not normally occur in the historically contiguous unaltered sagebrush habitats. The impacts of predation on greater sage-grouse can increase where habitat quality has been compromised by anthropogenic activities (exurban development, road development, etc.) (e.g., Coates 2007, p. 154, 155; Bui 2009, p. 16; Hagen in press, p. 12). Landscape fragmentation, habitat degradation, and human populations have the potential to increase predator populations through increasing ease of securing prey and subsidizing food sources and nest or den substrate. Thus, otherwise suitable habitat may change into a habitat sink for grouse populations (Aldridge and Boyce 2007, p. 517).

Anthropogenic influences on sagebrush habitats that increase suitability for ravens may also limit sage-grouse populations (Bui 2009, p. 32). Current land-use practices in the intermountain West favor high predator (in particular, raven) abundance relative to historical numbers (Coates *et al.* 2008, p. 426). The interaction between changes in habitat and predation may have substantial effects to the Gunnison sage-grouse at the landscape level (Coates 2007, p. 3-5). Since the Gunnison and greater sage-grouse have such similar behavior and life-history traits, we believe the current impacts on Gunnison sage-grouse are at least as significant as those documented in greater sage-grouse and to date in Gunnison sage-grouse. Given the small population sizes and fragmented nature of the remaining Gunnison sage-grouse habitat, we believe that the impacts of predation will likely be even greater as habitat fragmentation continues.

The studies presented above for greater sage-grouse suggest that, in areas of intensive habitat alteration and fragmentation, sage-grouse productivity and, therefore, populations could be negatively affected by increasing predation. Nest predation may be higher, more variable, and have a greater impact on the small, fragmented Gunnison sage-grouse populations, particularly the six smallest populations (GSRSC 2005, p. 134). Unfortunately, except for the relatively few studies presented here, data are lacking that link Gunnison sage-grouse population numbers and predator abundance. However, in at least six of the seven populations (Gunnison Basin potentially excluded), where habitats have been significantly altered by human activities, we believe that predation could be limiting Gunnison sage-grouse populations. As more habitats face development, even dispersed development such as that occurring throughout the range of Gunnison sage-grouse, we expect this threat to spread and increase. Studies of the effectiveness of predator control have failed to demonstrate a long-term inverse relationship between the predator numbers and sage-grouse nesting success or population numbers. Therefore, we believe that predation is currently a threat to the Gunnison sage-grouse and will continue to be a threat to the species within the foreseeable future.

Summary of Factor C

We have reviewed the available information on the effects of disease and predation on the Gunnison sage-grouse. The only disease that currently presents a potential impact to the Gunnison sage-grouse is West Nile virus. This virus is distributed throughout most of the species' range. However, despite its near 100 percent lethality, disease occurrence is sporadic in other taxa across the species' range and has not been detected to date in Gunnison sage-grouse. While we have no evidence of West Nile virus acting on the Gunnison sage-grouse, because of its presence within the species' range and the continued development of anthropogenic water sources in the area, the virus may pose a future threat to the species. We anticipate that West Nile virus will persist within the range of Gunnison sage-grouse indefinitely and will be exacerbated by any factor (e.g., climate change) that increases ambient temperatures and the presence of the vector on the landscape.

We believe that existing and continued landscape fragmentation will increase the effects of predation on this species, particularly in the six smaller populations, resulting in a reduction in sage-grouse productivity and abundance in the future.

We have evaluated the best available scientific information regarding disease and predation and their effects on the Gunnison sage-grouse. Based on the information available, we have determined that predation is a significant threat to the species throughout all or a significant portion of its range. Furthermore, we determine that disease is not currently a significant threat but has the potential to become a significant threat at any time.

D. The Inadequacy of Existing Regulatory Mechanisms

Under this factor, we examine whether threats to the Gunnison sage-grouse are adequately addressed by existing regulatory mechanisms. Existing regulatory mechanisms that could provide some protection for Gunnison sage-grouse include: (1) local land use laws, processes, and ordinances; (2) State laws and regulations; and (3) Federal laws and regulations. An example of a regulatory mechanism is the terms and conditions attached to a grazing permit that describe how a permittee will manage livestock on a BLM allotment. They are non-discretionary and enforceable, and are considered a regulatory mechanism under this analysis. Other examples include city or county ordinances, State governmental actions enforced under a State statute or constitution, or Federal action under statute. Actions adopted by local groups, States, or Federal entities that are discretionary or are not enforceable, including conservation

strategies and guidance, are typically not regulatory mechanisms.

Regulatory mechanisms, if they exist, may preclude the need for listing if such mechanisms are judged to adequately address the threat to the species such that listing is not warranted. Conversely, threats on the landscape are exacerbated when not addressed by existing regulatory mechanisms, or when the existing mechanisms are not adequate (or not adequately implemented or enforced). We cannot predict when or how local, State, and Federal laws, regulations, and policies will change; however, most Federal land use plans are valid for at least 20 years. In this section we review actions undertaken by local, State, and Federal entities designed to reduce or remove threats to Gunnison sage-grouse and its habitat.

Local Laws and Regulations

Rangewide approximately 41 percent of occupied Gunnison sage-grouse habitat is privately owned (calculation from Table 1). Gunnison County and San Miguel County, Colorado, are the only local or County entities that have regulations and policy, respectively, that provide a level of conservation consideration for the Gunnison sage-grouse or its habitats on private land (Dolores County 2002; Mesa County 2003; Montrose County 2003). In 2007, the Gunnison County, Colorado Board of County Commissioners approved Land Use Resolution (LUR) Number 07-17 to ensure all applications for land use change permits, including building permits, individual sewage disposal system permits, Gunnison County access permits, and Gunnison County Reclamation permits be reviewed for impact to Gunnison sage-grouse habitat within 1 km (0.6 mile) of an active lek. If impacts are determined to result from a project, impacts are to be avoided, minimized, and/or mitigated. Approximately 79 percent of private land occupied by the Gunnison Basin population is in Gunnison County, and thereby under the purview of these regulations. The remaining 21 percent of the private lands in the Gunnison Basin population is in Saguache County where similar regulations are not in place or applicable. Actions outside the 1 km (0.6 mi) buffer are not subject to Gunnison County LUR 07-17.

Colorado State statute (C.R.S. 30-28-101) exempts parcels of land of 14 ha (35 ac) or more per home from regulation, so county zoning laws in Colorado such as LUR 07-17 only apply to properties with housing densities greater than one house per 14 ha (35 ac). This statute allows these parcels to be exempt from county regulation and may negatively affect Gunnison sage-grouse by allowing for further development, degradation, and loss of the species' habitat. A total of 1,190 parcels, covering 16,351 ha (40,405 ac), within occupied habitat in Gunnison County currently contain development. Of those 1,190 parcels, 851 are less than 14 ha (35 ac) in size and subject to County review. However, those 851 parcels encompass only 13.1 percent of private land area with existing development in occupied habitat within Gunnison County. Parcels greater than 14 ha (35 ac) in size (339 of the 1,190) encompass 86.9 of the existing private land area within occupied habitat within Gunnison County. Cumulatively, 91 percent of the private land within the Gunnison County portion of the Gunnison Basin population that either has existing development or is potentially developable land is allocated in lots greater than 14 ha (35 ac) in size and therefore not subject to Gunnison County LUR 07-17. This situation limits the effectiveness of LUR 07-17 in providing protection to Gunnison sage-grouse in Gunnison County.

The only required review by Gunnison County under LUR 07-17 pertains to the construction of roads, driveways, and individual building permits. Of the 79 percent of area occupied by the Gunnison Basin population that falls within Gunnison County, 37 percent of the private land is not subject to the County LUR because the action would not be within 1 km (0.6 mi) of a lek. Gunnison County reviewed 231 projects from July 2006 through November 2009 under the LUR for impacts to Gunnison sage-grouse. All but one project was within the overall boundary of the Gunnison Basin population's occupied habitat, with most of the activity focused in the northern portion of this population. All of these projects were approved and allowed to proceed. The majority of these projects were within established areas of development, and some were for activities such as outbuildings or additions to existing buildings; nonetheless, these projects provide an indication of further encroachment and fragmentation of the remaining occupied habitat. Nineteen percent (44) of the projects were within 1 km (0.6 mi) of a lek. Nineteen percent (45) of the projects contained language within the permit that established conditions for control of pets. The use of the 1-km (0.6-mi) buffer around the lek provides some conservation benefit to the grouse. This buffer is not as large as that recommended by GSRSC (2005 entire) to meet all the species' year-round life-history needs (6.4 km (4 mi)). Because research summarized in GSRSC (2005 entire) has shown that impacts occur up to 6.4 km (4 mi) from the point of disturbance, these minimally or unregulated negative impacts will continue to fragment the habitat and thus have substantial impacts on the local, as well as landscape, conservation of the species. In summary, Gunnison County is to be highly commended for the regulatory steps they have implemented. However, the scope and implementation of that regulatory authority is limited in its ability to effectively and collectively conserve Gunnison sage-grouse due to the County's limited authority within the Gunnison Basin portion of the species' range.

In 2005, San Miguel County amended its Land Use Codes to include consideration and implementation, to the extent possible, of conservation measures recommended in GSRSC (2005, entire) for the Gunnison sage-grouse when considering land use activities and development located within its habitat (San Miguel County 2005). The County is only involved when there is a request for a special use permit, which limits their involvement in review of projects adversely affecting Gunnison sage-grouse and their habitat and providing recommendations. Conservation measures are solicited from the CDOW and a local Gunnison sage-grouse working group. Implementation of the conservation measure is dependent on negotiations between the County and the applicant. Some positive measures (e.g., locating a special use activity outside grouse habitat, establishing a 324-ha (800-ac) conservation easement; implementing speed limits to reduce likelihood of bird/vehicle collisions) have been implemented as a result of the policy. Typically, the County has not been involved with residential development, and most measures that result from discussions with applicants result in measures that the Service considers minimization, not mitigation measures, but which the County considers mitigation (Henderson 2010, pers. comm.). The San Miguel County Land Use Codes provide some conservation benefit to the species through some minimization of impacts and encouraging landowners to voluntarily minimize/mitigate impacts of residential development in grouse habitat. However, the codes allow for limited regulatory authority but are not sufficient to prevent or mitigate for the continued degradation and

fragmentation of Gunnison sage-grouse habitat.

In addition to the county regulations, Gunnison County hired a Gunnison Sage-grouse Coordinator (2005 to present) and organized a Strategic Committee (2005 to present) to facilitate implementation of conservation measures in the Gunnison Basin under both the local Conservation Plan and Rangewide Conservation Plan (RCP) (GSRSC 2005). San Miguel County hired a Gunnison Sage-grouse Coordinator for the San Miguel Basin population in March 2006. The Crawford working group hired a Gunnison sage-grouse coordinator in December 2009. Saguache County has applied for a grant to hire a part-time coordinator for the Poncha Pass population (grant status still pending). These efforts facilitate coordination relative to sage-grouse management and reflect positively on these Counties' willingness to conserve Gunnison sage-grouse, but have no regulatory authority. None of the other Counties with Gunnison sage-grouse populations have regulations, or staff, that implement regulation or policy review that consider the conservation needs of Gunnison sage-grouse. The inadequacy of existing regulatory mechanisms that address habitat loss, fragmentation, and degradation, in the other populations constitutes a threat to those populations.

Conservation measures that have regulatory authority that have been implemented as a result of the aforementioned collective efforts include: closing of shed antler collection in the Gunnison Basin by the Colorado Wildlife Commission due to its disturbance of Gunnison sage-grouse during the early breeding season; and a BLM/USFS/Gunnison County/CDOW collective effort to implement and enforce road closures during the early breeding season (March 15 to May 15). These regulatory efforts have provided benefits to Gunnison sage-grouse during the breeding season. However, these measures do not adequately address the primary threat to the species of fragmentation of the habitat.

Habitat loss is not regulated or monitored in Colorado counties where Gunnison sage-grouse occur. Therefore, conversion of agricultural land from one use to another, such as native pasture containing sagebrush converted to another use, such as cropland, would not normally come before a county zoning commission. Based on the information we have available for the range of the species, we do not believe that habitat loss from conversion of sagebrush habitat to agricultural lands is occurring at a level that makes it a threat. The permanent loss, and associated fragmentation and degradation, of sagebrush habitat is considered the largest threat to Gunnison sage-grouse (GSRSC 2005, p. 2). The minimally regulated residential/exurban development found throughout the vast majority of the species range is a primary cause of this loss, fragmentation, and degradation of Gunnison sage-grouse habitat. We are not aware of any existing local regulatory mechanisms that adequately address this threat.

We recognize that county or city ordinances in San Juan County, Utah, that address agricultural lands, transportation, and zoning for various types of land uses have the potential to influence sage-grouse. However, we are not aware of any existing County regulations that provide adequate regulatory mechanisms to address threats to the Gunnison sage-grouse and its habitat.

Each of the seven populations of Gunnison sage-grouse has a Conservation Plan written by the respective local working group with publication dates of 1999 to 2009. These plans provide recommendations for management of Gunnison sage-grouse and have been the basis for identifying and prioritizing local conservation efforts, but do not provide regulatory protection for Gunnison sage-grouse or its habitat.

State Laws and Regulations

State laws and regulations provide specific authority for sage-grouse conservation over lands that are directly owned by the State, provide broad authority to regulate and protect wildlife on all lands within their borders, and provide a mechanism for indirect conservation through regulation of threats to the species (e.g., noxious weeds).

Colorado Revised Statutes, Title 33, Article 1 gives CDOW responsibility for the management and conservation of wildlife resources within State borders. Title 33 Article 1-101, Legislative Declaration requires a continuous operation of planning, acquisition, and development of wildlife habitats and facilities for wildlife-related opportunities. The CDOW is required by statute (C.R.S. 106-7-104) to provide counties with information on "significant wildlife habitat," and provide technical assistance in establishing guidelines for designating and administering such areas, if asked. The CDOW also has authority to regulate possession of the Gunnison sage-grouse, set hunting seasons, and issue citations for poaching. These authorities provide individual Gunnison sage-grouse with protection from direct human-caused mortality to the level that hunting is not considered a threat to the species (see Factor B discussion, above). The Colorado Wildlife Commission is currently considering whether to include the Gunnison sage-grouse as an endangered or threatened species in accordance with Administrative Directive W-7 (State of Colorado, 2007, entire). These authorities do not regulate the primary threat to the species of fragmentation of habitat as described in Factor A.

The Wildlife Resources Code of Utah (Title 23) provides UDWR the powers, duties, rights, and responsibilities to protect, propagate, manage, conserve, and distribute wildlife throughout the State. Section 23-13-3 declares that wildlife existing within the State, not held by private ownership and legally acquired, is property of the State. Sections 23-14-18 and 23-14-19 authorize the Utah Wildlife Board to prescribe rules and regulations for the taking and/or possession of protected wildlife, including Gunnison sage-grouse. These authorities provide adequate protection to individual Gunnison sage-grouse from direct, human-caused mortality to the level that hunting is not considered a threat to the species (see Factor B discussion, above). However, these laws and regulations do not provide the regulatory authority needed to conserve sage-grouse habitats from the threats described in Factor A.

Gunnison sage-grouse are managed by CDOW and UDWR on all lands within each State as resident native game birds. In both States this classification allows the direct human taking of the bird during hunting seasons authorized and conducted under State laws and regulations. In 2000, CDOW closed the hunting season for Gunnison sage-grouse in the Gunnison Basin, the only area then open to hunting for the species. The hunting season for Gunnison sage-grouse in Utah has been closed since 1989. The Gunnison sage-grouse is listed as a species of special concern in Colorado, as a sensitive species in Utah, and as a Tier I species under the Utah Wildlife Action Plan, providing heightened priority for management (CDOW 2009a, p. 40; UDWR 2009, p. 9). The Colorado Wildlife Commission is currently considering a proposal from CDOW to list the Gunnison sage-grouse as a State endangered or threatened species. State listed species will be the focus of conservation actions such as monitoring, research, enhancement, restoration, or inventory, and will receive preferential consideration in the

annual budget development process (State of Colorado, 2007, p. 1). Hunting and other State regulations that deal with issues such as harassment provide adequate protection for individual birds (see discussion under Factor B), but do not protect the habitat. While we strongly support the use of regulatory mechanisms to control hunting of the species, the protection afforded through the aforementioned State regulatory mechanisms is limited.

Easements that prevent long-term or permanent habitat loss by prohibiting development are held by CDOW, UDWR, Natural Resources Conservation Service (NRCS), NPS, and non-governmental organizations (Table 4). Although the decision of whether to enter into a conservation easement is voluntary on the part of the landowner, conservation easements are legally binding documents. Therefore, we have determined that perpetual conservation easements offer some level of regulatory protection to the species. Some of the easements include conservation measures that are specific for Gunnison sage-grouse, while many are directed at other species, such as big game (GSRSC 2005, pp. 59-103). Some of these easements protect existing Gunnison sage-grouse habitat. Sixty-nine percent of the area under conservation easements have land cover types other than agricultural (covering 31 percent) that provide habitat for Gunnison sage-grouse. However, considering that the total easements recorded to date cover only 5.1 percent of private lands rangewide, that not all easements have sage-grouse specific habitat or conservation measures, and their scattered distribution throughout the range of the species, we believe that while easements provide some level of protection from future development, they are not sufficient to ameliorate the threat of loss and fragmentation of Gunnison sage-grouse habitat. We believe this to be true now and into the future, especially considering the costs of purchasing easements when compared to the cost paid for development of those lands, and money available through all sources to purchase easements. In addition, because entering into a conservation easement is voluntary on the part of the landowner, we cannot be sure that any future conservation easements will occur in such a configuration and magnitude that they will offer the species or its habitat substantial protection.

TABLE 4. AREA OF CONSERVATION EASEMENTS IN HECTARES (HA) AND ACRES (AC) BY POPULATION AND PERCENTAGE OF OCCUPIED HABITAT IN CONSERVATION EASEMENTS AS OF SEPTEMBER 2009.

Population	hectares	acres	Percent of Occupied Habitat in Respective Population
Gunnison Basin	11,334	28,008	4.7
Piñon Mesa	4,270	10,551	27.1
Cerro Summit-Cimarron-Sims Mesa	1,395	3,447	9.3
Monticello	1,036	2,560	3.6
San Miguel Basin	843	2,084	2.1
Dove Creek Group	330	815	2.0
Crawford	249	616	1.8
Poncha Pass	0	0	0
Rangewide	19,457	48,081	5.1

The CDOW has been implementing the CCAA referenced earlier in this document. As of February 2010, 4 landowners have completed Certificates of Inclusion (CI) for their properties enrolling 2,581 ha (6,377 ac). Because the Service issues a permit to applicants with an approved CCAA, we have some regulatory oversight over the implementation of the CCAA. However, permit holders and landowners can voluntarily opt out of the CCAA at any time. Thus, the CCAA provides important conservation measures that assist the species, and provides regulatory protection to enrolled landowners, but due to its voluntary nature, provides no regulatory protection. An additional 38 landowners (totaling approximately 18,211 ha (45,000 ac) within Gunnison sage-grouse occupied habitat), have worked with the CDOW to complete baseline reports in preparation for issuance of CIs. The reports describe property infrastructure and number of acres of Gunnison sage-grouse seasonal habitat. A CDOW review of all these reports and the condition of the habitat is pending. The CCAA/CI efforts described in this paragragh will provide conservation benefits to Gunnison sage-grouse throughout their range where they are in place (27 in the Gunnison Basin, 3 in San Miguel, 2 in Crawford, 5 in Pĩnon Mesa, 1 in Dove Creek). Even assuming the area of all landowners expressing interest and with completed baselines will ultimately be covered under CIs, the fact remains that these properties constitute only 13 percent of the total private land throughout the species range and that they are scattered throughout the species range. Therefore, we do not believe the CCAA/CI efforts would provide adequate regulatory coverage to ensure the long-term conservation of the species on private lands.

On April 22, 2009, the Governor of Colorado signed into law new rules (House Bill 1298) for the Colorado Oil and Gas Conservation Commission (COGCC), which is the entity responsible for permitting oil and gas well development in Colorado (COGCC 2009, entire). The rules went into effect on private lands on April 1, 2009, and on Federal lands July 1, 2009. The new rules require that permittees and

operators determine whether their proposed development location overlaps with "sensitive wildlife habitat," or is within a restricted surface occupancy (RSO) area. For Gunnison sage-grouse, areas within 1 km (0.6 mi) of an active lek can be designated as RSOs (CDOW 2009a, p. 27), and surface area occupancy will be avoided except in cases of economic or technical infeasibility (CDOW 2009a, p. 27). Areas within approximately 6.4 km (4 mi) of an active lek are considered sensitive wildlife habitat (CDOW 2009a, p. 27) and the development proponent is required to consult with the CDOW to identify measures to (1) avoid impacts on wildlife resources, including sage-grouse; (2) minimize the extent and severity of those impacts that cannot be avoided; and (3) mitigate those effects that cannot be avoided or minimized (COGCC 2009, section 1202.a). The COGCC will consider CDOW's recommendations in the permitting decision, although the final permitting and conditioning authority remains with COGCC. As stated in Section 1202.d of the new rules, consultation with CDOW is not required under certain circumstances such as, the issuance of a variance by the Director of the COGCC, the existence of a previously CDOW-approved wildlife mitigation plan, and others. Other categories for potential exemptions also can be found in the new rules (e.g., 1203.b).

Because the new rules have only been in place for less than a year and their implementation is still being discussed, it remains to be seen what level of protection will be afforded to Gunnison sage-grouse. The new rules could provide for greater consideration of the conservation needs of the species. It should be noted that leases that have already been approved but not drilled (e.g., COGCC 2009, 1202.d(1)), or drilling operations that are already on the landscape, may continue to operate without further restriction into the future. We are not aware of any situations where RSOs have been effectively applied or where conservation measures have been implemented for potential oil and gas development impacts to Gunnison sage-grouse on private lands underlain with privately owned minerals, which are regulated by the appropriate governing bodies.

Colorado and Utah have laws that directly address the priorities for use of State school section lands, which require that management of these properties be based on maximizing financial returns. State school section lands account for only one percent of occupied habitat in Colorado and one percent in Utah, so impacts may be considered negligible. We are not aware of any conservation measures that will be implemented under regulatory authority for Gunnison sage-grouse on State school section lands, other than a request to withdraw or apply "no surface occupancy" and conservation measures from the RCP (GSRSC 2005) to four sections available for oil and gas leasing in the San Miguel Basin population (see Factor A for further discussion). The State Land Board (SLB) recently purchased the Miramonte Meadows property (approximately 809 ha (2,000 ac) next to the Dan Noble State Wildlife Area (SWA). Roughly 526 ha (1,300 ac) is considered prime Gunnison sage-grouse habitat (Garner 2010, pers. comm.). Discussions with the SLB have indicated a willingness to implement habitat improvements (juniper removal) on the property. They have also accepted an application to designate the tract as a "Stewardship Trust" parcel. The Stewardship Trust program is capped at 119,383 to 121,406 ha (295,000 to 300,000 ac), and no more property can be added until another tract is removed from the program. Because of this cap, it is unknown if or when the designation of the tract as a Stewardship Trust parcel may occur. The scattered nature of State school sections (single sections) across the landscape and the requirement to conduct activities to maximize financial returns minimize the likelihood of implementation of measures that will benefit Gunnison sage-grouse. Thus, mechanisms present on State trust lands are inadequate to minimize degradation and fragmentation of habitat and thus ensure conservation of the species.

Some States require landowners to control noxious weeds, a potential habitat threat to sage-grouse (as discussed in Factor A). The types of plants considered to be noxious weeds vary by State. Cheatgrass is listed as a Class C species in Colorado (Colorado Department of Agriculture 2010, p. 3). The Class C designation delegates to local governments the choice of whether or not to implement activities for the control of cheatgrass. Gunnison, Saguache, and Hinsdale Counties target cheatgrass with herbicide applications (GWWC 2009, pp. 2- 3). The CDOW annually sprays for weeds on SWAs (CDOW 2009a, p. 106). The State of Utah does not consider cheatgrass as noxious within the State (Utah Department of Agriculture 2010, p. 1) nor in San Juan County (Utah Department of Agriculture 2010a, p. 1). The laws dealing with other noxious and invasive weeds may provide some protection for sage-grouse in local areas by requiring some control of the invasive plants, although large-scale control of the most problematic invasive plants is not occurring. Rehabilitation and restoration techniques for sagebrush habitats are mostly unproven and experimental (Pyke in press, p. 25). Regulatory authority has not been demonstrated to be effective in addressing the overall impacts of invasive plants on the degradation and fragmentation of sagebrush habitat within the species range.

Federal Laws and Regulations

Gunnison sage-grouse are not covered or managed under the provisions of the Migratory Bird Treaty Act (16 U.S.C. 703-712) because they are considered resident game species. Federal agencies are responsible for managing 54 percent of the total Gunnison sage-grouse habitat. The Federal agencies with the most sagebrush habitat are BLM, an agency of the Department of the Interior, and USFS, an agency of the Department of Agriculture. The NPS in the Department of the Interior also has responsibility for lands that contain Gunnison sage-grouse habitat.

BLM

About 42 percent of Gunnison sage-grouse occupied habitat is on BLM-administered land (Table 1 details percent ownership within each population). The Federal Land Policy and Management Act of 1976 (FLPMA) (43 U.S.C. 1701 *et seq.*) is the primary Federal law governing most land uses on BLM-administered lands. Section 102(a)(8) of FLPMA specifically recognizes wildlife and fish resources as being among the uses for which these lands are to be managed. Regulations pursuant to FLPMA and the Mineral Leasing Act (30 U.S.C. 181 *et seq.*) that address wildlife habitat protection on BLM-administered land include 43 CFR 3162.3-1 and 43 CFR 3162.5-1; 43 CFR 4120 *et seq.*; and 43 CFR 4180 *et seq.*

Gunnison sage-grouse have been designated as a BLM Sensitive Species since they were first identified and described in 2000 (BLM 2009, p. 7). The management guidance afforded sensitive species under BLM Manual 6840 – Special Status Species Management (BLM 2008, entire) states that "Bureau sensitive species will be managed consistent with species and habitat management objectives in land use and implementation plans to promote their conservation and to minimize the likelihood and need for listing under the ESA" (BLM 2008, p. 05V). BLM Manual 6840 further requires

that Resource Management Plans (RMPs) should address sensitive species, and that implementation "should consider all site-specific methods and procedures needed to bring species and their habitats to the condition under which management under the Bureau sensitive species policies would no longer be necessary" (BLM 2008, p. 2A1). As a designated sensitive species under BLM Manual 6840, sage-grouse conservation must be addressed in the development and implementation of RMPs on BLM lands.

RMPs are the basis for all actions and authorizations involving BLM-administered lands and resources. They establish allowable resource uses, resource condition goals and objectives to be attained, program constraints and general management practices needed to attain the goals and objectives, general implementation sequences, and intervals and standards for monitoring and evaluating the plan to determine its effectiveness and the need for amendment or revision (43 CFR 1601.0-5(k)).

The RMPs provide a framework and programmatic guidance for activity plans, which are site-specific plans written to implement decisions made in a RMP. Examples include Allotment Management Plans that address livestock grazing, oil and gas field development, travel management (motorized and mechanized road and trail use), and wildlife habitat management. Activity plan decisions normally require additional planning and National Environmental Policy Act (NEPA) analysis. If an RMP contains specific direction regarding sage-grouse habitat, conservation, or management, it represents an enforceable regulatory mechanism to ensure that the species and its habitats are considered during permitting and other decision-making on BLM lands.

The BLM manages Gunnison sage-grouse habitat under five existing RMPs. These RMPs contain some specific measures or direction pertinent to management of Gunnison sage-grouse or their habitats. Three of these RMPs (San Juan, Grand Junction, and Uncompahgre– covering all or portions of the San Miguel, Pĩnon Mesa, Crawford, and Cerro Summit–Cimarron–Sims Mesa populations, and the Dove Creek group) are in various stages of revision. All RMPs currently propose some conservation measures (measures that if implemented should provide a level of benefit to Gunnison sage-grouse) outlined in GSRSC (2005, entire) or local Gunnison sage-grouse Conservation Plans through project- or activity-level NEPA reviews (BLM 2009, p. 6). In addition, several offices have undergone other program-level planning, such as travel management, that incorporate some conservation measures to benefit the species (BLM 2009, p. 6). However, the information provided to us by the BLM in Colorado did not specify what requirements, direction, measures, or guidance will ultimately be included in the revised Colorado RMPs to address threats to sage-grouse and sagebrush habitat. Additionally we do not know the effectiveness of these proposed measures.

We do not have information on RMP implementation by Utah BLM. Therefore, we cannot assess the future value of BLM RMPs as regulatory mechanisms for the conservation of the Gunnison sage-grouse. Current BLM RMPs provide some limited regulatory authority as they are being implemented through project-level planning (e.g., travel management (the management of the motorized and nonmotorized use of public lands) and grazing permit renewals). We do not know the final measures that will be included in the revised RMPs and therefore what will be implemented, so we cannot evaluate their effectiveness. Based on modeling results demonstrating the effects of roads on Gunnison sage-grouse (Aldridge and Saher 2010 entire – discussed in detail in Factor A), we believe that implementation of even the most restrictive travel management alternatives proposed by the BLM and USFS will still result in further degradation and fragmentation of Gunnison sage-grouse habitat in the Gunnison Basin.

In addition to land use planning, BLM uses Instruction Memoranda (IM) to provide instruction to district and field offices regarding specific resource issues. Instruction Memoranda are guidance that require a process to be followed but do not mandate results. Additionally, IMs are of short duration (1 to 2 years) and are intended to address resource concerns by providing direction to staff until a threat passes or the resource issue can be addressed in a long-term planning document. BLM issued IM Number CO-2005-038 on July 12, 2005, stating BLM's intent and commitment to assist with and participate in the implementation of the RCP. Although this IM has not been formally updated or reissued, it continues to be used for BLM-administered lands in the State (BLM 2009, p. 6).

The BLM has regulatory authority for oil and gas leasing on Federal lands and on private lands with a severed Federal mineral estate, as provided at 43 CFR 3100 *et seq.*, and they are authorized to require stipulations as a condition of issuing a lease. The BLM's planning handbook has program-specific guidance for fluid minerals (which include oil and gas) that specifies that RMP decisions will identify restrictions on areas subject to leasing, including closures, as well as lease stipulations (BLM 2000, Appendix C, p.16). The handbook also specifies that all stipulations must have waiver, exception, or modification criteria documented in the plan, and notes that the least restrictive constraint to meet the resource protection objective should be used (BLM 2000, Appendix C, p. 16). The BLM has regulatory authority to condition "Application for Permit to Drill" authorizations, conducted under a lease that does not contain specific sage-grouse conservation stipulations, but utilization of conditions is discretionary and we are uncertain as to how this authority will be applied. Also, oil and gas leases have a 200-m (650-ft) stipulation, which allows movement of the drilling area by that distance to avoid sensitive resources. Many of the BLM field offices work with the operators to move a proposed drilling site farther or justify such a move through the site-specific NEPA process.

For existing oil and gas leases on BLM land in occupied Gunnison sage-grouse habitat, oil and gas companies can conduct drilling operations if they wish, but are always subject to permit conditions. The BLM has stopped issuing new drilling leases in occupied sage-grouse habitat in Colorado at least until the new RMPs are in place. All occupied habitat in the Crawford Area and Gunnison Basin populations are covered by this policy. However, leases already exist in 17 percent of the Pĩnon Mesa population, and 49 percent of the San Miguel Basin population. Given the already small and fragmented nature of the populations where oil and gas leases are likely to occur, additional development within occupied habitat would negatively impact those populations by causing additional actual and functional habitat loss and fragmentation. Since we do not know what minimization and mitigation measures might be applied, we cannot assess the overall conservation impacts to those populations.

The oil and gas leasing regulations authorize BLM to modify or waive lease terms and stipulations if the authorized officer determines that the factors leading to inclusion of the term or stipulation have changed sufficiently to no longer justify protection, or if proposed operations would not cause unacceptable impacts (43 CFR 3101.1-

4). The Service has no information indicating that the BLM has granted any waivers of stipulations pertaining to the Gunnison sage-grouse and their habitat.

The Energy Policy and Conservation Act of 2000 included provisions requiring the Secretary of the Department of the Interior to conduct a scientific inventory of all onshore Federal lands to identify oil and gas resources underlying these lands and the nature and extent of any restrictions or impediments to the development of such resources (U.S.C. Title 42, Chapter 77, §6217(a)). On May 18, 2001, President Bush signed Executive Order 13212-Actions to Expedite Energy-Related Projects (66 FR 28357, May 22, 2001), which states that the executive departments and agencies shall take appropriate actions, to the extent consistent with applicable law, to expedite projects that will increase the production, transmission, or conservation of energy. The Executive Order specifies that this includes expediting review of permits or taking other actions as necessary to accelerate the completion of projects, while maintaining safety, public health, and environmental protections. Due to the relatively small amount of energy development activities occurring within Gunnison sage-grouse habitat (with the exception of the Dry Creek Basin subpopulation of the San Miguel population), we believe that energy development activities are not a significant threat. However, given scenarios such as Dry Creek Basin, if the level of energy development activities should increase, current regulations and policies do not provide adequate regulatory protection to prevent oil and gas development from becoming a threat to this subpopulation.

As stated previously, Gunnison sage-grouse are considered a BLM Sensitive Species and therefore receive Special Status Species management considerations. The BLM regulatory authority for grazing management is provided at 43 CFR 4100 (Regulations on Grazing Administration Exclusive of Alaska). Livestock grazing permits and leases contain terms and conditions determined by BLM to be appropriate to achieve management and resource condition objectives on the public lands and other lands administered by BLM, and to ensure that habitats are, or are making significant progress toward being, restored or maintained for BLM special status species (43 CFR 4180.1(d)). The State or regional standards for grazing administration must address habitat for endangered, threatened, proposed, candidate, or special status species, and habitat quality for native plant and animal populations and communities (43 CFR 4180.2(d)(4) and (5)). The guidelines must address restoring, maintaining, or enhancing habitats of BLM special status species to promote their conservation, as well as maintaining or promoting the physical and biological conditions to sustain native populations and communities (43 CFR 4180.2(e)(9) and (10). The BLM is required to take appropriate action not later than the start of the next grazing year upon determining that existing grazing practices or levels of grazing use are significant factors in failing to achieve the standards and conform with the guidelines (43 CFR 4180.2(c)).

The BLM agreed to work with their resource advisory councils to expand the rangeland health standards required under 43 CFR 4180 so that there are public land health standards relevant to all ecosystems, not just rangelands, and that they apply to all BLM actions, not just livestock grazing (BLM Manual 180.06.A). Both Colorado and Utah have resource advisory councils. Within the Gunnison Basin population, 16 percent of the BLM and USFS allotment management plans in occupied habitat currently have incorporated Gunnison sage-grouse habitat objectives (USFWS, 2010c, entire). Rangewide, of the offices providing information specific to allotment management plans, only 24 percent of 148 BLM and USFS grazing allotments have thus far incorporated Gunnison sage-grouse habitat objectives into the allotment management plans or in permit renewals. Land health objectives were being met in 37 of the 80 (46 percent) BLM active allotments for which data were reported. Land Health Assessments (LHAs) were not conducted in an additional 20 allotments.

The BLM Gunnison Field Office conducted Gunnison sage-grouse habitat assessments in two major occupied habitat locations in the Gunnison Basin population quantifying vegetation structural characteristics and plant species diversity. Data were collected and compared to Gunnison sage-grouse Structural Habitat Guidelines (GSRSC, 2005, Appendix H) during optimal growing conditions in these two major occupied areas. Guidelines for sage cover, grass cover, forb cover, sagebrush height, grass height, and forb height were met in 45, 30, 25, 75, 81, and 39 percent, respectively, of 97 transects (BLM 2009, pp. 31-32). Using the results of the two assessments along with results from LHAs, habitat conditions are not being adequately managed to meet the life history requirements of Gunnison sage-grouse in the majority of the Gunnison Basin. Only 40 percent of the allotments in the San Miguel population were meeting LHA objectives. This data suggests that regulatory mechanisms applied within livestock grazing permits and leases are not being implemented such that they ensure that habitats within two of the largest Gunnison sage-grouse populations are making significant progress toward being restored or maintained for Gunnison sage-grouse.

USFS

The USFS manages 10 percent of the occupied Gunnison sage-grouse habitat (Table 1). Management of National Forest System lands is guided principally by the National Forest Management Act (NFMA) (16 U.S.C. 1600-1614, August 17, 1974, as amended). The NFMA specifies that all National Forests must have a Land and Resource Management Plan (LRMP) (16 U.S.C. 1600) to guide and set standards for all natural resource management activities on each National Forest or National Grassland. The NFMA requires USFS to incorporate standards and guidelines into LRMPs (16 U.S.C. 1600). USFS conducts NEPA analysis on its LRMPs, which include provisions to manage plant and animal communities for diversity, based on the suitability and capability of the specific land area in order to meet overall multiple-use objectives. The USFS planning process is similar to that of BLM.

The Gunnison sage-grouse is a USFS sensitive species in both Region 2 (Colorado) and Region 4 (Utah). USFS policy provides direction to analyze potential impacts of proposed management activities to sensitive species in a biological evaluation. The forests within the range of sage-grouse provide important seasonal habitats for the species, particularly the Grand Mesa, Uncompahgre, and Gunnison (GMUG) National Forests. The 1991 Amended Land and Resource Management Plan for the GMUG National Forests has not directly incorporated Gunnison sage-grouse conservation measures or habitat objectives. The Regional Forester signed the RCP and as such has agreed to follow and implement those recommendations. Three of the 34 grazing allotments in occupied grouse habitat have incorporated Gunnison sage-grouse habitat objectives. To date USFS has not deferred or withdrawn oil and gas leasing in occupied habitat, but sage-grouse conservation measures can be included at the "Application for Permit to Drill" stage. The BLM, which regulates oil and gas leases on USFS lands, has the authority to defer leases.

However, the only population within USFS lands that is in areas of high or even medium potential for oil and gas reserves is the San Miguel Basin, and USFS lands only make up 1.4 percent of that population (GSRSC 2005, D-8). While consideration as a sensitive species and following the recommendations contained in the Gunnison sage-grouse Rangewide Conservation Plan (GSRSC 2005, entire) can provide some conservation benefits, they are voluntary in nature. Considering the aforementioned, the USFS has minimal regulatory authority that has been implemented to provide for the long-term conservation of Gunnison sage-grouse and its habitat.

NPS

The NPS manages two percent of occupied Gunnison sage-grouse habitat (Table 1), which means that there is little opportunity for the agency to affect range-wide conservation of the species. The NPS Organic Act (39 Stat. 535; 16 U.S.C. 1, 2, 3, and 4) states that NPS will administer areas under their jurisdiction "by such means and measures as conform to the fundamental purpose of said parks, monuments, and reservations, which purpose is to conserve the scenery and the natural and historical objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations." Lands in the Black Canyon of the Gunnison National Park and the Curecanti National Recreation Area include portions of occupied habitat of the Crawford and Gunnison Basin populations. The 1993 Black Canyon of the Gunnison Resource Management Plan (NPS 1993, entire) and the 1995 Curecanti National Recreation Area Resource Management Plan (NPS 1995, entire) do not identify any specific conservation measures for Gunnison sage-grouse. However, these Resource Management Plans are outdated and will be replaced with Resource Stewardship Strategies, which will be developed in the next five to seven years. In the mean time, NPS ability to actively manage for species of special concern is not limited by the scope of their management plans.

NPS completed a Fire Management Plan in 2006 (NPS 2006, entire). Both prescribed fire and fire use (allowing wildfires to burn) are identified as a suitable use in Gunnison sage-grouse habitat. However, Gunnison sage-grouse habitat is identified as a Category C area, meaning that while fire is a desirable component of the ecosystem, ecological constraints must be observed. For Gunnison sage-grouse, constraints include limitation of acreage burned per year and limitation of percent of project polygons burned. The NPS is currently following conservation measures in the local conservation plans and the RCP (Stahlnecker 2010, pers. comm.).

In most cases, implementation of NPS fire management policies should result in minimal adverse effects since emphasis is placed on activities that will minimize, or ideally benefit, impacts to Gunnison sage-grouse habitat. Overall, implementation of NPS regulations should minimize impacts to Gunnison sage-grouse. Certain activities, such as human recreation activities occurring within occupied habitat, may have adverse effects, although we believe the limited nature of such activities on NPS lands would limit their impacts on the species and thus not be considered a threat to Gunnison sage-grouse. Grazing management activities on NPS lands are governed by BLM regulations and their implementation.

Summary of Factor D

Gunnison sage-grouse conservation has been addressed in some local, State, and Federal plans, laws, regulations, and policies. Gunnison County has implemented regulatory authority over development within their area of jurisdiction, for which they are to be highly commended. No other counties within the range of the species have implemented such regulations. While regulations implemented in Gunnison County have minimized some impacts, it has not curtailed the habitat loss, fragmentation, and degradation occurring within the County's jurisidictional boundary. Due to the limited scope and applicability of these regulations throughout the range of the species and within all populations, the current local land use or development planning regulations do not provide adequate regulatory authority to protect sage-grouse from development or other harmful land uses that result in habitat loss, degradation, and fragmentation. The CDOW and UDWR have implemented and continue to pursue conservation easements in Colorado and Utah, respectively, to conserve Gunnison sage-grouse habitat and meet the species' needs. These easements provide protection for the species where they occur, but do not cover enough of the landscape to provide for long-term conservation of the species. State wildlife regulations provide protection for individual Gunnison sage-grouse from direct mortality due to hunting but do not protect its habitat from the main threat of loss and fragmentation. Our assessment of the implementation of regulations and associated stipulations guiding exurban development indicates that current regulatory measures do not adequately ameliorate impacts to sage-grouse and its habitat.

Energy development is only considered a threat in the Dry Creek Basin subpopulation of the San Miguel population. For the BLM and USFS, RMPs and LRMPs are mechanisms through which adequate and enforceable protections for Gunnison sage-grouse could be implemented. However, the extent to which appropriate measures to reduce or eliminate threats to sage-grouse resulting from the various activites the agencies manage have been incorporated into those planning documents, or are being implemented, vary across the range. As evidenced by the discussion above, and the ongoing threats described under Factor A, BLM and the USFS are not fully implementing the regulatory mechanisms available to conserve Gunnison sage-grouse and their habitats on their lands.

We have evaluated the best available scientific information on the adequacy of regulatory mechanisms to address threats to Gunnison sage-grouse and its habitats. While 54 percent of Gunnison sage-grouse habitat is managed by Federal agencies, these lands are interspersed with private lands, which do not have adequate regulatory mechanisms to ameliorate the further loss and fragmentation of habitat in all populations. This interspersion of private lands throughout Federal and other public lands extends the negative influence of those activities beyond the actual 41 percent of occupied habitat that private lands overlay. While we are unable to quantify the extent of the impacts on Federal lands resulting from activities on private lands, we have determined that the inadequacy of regulatory mechanisms on private lands as they pertain to human infrastructure development and the inadequate implementation of Federal authorities on some Federal lands pose a significant threat to the species throughout its range. Further, the threat of inadequate regulatory mechanisms is expected to continue or even increase in the future.

E. Other Natural or Manmade Factors Affecting Its Continued Existence

Other factors potentially affecting the Gunnison sage-grouse's continued existence include genetic risks, drought, recreational activities, pesticides and herbicides, and contaminants.

Genetics and Small Population Size

Small populations face three primary genetic risks: inbreeding depression; loss of genetic variation; and accumulation of new mutations. Inbreeding can have individual and population consequences by either increasing the phenotypic expression of recessive, deleterious alleles (the expression of harmful genes through the physical appearance) or by reducing the overall fitness of individuals in the population (GSRSC 2005, p.109 and references therein). At the species level, Gunnison sage-grouse have low levels of genetic diversity particularly when compared to greater sage-grouse (Oyler-McCance *et al.* 2005, p. 635). There is no consensus regarding how large a population must be in order to prevent inbreeding depression. However, the San Miguel Basin Gunnison sage-grouse effective population size was below the level at which inbreeding depression has been observed to occur (Stiver *et al.* 2008, p. 479). Lowered hatching success is a well documented correlate of inbreeding in wild bird populations (Stiver *et al.* 2008, p. 479 and references therein). Stiver *et al.* (2008, p. 479) suggested the observed lowered hatching success rate of Gunnison sage-grouse in their study may be caused by inbreeding depression. Similarities of hatchability rates exist among other bird species that had undergone genetic bottlenecks. The application of the same procedures of effective population size estimation as used for the San Miguel Basin to the other Gunnison sage-grouse populations indicated that all populations other than the Gunnison Basin population may have population sizes low enough to induce inbreeding depression; and all populations could be losing adaptive potential (Stiver *et al.* 2008, p. 479).

Population structure of Gunnison sage-grouse was investigated using mitochondrial DNA sequence (mtDNA, maternally inherited DNA located in cellular organelles called mitochondria) and nuclear microsatellite data from seven geographic areas (Cerro Summit–Cimarron–Sims Mesa, Crawford, Gunnison Basin, Curecanti area of the Gunnison Basin, Monticello–Dove Creek, Pĩnon Mesa, and San Miguel Basin) (Oyler-McCance *et al.* 2005, entire). The Cerro Summit–Cimarron–Sims Mesa population was not included in the analysis due to inadequate sample sizes. The Poncha Pass population also was not included as it is composed of individuals transplanted from Gunnison Basin. Oyler-McCance *et al.* (2005, entire) found that levels of genetic diversity were highest in the Gunnison Basin, which consistently had more alleles and most of the alleles present in other populations. All other populations had much lower levels of diversity.

The lower diversity levels are linked to small population sizes and a high degree of geographic isolation. Collectively, the smaller populations contain 24 percent of the genetic diversity of the species. Individually, each of the small populations may not be important genetically to the survival of the species, but collectively it is likely that 24 percent of the genetic diversity is important to future rangewide survival of the species. Some of the genetic makeup contained within the smaller populations (with the potential exception of the Poncha Pass population since it consists of birds from the Gunnison Basin) may be critical to maintaining adaptability in the face of issues such as climate change or other environmental change. All populations sampled were found to be genetically discrete units (Oyler-McCance *et al.* 2005, p. 635), so the loss of any of them would result in a decrease in genetic diversity of the species. In addition, multiple populations across a broad geographic area provide insurance against a single catastrophic event (such as the effects of a significant drought even), and the aggregate number of individuals across all populations increases the probability of demographic persistence and preservation of overall genetic diversity by providing an important genetic reservoir (GSRSC 2005, p. 179). Consequently, the loss of any one population would have a negative effect on the species as a whole.

Historically, the Monticello–Dove Creek, San Miguel, Crawford, and Pĩnon Mesa populations were larger and were connected through more contiguous areas of sagebrush habitat. A 20 percent loss of habitat and 37 percent fragmentation of sagebrush habitat was documented in southwestern Colorado between the late 1950s and the early 1990s (Oyler-McCance *et al.* 2001, p.), which led to the current isolation of these populations and is consistent with the documented low amounts of gene flow and isolation by distance (Oyler-McCance *et al.* 2005, p. 635). However, Oyler-McCance *et al.* (2005, p. 636) noted that a few individuals in their analysis appeared to have the genetic characteristics of a population other than their own, suggesting they were dispersers from a different population. Two probable dispersers were individuals moving from San Miguel into Monticello–Dove Creek and Crawford. The San Miguel population itself appeared to have a mixture of individuals with differing probabilities of belonging to different clusters. This information suggests that the San Miguel population may act as a conduit of gene flow among the satellite populations surrounding the larger Gunnison Basin population. Additionally, another potential disperser into Crawford was found from the Gunnison Basin (Oyler-McCance *et al.* 2005, p. 636). This result is not surprising given their close geographic proximity.

Effective population size (Ne) is an important parameter in conservation biology. It is defined as the size of an idealized population of breeding adults that would experience the same rate of (1) loss of heterozygosity (the amount and number of different genes within individuals in a population), (2) change in the average inbreeding coefficient (a calculation of the amount of breeding by closely related individuals), or (3) change in variance in allele (one member if a pair or series of genes occupying a specific position in a specific chromosome) frequency through genetic drift (the fluctuation in gene frequency occurring in an isolated population) as the actual population. The effective size of a population is often much less than its actual size or number of individuals. As effective population size decreases, the rate of loss of allelic diversity via genetic drift increases. Two consequences of this loss of genetic diversity, reduced fitness through inbreeding depression and reduced response to sustained directional selection (''adaptive potential''), are thought to elevate extinction risk (Stiver *et al.*, 2008, p. 472 and references therein). While no consensus exists on the population size needed to retain a level of genetic diversity that maximizes evolutionary potential (i.e., the ability to adapt to local changes), up to 5,000 greater sage-grouse may be necessary to maintain an effective population size of 500 birds (Aldridge and Brigham, 2003, p. 30). Other recent recommendations also suggest populations of at least 5,000 individuals to deal with evolutionary and demographic constraints (Trail *et al.* 2009, in press, p. 3, and references therein). While the persistence of wild populations is usually influenced more by ecological rather than by genetic effects, once they are reduced in size, genetic factors become increasingly important (Lande 1995, p. 318).

The CDOW contracted for a population viability analysis (PVA) for the Gunnison sage-grouse (GSRSC 2005, Appendix G). The purpose of the Gunnison sage-grouse PVA was to assist

the CDOW in evaluating the relative risk of extinction for each population under the conditions at that time (i.e., the risk of extinction if nothing changed), to estimate relative extinction probabilities and loss of genetic diversity over time for various population sizes, and to determine the sensitivity of Gunnison sage-grouse population growth rates to various demographic parameters (GSRSC 2005, p. 169). The PVA was used as a tool to predict the relative, not absolute or precise, probability of extinction for the different populations under various management scenarios based on information available at that time and with the understanding that no data were available to determine how demographic rates would be affected by habitat loss or fragmentation. The analysis indicated that small populations (< 50 birds) are at a serious risk of extinction within the next 50 years (assuming some degree of consistency of environmental influences in sage-grouse demography). In contrast, populations in excess of 500 birds had an extinction risk of less than 5 percent within the same time period. These results suggested that the Gunnison Basin population is likely to persist long term in the absence of threats acting on it. In the absence of intervention, the Cerro Summit–Cimarron–Sims Mesa and Poncha Pass populations and the Dove Creek group of the Monticello–Dove Creek population were likely to become extirpated (GSRSC 2005, pp. 168-179). Based on 2009 population estimates and an overall declining population trend, the same three populations may soon be extirpated. Additionally, Gunnison sage-grouse estimates in the Crawford and Pĩnon Mesa populations have declined by over 50 percent since the PVA was conducted (Table 2), so they too are likely trending towards extirpation. The San Miguel population has declined by 40 percent since 2004, so cumulative factors may be combining to cause its future extirpation also.

The lack of large expanses of sagebrush habitat required by Gunnison sage-grouse in at least six of the seven Gunnison sage-grouse populations (as discussed in Factor A), combined with the results of the PVA and current population trends suggest that at least five, and most likely six, of the seven Gunnison sage-grouse populations are at high risk of extirpation. The loss of genetic diversity from the extirpation of the aforementioned populations would result in a loss of genetic diversity of the species as a whole and thus contribute to decreased functionality of these remaining populations in maintaining viability and adaptability, as well as the contribution of these populations to connectivity and the continued existence of the entire species.

Six of the seven Gunnison sage-grouse populations may have effective sizes low enough to induce inbreeding depression and all seven could be losing adaptive potential, with the assumption that the five populations smaller than the San Miguel population are exhibiting similar demography to the San Miguel population (Stiver *et al.* 2008, p. 479) and thus trending towards extirpation. Stiver *et al.* (2008, p. 479) suggested that long-term persistence of the six smaller populations would require translocations to supplement genetic diversity. The only population currently providing individuals to be translocated is the Gunnison Basin population, but because of substantial population declines such as those observed between the 2001 and 2004 lek counts (Stiver *et al.*, 2008, p. 479), significant questions arise as to whether this population would be able to sustain the loss of individuals required by translocations. Lek counts, and consequently population estimates, especially in the San Miguel Basin and Gunnison Basin populations, have undergone substantial declines (Table 2) since peaks observed in the annual 2004 and 2005 counts, thus making inbreeding depression even more likely to be occurring within all populations except the Gunnison Basin. While we recognize that sage-grouse population sizes are cyclical, and that there are concerns about the statistical reliability of lek counts and the resulting population estimates (CDOW 2009a, pp. 1-3), we nonetheless believe that the overall declining trends of 6 of the 7 Gunnison sage-grouse populations, and for the species as a whole, are such that they are having a significant impact on the species' ability to persist.

In summary, the declines in estimates of grouse numbers since 2005 are likely to contribute to even lower levels of genetic diversity and higher levels of inbreeding depression than previously considered, thus making the species as a whole less adaptable to environmental variables and more vulnerable to extirpation. Based on the information presented above, we have determined that genetic risks related to the small population size of Gunnison sage-grouse are a threat to the species now and in the foreseeable future.

Drought

Drought is a common occurrence throughout the range of the Gunnison and greater sage-grouse (Braun 1998, p. 148) and is considered a universal ecological driver across the Great Plains (Knopf 1996, p.147). Infrequent, severe drought may cause local extinctions of annual forbs and grasses that have invaded stands of perennial species, and recolonization of these areas by native species may be slow (Tilman and El Haddi 1992, p. 263). Drought reduces vegetation cover (Milton *et al.* 1994, p. 75; Connelly *et al.* 2004, p. 7-18), potentially resulting in increased soil erosion and subsequent reduced soil depths, decreased water infiltration, and reduced water storage capacity. Drought also can exacerbate other natural events such as defoliation of sagebrush by insects. For example, approximately 2,544 km^2 (982 mi^2) of sagebrush shrublands died in Utah in 2003 as a result of drought and infestations with the *Aroga* (webworm) moth (Connelly *et al.* 2004, p. 5-11). Sage-grouse are affected by drought through the loss of vegetative habitat components, reduced insect production (Connelly and Braun 1997, p. 9), and potential increased risk of virus infections, such as the West Nile virus. These habitat component losses can result in declining sage-grouse populations due to increased nest predation and early brood mortality associated with decreased nest cover and food availability (Braun 1998, p. 149; Moynahan *et al.* 2007, p. 1781).

Greater sage-grouse populations declined during the 1930s period of drought (Patterson 1952, pp. 68-69; Braun 1998, p. 148). Drought conditions in the late 1980s and early 1990s also coincided with a period when sage-grouse populations were at historically low levels (Connelly and Braun 1997, p. 8). Although drought has been a consistent and natural part of the sagebrush-steppe ecosystem, drought impacts on sage-grouse can be exacerbated when combined with other habitat impacts, such as human developments, that reduce cover and food (Braun 1998, p. 148).

Aldridge *et al.* (2008, p. 992) found that the number of severe droughts from 1950 to 2003 had a weak negative effect on patterns of greater sage-grouse persistence. However, they cautioned that drought may have a greater influence on future sage-grouse populations as temperatures rise over the next 50 years, and synergistic effects of other threats affect habitat quality (Aldridge *et al.* 2008, p. 992). Populations on the periphery of the range may suffer extirpation during a severe and prolonged drought (Wisdom *et al.* in press, p. 22).

Gunnison sage-grouse are capable of enduring moderate or severe, but relatively short-term, drought as observed from persistence of the

populations during drought conditions from 1999-2003 throughout much of the range. The drought that began by at least 2001 and was most severe in 2002 had varying impacts on Gunnison sage-grouse habitat and is discussed in detail in our April 18, 2006, finding (71 FR 19954). Habitat appeared to be negatively affected by drought across a broad area of the Gunnison sage-grouse's range. However, the reduction of sagebrush density in some areas, allowing for greater herbaceous growth and stimulating the onset of sagebrush seed crops may have been beneficial to sagebrush habitats over the long term. Six of the seven grouse populations (except for the Gunnison Basin population) have decreased in number since counts were conducted during the drought year of 2002 (Table 2). Data are not available to scientifically determine if the declines are due to the drought alone. The current status of the various populations throughout the species' range make it highly susceptible to stochastic factors such as drought, particularly when it is acting in conjunction with other factors such as habitat fragmentation, small population size, predation, and low genetic diversity. We believe that the available information is too speculative to conclude that drought alone is a threat to the species at this time; however, based on rapid species decline in drought years, it is likely that drought exacerbates other known threats and thus is an indirect threat to the species.

Recreation

Studies have determined that nonconsumptive recreational activities can degrade wildlife resources, water, and the land by distributing refuse, disturbing and displacing wildlife, increasing animal mortality, and simplifying plant communities (Boyle and Samson 1985, pp. 110-112). Sage-grouse response to disturbance may be influenced by the type of activity, recreationist behavior, predictability of activity, frequency and magnitude, timing, and activity location (Knight and Cole 1995, p. 71). We have not located any published literature concerning measured direct effects of recreational activities on Gunnison or greater sage-grouse, but can infer potential impacts on Gunnison sage-grouse from studies on related species and from research on nonrecreational activities. Baydack and Hein (1987, p. 537) reported displacement of male sharp-tailed grouse at leks from human presence resulting in loss of reproductive opportunity during the disturbance period. Female sharp-tailed grouse were observed at undisturbed leks while absent from disturbed leks during the same time period (Baydack and Hein 1987, p. 537). Disturbance of incubating female sage-grouse could cause displacement from nests, increased predator risk, or loss of nests. Disruption of sage-grouse during vulnerable periods at leks, or during nesting or early brood rearing could affect reproduction or survival (Baydack and Hein 1987, pp. 537-538).

Recreational use of off-highway vehicles (OHVs) is one of the fastest-growing outdoor activities. In the western United States, greater than 27 percent of the human population used OHVs for recreational activities between 1999 and 2004 (Knick *et al.*, in press, p. 19). Knick *et al.* (in press, p. 1) reported that widespread motorized access for recreation facilitated the spread of predators adapted to humans and the spread of invasive plants. Any high-frequency human activity along established corridors can affect wildlife through habitat loss and fragmentation (Knick *et al.* in press, p. 25). The effects of OHV use on sagebrush and sage-grouse have not been directly studied (Knick *et al.* in press, p. 25). However, local working groups considered recreational uses, such as off-road vehicle use and biking, to be a risk factor in many areas.

Recreation from OHVs, hikers, mountain bikes, campers, snowmobiles, bird watchers, and other sources has affected many parts of the range, especially portions of the Gunnison Basin and Pīnon Mesa population (BLM 2005a, p. 14; BLM 2005d, p. 4; BLM 2009, p. 36). These activities can result in abandonment of lekking activities and nest sites, energy expenditure reducing survival, and greater exposure to predators (GSRSC 2005).

Recreation is a significant use on lands managed by BLM (Connelly *et al.* 2004, p. 7-26). Recreational activities within the Gunnison Basin are widespread, occur during all seasons of the year, and have expanded as more people move to the area or come to recreate (BLM 2009, pp. 36-37). Four wheel drive, OHV, motorcycle, and other means of mechanized travel have been increasing rapidly. The number of annual OHV registrations in Colorado increased from 12,000 in 1991 to 131,000 in 2007 (BLM 2009, p. 37). Recreational activities are recognized as a direct and indirect threat to the Gunnison sage-grouse and their habitat (BLM 2009, p. 36). The Grand Mesa, Uncompaghre, and Gunnison (GMUG) National Forest is the fourth most visited National Forest in the Rocky Mountain Region of the USFS (Region 2) (Kocis *et al.*, 2004 in Draft Environmental Impact Statement for Gunnison Basin Federal Lands Travel Management (2009, p. 137)). The GMUG is the second most heavily visited National Forest on the western slope of Colorado (DEIS Gunnison Basin Federal Lands Travel Management 2009, p. 137). However, it is unknown what percentage of the visits occur within Gunnison sage-grouse habitat on the Gunnison Ranger District ((DEIS Gunnison Basin Federal Lands Travel Management 2009, p. 137). With human populations expected to increase in towns and cities within and adjacent to the Gunnison Basin and nearby populations (see Factor A), we believe the impacts to Gunnison sage-grouse from recreational use will continue to increase.

The BLM and Gunnison County have 38 closure points within the Basin from March 15 to May 15 each year (BLM 2009, p. 40). While road closures may be violated in a small number of situations, we believe that road closures are having a beneficial effect on Gunnison sage-grouse through avoidance and/or minimization of impacts during the breeding season.

Dispersed camping occurs at a low level on public lands in all of the populations, particularly during the hunting seasons for other species. However, we have no information indicating that these camping activities are adversely affecting Gunnison sage-grouse.

Domestic dogs accompanying recreationists or associated with residences can disturb, harass, displace, or kill Gunnison sage-grouse. Authors of many wildlife disturbance studies concluded that dogs with people, dogs on leash, or loose dogs provoked the most pronounced disturbance reactions from their study animals (Sime 1999 and references within). The primary consequences of dogs being off leash is harassment, which can lead to physiological stress as well as the separation of adult and young birds, or flushing incubating birds from their nest. However, we have no data indicating that this activity is adversely affecting Gunnison sage-grouse population numbers such that it can be considered a rangewide or population-level threat.

Recreational activities as discussed above do not singularly pose a significant threat to Gunnison sage-grouse now or are expected to do so in the foreseeable future. However, there may be certain situations where recreational activities are impacting local concentrations of Gunnison sage-grouse, especially in areas where habitat is already fragmented such as in the six

small populations and in certain areas within the Gunnison Basin.

Pesticides and Herbicides

Insects are an important component of sage-grouse chick and juvenile diets (GSRSC 2005, p.132 and references therein). Insects, especially ants (Hymenoptera) and beetles (Coleoptera), can comprise a major proportion of the diet of juvenile sage-grouse and are important components of early brood-rearing habitats (GSRSC 2005, p. 132 and references therein). Most pesticide applications are not directed at control of ants and beetles. Pesticides are used primarily to control insects causing damage to cultivated crops on private lands and to control grasshoppers (Orthoptera) and Mormon crickets (*Mormonius sp.*) on public lands.

Few studies have examined the effects of pesticides to sage-grouse, but at least two have documented direct mortality of greater sage-grouse from use of these chemicals. Greater sage-grouse died as a result of ingestion of alfalfa sprayed with organophosphorus insecticides (Blus *et al.* 1989, p. 1142; Blus and Connelly 1998, p. 23). In this case, a field of alfalfa was sprayed with methamidophos and dimethoate when approximately 200 greater sage-grouse were present; 63 of these sage-grouse were later found dead, presumably as a result of pesticide exposure (Blus *et al.* 1989; p. 1142, Blus and Connelly 1998, p. 23). Both methamidophos and dimethoate remain registered for use in the United States (Christiansen and Tate in press, p. 21), but we found no further records of sage-grouse mortalities from their use. In 1950, rangelands treated with toxaphene and chlordane bait to control grasshoppers in Wyoming resulted in game bird mortality of 23.4 percent (Christian and Tate in press, p. 20). Forty-five greater sage-grouse deaths were recorded, 11 of which were most likely related to the pesticide (Christiansen and Tate in press, p. 20, and references therein). Greater sage-grouse who succumbed to vehicle collisions and mowing machines in the same area also were likely compromised from pesticide ingestion (Christian and Tate in press, p. 20). Neither of these chemicals has been registered for grasshopper control since the early 1980s (Christiansen and Tate in press, p. 20, and references therein).

Infestations of Russian wheat aphids (*Diuraphis noxia*) have occurred in Gunnison sage-grouse occupied range in Colorado and Utah (GSRSC 2005, p. 132). Disulfoton, a systemic organophosphate extremely toxic to wildlife, was routinely applied to over 400,000 ha (million ac) of winter wheat crops to control the aphids during the late 1980s. We have no data indicating there were any adverse effects to Gunnison sage-grouse (GSRSC 2005, p. 132). More recently, an infestation of army cutworms (*Euxoa auxiliaries*) occurred in Gunnison sage-grouse habitat along the Utah-Colorado State line. Thousands of ha (thousands of ac) of winter wheat and alfalfa fields were sprayed with insecticides such as permethrin by private landowners to control them (GSRSC 2005, p. 132) but again, we have no data indicating any adverse effects to Gunnison sage-grouse.

Game birds that ingested sublethal levels of pesticides have been observed exhibiting abnormal behavior that may lead to a greater risk of predation (Dahlen and Haugen 1954, p. 477; McEwen and Brown 1966, p. 609; Blus *et al.* 1989, p. 1141). McEwen and Brown (1966, p. 689) reported that wild sharp-tailed grouse poisoned by malathion and dieldrin exhibited depression, dullness, slowed reactions, irregular flight, and uncoordinated walking. Although no research has explicitly studied the indirect levels of mortality from sublethal doses of pesticides (e.g., predation of impaired birds), it has been assumed to be the reason for mortality among some study birds (McEwen and Brown 1966 p. 609; Blus *et al.* 1989, p. 1142; Connelly and Blus 1991, p. 4). Both Post (1951, p. 383) and Blus *et al.* (1989, p. 1142) located depredated sage-grouse carcasses in areas that had been treated with insecticides. Exposure to these insecticides may have predisposed sage-grouse to predation. Sage-grouse mortalities also were documented in a study where they were exposed to strychnine bait used to control small mammals (Ward *et al.* 1942 as cited in Schroeder *et al.* 1999, p. 16). While we do not have specific information of these effects occurring in Gunnison sage-grouse, we believe the effects observed in greater sage-grouse can be expected if similar situations arise within Gunnison sage-grouse habitat.

Cropland spraying may affect populations that are not adjacent to agricultural areas, given the distances traveled by females with broods from nesting areas to late brood-rearing areas (Knick *et al.* in press, p. 17). The actual footprint of this effect cannot be estimated, because the distances sage-grouse travel to get to irrigated and sprayed fields is unknown (Knick *et al.* in press, p. 17). Similarly, actual mortalities from pesticides may be underestimated if sage-grouse disperse from agricultural areas after exposure.

Much of the research related to pesticides that had either lethal or sublethal effects on greater sage-grouse was conducted on pesticides that have been banned or have had their use further restricted for more than 20 years due to their toxic effects on the environment (e.g., dieldrin). We currently do not have any information to show that the banned pesticides are having negative impacts to sage-grouse populations through either illegal use or residues in the environment. For example, sage-grouse mortalities were documented in a study where they were exposed to strychnine bait used to control small mammals (Ward *et al.* 1942 as cited in Schroeder *et al.* 1999, p. 16). According to the U.S. Environmental Protection Agency (EPA), above-ground uses of strychnine were prohibited in 1988 and those uses remain temporarily cancelled today. We do not know when, or if, above-ground uses will be permitted to resume. Currently, strychnine is registered for use only below-ground as a bait application to control pocket gophers (*Thomomys* sp.; EPA 1996, p. 4). Therefore, the current legal use of strychnine baits is unlikely to present a significant exposure risk to sage-grouse. No information on illegal use, if it occurs, is available. We have no other information regarding mortalities or sublethal effects of strychnine or other banned pesticides on sage-grouse.

Although a reduction in insect population levels resulting from insecticide application can potentially affect nesting sage-grouse females and chicks (Willis *et al.* 1993, p. 40; Schroeder *et al.* 1999, p. 16), there is no information as to whether insecticides are impacting survivorship or productivity of the Gunnison sage-grouse.

Herbicide applications can kill sagebrush and forbs important as food sources for sage-grouse (Carr 1968 *in* Call and Maser 1985, p. 14). The greatest impact resulting from a reduction of either forbs or insect populations is to nesting females and chicks due to the loss of potential protein sources that are critical for successful egg production and chick nutrition (Johnson and Boyce 1991, p. 90; Schroeder *et al.* 1999, p. 16). A comparison of applied levels of herbicides with toxicity studies of grouse, chickens, and other gamebirds (Carr 1968, *in* Call and Maser 1985, p. 15) concluded that herbicides applied at recommended rates should not result in sage-grouse poisonings.

Use of insecticides to control mosquitoes is infrequent and probably does not have detrimental effects on sage-grouse. Available insecticides that kill adult mosquitoes include synthetic pyrethroids such as permethrin, which

are applied at very low concentrations and have very low vertebrate toxicity (Rose 2004). Organophosphates such as malathion have been used at very low rates to kill adult mosquitoes for decades, and are judged relatively safe for vertebrates (Rose 2004).

In summary, historically insecticides have been shown to result in direct mortality of individuals, and also can reduce the availability of food sources, which in turn could contribute to mortality of sage-grouse. Despite the potential effects of pesticides, we could find no information to indicate that the use of these chemicals, at current levels, negatively affects Gunnison sage-grouse population numbers. Schroeder *et al.*'s (1999, p. 16) literature review found that the loss of insects can have significant impacts on nesting females and chicks, but those impacts were not detailed. Many of the pesticides that have been shown to have an effect on sage-grouse have been banned in the United States for more than 20 years. We currently do not have any information to show that either the illegal use of banned pesticides or residues in the environment are presently having negative impacts to sage-grouse populations. While the reduction in insect availability via insecticide application has not been documented to affect overall population numbers in sage-grouse, we believe that insect reduction, because of its importance to chick production and survival, could be having as yet undetected negative impacts in populations with low population numbers. There is no information available to indicate that either herbicide or insecticide applications pose a threat to the species now or in the foreseeable future.

Contaminants

Gunnison sage-grouse exposure to various types of environmental contaminants may potentially occur as a result of agricultural and rangeland management practices, mining, energy development and pipeline operations, and transportation of materials along highways and railroads.

We expect that the number of sage-grouse occurring in the immediate vicinity of wastewater pits associated with energy development would be small due to the small amount of energy development within the species' range, the typically intense human activity in these areas, the lack of cover around the pits, and the fact that sage-grouse do not require free water. Most bird mortalities recorded in association with wastewater pits are water-dependent species (e.g., waterfowl), whereas dead ground-dwelling birds (such as the sage-grouse) are rarely found at such sites (Domenici 2008, pers. comm.). However, if the wastewater pits are not appropriately screened, sage-grouse may have access to them and could ingest water and become oiled while pursing insects. If these birds then return to sagebrush cover and die, their carcasses are unlikely to be found as only the pits are surveyed.

A few gas and oil pipelines occur within the San Miguel population. Exposure to oil or gas from pipeline spills or leaks could cause mortalities or morbidity to Gunnison sage-grouse. Similarly, given the network of highways and railroad lines that occur throughout the range of the Gunnison sage-grouse, there is some potential for exposure to contaminants resulting from spills or leaks of hazardous materials being conveyed along these transportation corridors. We found no documented occurrences of impacts to Gunnison sage-grouse from such spills, and we do not expect they are a significant source of mortality and a threat to the species because these types of spills occur infrequently and may involve only a small area within the occupied range of the species.

Summary of Factor E

Although genetic consequences of low Gunnison sage-grouse population numbers have not been definitively detected to date, the results from Stiver *et al.* (2008, p. 479) suggest that six of the seven populations may have effective sizes low enough to induce inbreeding depression and all seven could be losing adaptive potential. While some of these consequences may be ameliorated by translocations, we believe the long-term viability of Gunnison sage-grouse is compromised by this situation, particularly when combined with threats discussed under other Factors, and we have determined that genetics risks related to the small population size of Gunnison sage-grouse are a threat to the species now and in the foreseeable future.

While sage-grouse have evolved with drought, population numbers suggest that drought is at least correlated with, and potentially an underlying cause of, the declines. Although we cannot determine whether drought alone is a threat to the species, we believe it is an indirect threat exacerbating other threat factors such as predation or habitat fragmentation. Based on the available information, insecticides are being used infrequently enough and in accordance with manufacturer labeling such that they are not adversely affecting populations of the Gunnison sage-grouse. The most likely impact of pesticides on Gunnison sage-grouse is the reduction of insect prey items. However, we could find no information to indicate that use of pesticides, in accordance with their label instructions, is a threat to Gunnison sage-grouse.

Thus, based on the best scientific and commercial data available, we have concluded that other natural or manmade factors are a significant threat to the Gunnison sage-grouse.

Finding

We have carefully assessed the best scientific and commercial information available regarding the present and future threats to the Gunnison sage-grouse. We have reviewed the information available in our files, information received during the comment period, and other published and unpublished information, and consulted with recognized Gunnison-sage grouse and sagebrush habitat experts. On the basis of the best scientific and commercial information available, we find that listing of the Gunnison sage-grouse is warranted throughout all of its range.

Gunnison sage-grouse, a sagebrush obligate, are a landscape-scale species requiring large, contiguous areas of sagebrush for long-term persistence. Gunnison sage-grouse occur in seven isolated and fragmented populations, primarily in southwestern Colorado, with a small portion of its range extending into southeastern Utah. Populations have been declining since the 1960s, with the Gunnison Basin population the only relatively stable population. Six of the seven remaining populations are now small enough to be vulnerable to extirpation (Stiver *et al.* 2008, p. 479). Specific issues identified under Factors A, C, D, and E are threats to the Gunnison sage-grouse. These threats are exacerbated by small population sizes, the isolated and fragmented nature of the remaining sagebrush habitat, and the potential effects of climate change.

Current and future direct and functional loss of habitat due to residential and road development in all populations (as discussed in Factor A) is the principal threat to the Gunnison sage-grouse. Other threats from human infrastructure such as fences and powerlines (as discussed in Factor A) may not individually threaten the Gunnison sage-grouse; however, the cumulative presence of these features, particularly when considered with residential and road development, do constitute a threat to the continued existence of the Gunnison sage-grouse as they collectively contribute to habitat loss and fragmentation. These impacts

exacerbate the fragmentation that has already occurred in Gunnison sage-grouse habitat from past agricultural conversion and residential development. Gunnison sage-grouse are sensitive to these forms of habitat fragmentation because they require large areas of contiguous, suitable habitat. Given the increasing human population trends in Gunnison sage-grouse habitat, we expect urban and exurban development and associated roads and infrastructure to continue to expand. Likewise, we expect direct and indirect effects from these activities, including habitat loss, degradation and fragmentation, to increase in sage-grouse habitats.

Invasive species, fire, and climate change (as discussed in Factor A) may not individually threaten the Gunnison sage-grouse; however, the documented synergy among these factors result in a high likelihood that they will threaten the species in the future. Noxious and invasive plant incursions into sagebrush ecosystems, which are facilitated by human activities and fragmentation, are likely to increase wildfire frequencies, further contributing to direct loss of habitat and fragmentation. Climate change may alter the range of invasive plants, intensifying the proliferation of invasive plants to the point that they become a threat to the species. While recent local climatic moderations may have produced some improved habitat quality (increased forb and grass growth providing enhanced grouse productivity and survival). Habitat conservation efforts have been implemented to benefit local habitat conditions, but they have not cumulatively resulted in local population recoveries because unfragmented sagebrush habitats on the scale required that contain the necessary ecological attributes (e.g., connectivity and landscape context) have been lost. Sagebrush habitats are highly fragmented due to anthropogenic impacts, and in most cases are not resilient enough to return to native vegetative states following disturbance from fire, invasive species, and the effects of climate change. We expect these threats to continue and potentially increase in magnitude in the future.

We found no evidence that the threats summarized above, which contribute to habitat loss, degradation and fragmentation will subside within the foreseeable future. Six populations are extremely small and compromised by existing fragmentation. The one remaining relatively contiguous patch of habitat (Gunnison Basin) for the species is somewhat compromised by existing fragmentation. Based on the current and anticipated habitat threats and their cumulative effects as they contribute to the overall fragmentation of Gunnison sage-grouse habitat, we have determined that threats identified under Factor A pose a significant threat to the species throughout its range. We find that the present or threatened destruction, modification, or curtailment of Gunnison sage-grouse habitat is a threat to the species future existence.

We believe that existing and continued landscape fragmentation will increase the effects of predation (discussed in Factor C above) on this species, particularly in the six smaller populations, resulting in a reduction in sage-grouse productivity and abundance in the future. Predation has a strong relationship with anthropogenic factors on the landscape, and human presence on the landscape will continue to increase in the future. We find that predation is a significant threat to the species.

West Nile virus (discussed in Factor C above) is the only disease that currently presents a potential threat to the Gunnison sage-grouse. While we have no evidence of West Nile virus acting on the Gunnison sage-grouse, because of the virus's presence within the species' range and the continued development of anthropogenic water sources in the area, the virus may pose a future threat to the species. We have determined that disease is not currently a threat to the species. However, we anticipate that West Nile virus will persist within the range of Gunnison sage-grouse indefinitely and will be exacerbated by factors such as climate change that could increase ambient temperatures and the presence of the vector on the landscape.

An examination of regulatory mechanisms (discussed in Factor D above) for both the Gunnison sage-grouse and sagebrush habitats revealed that while limited mechanisms exist, they are not broad enough in their potential conservation value throughout the species range, and are not being implemented consistent with our current understanding of the species' biology and reaction to disturbances, to be effective at ameliorating threats. This is particularly true on private lands, which comprise 41 percent of the species' extant range and are highly dispersed throughout all populations. Inadequate regulation of grazing practices on public land is occurring in some locations within the species' range. Public land management agencies should continue to improve habitat conditions to be compatible with Gunnison sage-grouse life-history requirements. Some local conservation efforts are effective and should be continued, but to date have occurred on a scale that is too small to remove threats at a range-wide level. Many conservation efforts lacked sufficient monitoring to demonstrate their overall effectiveness in minimizing or eliminating the primary threat of habitat loss, fragmentation, and degradation. Therefore, we find the existing regulatory mechanisms are ineffective at ameliorating habitat-based threats.

Small population size and genetic factors (discussed in Factor E above) subject at least six of the seven populations to a high risk of extirpation from stochastic events. All populations are currently isolated as documented by low amounts of gene flow (Oyler-McCance *et al.* 2005, p. 635). The loss of connectivity and the concomitant isolation of the populations also increase the species' extinction risk. Fitness and population size are strongly correlated, and smaller populations are more subject to environmental and demographic stochasticity. When coupled with mortality stressors related to human activity and significant fluctuations in annual population size, long-term persistence of small populations is always problematic. Given the species' relatively low rate of growth and strong site fidelity, recovery and repopulation of extirpated, or nearly extirpated areas, will be extremely challenging. Translocation of Gunnison sage-grouse is difficult and to date has not been demonstrated to be successful in maintaining and improving population and species viability. Given the limited number of source individuals, sustainable, successful translocation efforts involving large numbers of individuals are unlikely at this time. Recent captive-rearing efforts by CDOW have provided some optimistic results. Nonetheless, even assuming CDOW captive-rearing and tranlocation efforts prove to be successful in the long-term, the existing condition of the habitat throughout the species' range will need to be improved, before captive rearing and translocation can be relied on to maintain population and species viability.

The existing and continuing loss, degradation, and fragmentation of sage-grouse habitat; extremely small population sizes; occupancy of extremely small, isolated, and fragmented sagebrush areas; increased susceptibility to predation; lack of interconnectivity; low genetic diversity; and the potential for catastrophic stochastic (random) events, combined with the inadequacy of existing regulations to manage habitat loss (either direct or functional), endanger all Gunnison sage-grouse populations

and the species as a whole. Threat factors affecting the Gunnison sage-grouse are summarized in Table 5 below. As required by the Act, we have reviewed and taken into account efforts being made to protect Gunnison sage-grouse. Although some local conservation efforts have been implemented and are effective in small areas, they are not at a scale that is sufficient to ameliorate threats to the species as a whole. Other conservation efforts (such as habitat treatments, establishment of conservation easements, improved grazing practices, additional travel management efforts that benefit Gunnison sage-grouse) are being planned, but there is substantial uncertainty as to whether, where, and when they will be implemented, and whether they will be effective.

TABLE 5. THREAT SUMMARY FOR FACTORS AFFECTING GUNNISON SAGE-GROUSE. A "+" INDICATES HIGHER LEVEL OF THREAT.

Listing Factor	Threat or Impact	Magnitude			Imminence		Species' Response	Foreseeable Future	Overall Threat
		Overall Magnitude	Intensity	Exposure (percent)	Overall Immi-nence	Likelihood			
A	Conversion to Agriculture	Moderate	Moderate	40%	Non-Imminent	Low	Past conversion contributes to current habitat fragmentation and degradation.	Year 2050[a]	Low
A	Water Development	Low	Low	<20%	Non-Imminent	Low	Past development contributes to habitat fragmentation and degrada-tion	Year 2050	Low
A	Residential Development	High+	High	70%	Imminent	High	Habitat loss, fragmentation and degradation; increased predation	Year 2050	High
A	Fences	Moderate	Low	75%	Imminent	High	Habitat fragmentation and degradation; increased predation; direct mortality	Year 2050	Moderate
A	Roads	High+	High	90%	Imminent	High	Habitat loss, fragmentation and degradation; increased predation; direct mortality	Year 2050	High
A	Powerlines	Moderate	Moderate	60%	Imminent	High	Habitat loss, fragmentation and degradation; increased predation	Year 2050	Moderate+
A	Fire	Low	Low	10%	Non-Imminent	Low	Habitat loss, fragmentation, and degradation	Likely to increase indefinitely with cheatgrass invasion	Low+
A	Invasive Plants	Moderate	Moderate	65%	Imminent	Moderate	Habitat loss, fragmentation, and degradation	Likely to increase indefinitely due to increased human presence and climate change	Moderate+
A	Piñon-Juniper Encroachment	Low	Low	15%	Imminent	Moderate	Habitat fragmentation and degradation; increased predation	Indefinitely	Low
A	Domestic and Wild Ungulate Herbivory	High	Low	85%	Imminent	Moderate	Habitat degradation	Indefinitely	Moderate

TABLE 5. THREAT SUMMARY FOR FACTORS AFFECTING GUNNISON SAGE-GROUSE. A "+" INDICATES HIGHER LEVEL OF THREAT.—Continued

Listing Factor	Threat or Impact	Magnitude			Imminence		Species' Response	Foreseeable Future	Overall Threat
		Overall Magnitude	Intensity	Exposure (percent)	Overall Immi-nence	Likelihood			
A	Non-renewable Energy Development	Low+	Moderate	10%	Imminent	Low	Habitat fragmentation and degradation; increased predation	Year 2050	Low
A	Renewable Energy Develop-ment	Low+	Low+	15%	Non-Imminent	Moderate	Habitat fragmentation and degradation; increased predation	Year 2050	Low
A	Climate Change	Low	Moderate	100%	Imminent	Moderate	Unknown, but could facili-tate increase in invasive plants and corresponding increased fire frequency	Climate models predict out to 40 years	Low
B	Hunting	Low	Low	0%	Non-Imminent	Low	None	Year 2050	Low
B	Lek Viewing	Low	Low	10%	Imminent	Moderate	Harassment; avoidance	Year 2050	Low
B	Scientific Research	Low+	Low+	50%	Imminent	Moderate	Harassment; direct mortality	Year 2050	Low
C	Disease	Low	Low	100%	Non-Imminent	Moderate	Direct mortality	Indefinitely	Low
C	Predation	High	Moderate+	90%	Imminent	High	Direct mortality	Indefinitely	Moderate+
D	Inadequacy of Local Laws and Regulations	High	Moderate	50%	Imminent	High	Habitat loss, fragmentation, and degradation	Year 2050	High
D	Inadequacy of State Laws and Regulations	Moderate	High	60%	Imminent	High	Habitat loss, fragmentation, and degradation	Year 2050	Moderate
D	Inadequacy of Federal Laws and Regulations	High	High	75%	Imminent	High	Habitat loss, fragmentation, and degradation	Year 2050	High
E	Genetic Complications	High	Moderate+	70%	Imminent	High	Inbreeding depression; loss of adaptive potential	Indefinitely	High
E	Small Population Size	Moderate+	Moderate+	60%	Imminent	High	Population vulnerability to stochastic events	Indefinitely	Moderate+
E	Drought	Moderate+	High	100%	Imminent	Moderate	Habitat degradation; decline in species reproductive potential	Indefinitely	Moderate
E	Recreation	Low	Low+	50%	Imminent	Moderate	Harassment; avoidance	Year 2050	Low
E	Pesticides and Herbicides	Low	Low	10%	Non-Imminent	Low	Direct mortality; habitat degradation	Year 2050	Low
E	Contaminants	Low	Low	<5%	Non-Imminent	Low	Direct mortality	Year 2050	Low

[a] The foreseeable future date of 2050 was determined for threats or impacts directly related to anthropogenic activities based on the furthest population projection from CWCB (2009, p. 53).

Listing factors include: (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.

We have carefully assessed the best scientific and commercial information available regarding the present and future threats to the Gunnison sage-grouse. We have reviewed petitions, information available in our files, and other published and unpublished information, and consulted with recognized Gunnison sage-grouse and greater sage-grouse experts. We have considered and taken into account efforts being made to conserve protect the species. On the basis of the best scientific and commercial information available, we find that listing of the Gunnison sage-grouse is warranted throughout all of its range. However, listing the Gunnison sage-grouse is precluded by higher priority listing actions at this time, as discussed in the **Preclusion and Expeditious Progress** section below.

Listing Priority Number

The Service adopted guidelines on September 21, 1983 (48 FR 43098), to establish a rational system for utilizing available resources for the highest priority species when adding species to the Lists of Endangered or Threatened Wildlife and Plants or reclassifying species listed as threatened to endangered status. These guidelines, titled "Endangered and Threatened Species Listing and Recovery Priority Guidelines" address the immediacy and magnitude of threats, and the level of taxonomic distinctiveness by assigning priority in descending order to monotypic genera (genus with one species), full species, and subspecies (or equivalently, distinct population segments of vertebrates).

As a result of our analysis of the best available scientific and commercial information, we assigned the Gunnison sage-grouse an LPN of 2 based on our finding that the species faces threats that are of high magnitude and are imminent. These threats include the present or threatened destruction, modification, or curtailment of its habitat; predation; the inadequacy of existing regulatory mechanisms; and other natural or man-made factors affecting its continued existence. Our rationale for assigning the Gunnison sage-grouse an LPN 2 is outlined below.

Under the Service's LPN Guidance, the magnitude of threat is the first criterion we look at when establishing a listing priority. The guidance indicates that species with the highest magnitude of threat are those species facing the greatest threats to their continued existence. These species receive the highest listing priority. We consider the threats that the Gunnison sage-grouse faces to be high in magnitude because the major threats (exurban development, inadequacy of regulatory mechanisms, genetic issues, roads) occur throughout all of the species range. Based on an evaluation of biotic, abiotic, and anthropogenic factors, no strongholds are believed to exist for Gunnison sage-grouse (Wisdom *et al.*, in press, entire). All seven populations are experiencing habitat degradation and fragmentation due to exurban development and roads. Six of the seven populations of Gunnison sage-grouse currently contain so little occupied habitat that continued degradation and fragmentation will place their continued existence in question. The remaining population (Gunnison Basin) is so interspersed with development and roads that it is likely to degrade and fragment the habitat (Aldridge and Saher, in press, entire). We believe it is not functional for a species that requires large expanses of sagebrush. Six of the seven populations of Gunnison sage-grouse have population sizes low enough to induce inbreeding depression, and all seven may be losing their adaptive potential (Stiver 2008, p. 479). Predation is exerting a strong influence on all populations, but especially the six smaller populations. Invasive weeds are likely to exert a strong influence on all populations in the future. Adequate regulations are not in place at the local, State, or Federal level to adequately minimize the threat of habitat degradation and fragmentation resulting from exurban development. Regulatory mechanisms are not being appropriately implemented such that land use practices result in habitat conditions that adequately support the life-history needs of the species. Adequate regulations are also not in place to ameliorate the threats resulting from predation, genetic issues, or invasive weeds. Due to the impacts resulting from the issues described above and the current small population sizes and habitat areas, impacts from other stressors such as fences, recreation, grazing, powerlines, and drought/weather are likely acting cumulatively to further decrease the likelihood of at least the six small populations, and potentially all seven, persisting into the future. We believe the ability of all remaining populations and habitat areas to retain the attributes required for long-term sustainability of this landscape-scale species are highly diminished indicating that the magnitude of threats is high.

Under our LPN Guidance, the second criterion we consider in assigning a listing priority is the immediacy of threats. This criterion is intended to ensure that the species facing actual, identifiable threats are given priority over those for which threats are only potential or that are intrinsically vulnerable but are not known to be presently facing such threats. We consider the threats imminent because we have factual information that the threats are identifiable and that the species is currently facing them in many portions of its range. These actual, identifiable threats are covered in great detail in Factors A, C, D, and E of this finding and currently include habitat degradation and fragmentation from exurban development and roads, inadequate regulatory mechanisms, genetic issues, predation, invasive plants, and drought/weather. In addition to their current existence, we expect these threats to continue and likely intensify in the foreseeable future.

The third criterion in our LPN guidance is intended to devote resources to those species representing highly distinctive or isolated gene pools as reflected by taxonomy. The Gunnison sage-grouse is a valid taxon at the species level, and therefore receives a higher priority than subspecies or DPSs, but a lower priority than species in a monotypic genus.

We will continue to monitor the threats to the Gunnison sage-grouse, and the species' status on an annual basis, and should the magnitude or the imminence of the threats change, we will re-visit our assessment of LPN.

Currently, work on a proposed listing determination for the Gunnison sage-grouse is precluded by work on higher priority listing actions with absolute statutory, court-ordered, or court-approved deadlines and final listing determinations for those species that were proposed for listing with funds from FY 2009. Additionally, remaining listing funding from FY 2010 has been directed to work on listing determinations for species at significantly greater risk of extinction than the Gunnison sage-grouse faces. Because of the large number of high-priority species, we further ranked the candidate species with an LPN of 2. The resulting "Top 40" list of candidate species have the highest priority to receive funding to work on a proposed

listing determination (see the **Preclusion and Expeditious Progress** section below). This work includes all the actions listed in the tables below under expeditious progress.

Preclusion and Expeditious Progress

Preclusion is a function of the listing priority of a species in relation to the resources that are available and competing demands for those resources. Thus, in any given fiscal year (FY), multiple factors dictate whether it will be possible to undertake work on a proposed listing regulation or whether promulgation of such a proposal is warranted but precluded by higher-priority listing actions.

The resources available for listing actions are determined through the annual Congressional appropriations process. The appropriation for the Service Listing Program is available to support work involving the following listing actions: Proposed and final listing rules; 90–day and 12–month findings on petitions to add species to the Lists of Endangered and Threatened Wildlife and Plants (Lists) or to change the status of a species from threatened to endangered; annual determinations on prior "warranted but precluded" petition findings as required under section 4(b)(3)(C)(i) of the Act; critical habitat petition findings; proposed and final rules designating critical habitat; and litigation-related, administrative, and program-management functions (including preparing and allocating budgets, responding to Congressional and public inquiries, and conducting public outreach regarding listing and critical habitat). The work involved in preparing various listing documents can be extensive and may include, but is not limited to: Gathering and assessing the best scientific and commercial data available and conducting analyses used as the basis for our decisions; writing and publishing documents; and obtaining, reviewing, and evaluating public comments and peer review comments on proposed rules and incorporating relevant information into final rules. The number of listing actions that we can undertake in a given year also is influenced by the complexity of those listing actions; that is, more complex actions generally are more costly. The median cost for preparing and publishing a 90–day finding is $39, 276; for a 12–month finding, $100,690; for a proposed rule with critical habitat, $345,000; and for a final listing rule with critical habitat, the median cost is $305,000.

We cannot spend more than is appropriated for the Listing Program without violating the Anti-Deficiency Act (see 31 U.S.C. 1341(a)(1)(A)). In addition, in FY 1998 and for each fiscal year since then, Congress has placed a statutory cap on funds which may be expended for the Listing Program, equal to the amount expressly appropriated for that purpose in that fiscal year. This cap was designed to prevent funds appropriated for other functions under the Act (for example, recovery funds for removing species from the Lists), or for other Service programs, from being used for Listing Program actions (see House Report 105-163, 105th Congress, 1st Session, July 1, 1997).

Since FY 2002, the Service's budget has included a critical habitat subcap to ensure that some funds are available for other work in the Listing Program ("The critical habitat designation subcap will ensure that some funding is available to address other listing activities" (House Report No. 107 - 103, 107th Congress, 1st Session, June 19, 2001)). In FY 2002 and each year until FY 2006, the Service has had to use virtually the entire critical habitat subcap to address court-mandated designations of critical habitat, and consequently none of the critical habitat subcap funds have been available for other listing activities. In FY 2007, we were able to use some of the critical habitat subcap funds to fund proposed listing determinations for high-priority candidate species. In FY 2009, while we were unable to use any of the critical habitat subcap funds to fund proposed listing determinations, we did use some of this money to fund the critical habitat portion of some proposed listing determinations so that the proposed listing determination and proposed critical habitat designation could be combined into one rule, thereby being more efficient in our work. In FY 2010, we are using some of the critical habitat subcap funds to fund actions with statutory deadlines.

Thus, through the listing cap, the critical habitat subcap, and the amount of funds needed to address court-mandated critical habitat designations, Congress and the courts have in effect determined the amount of money available for other listing activities. Therefore, the funds in the listing cap, other than those needed to address court-mandated critical habitat for already listed species, set the limits on our determinations of preclusion and expeditious progress.

Congress also recognized that the availability of resources was the key element in deciding, when making a 12–month petition finding, whether we would prepare and issue a listing proposal or instead make a "warranted but precluded" finding for a given species. The Conference Report accompanying Public Law 97-304, which established the current statutory deadlines and the warranted-but-precluded finding, states (in a discussion on 90–day petition findings that by its own terms also covers 12–month findings) that the deadlines were "not intended to allow the Secretary to delay commencing the rulemaking process for any reason other than that the existence of pending or imminent proposals to list species subject to a greater degree of threat would make allocation of resources to such a petition [that is, for a lower-ranking species] unwise."

In FY 2010, expeditious progress is that amount of work that can be achieved with $10,471,000, which is the amount of money that Congress appropriated for the Listing Program (that is, the portion of the Listing Program funding not related to critical habitat designations for species that are already listed). However these funds are not enough to fully fund all our court-ordered and statutory listing actions in FY 2010, so we are using $1,114,417 of our critical habitat subcap funds in order to work on all of our required petition findings and listing determinations. This brings the total amount of funds we have for listing actions in FY 2010 to $11,585,417. Our process is to make our determinations of preclusion on a nationwide basis to ensure that the species most in need of listing will be addressed first and also because we allocate our listing budget on a nationwide basis. The $11,585,417 is being used to fund work in the following categories: compliance with court orders and court-approved settlement agreements requiring that petition findings or listing determinations be completed by a specific date; section 4 (of the Act) listing actions with absolute statutory deadlines; essential litigation-related, administrative, and listing program-management functions; and high-priority listing actions for some of our candidate species. In 2009, the responsibility for listing foreign species under the Act was transferred from the Division of Scientific Authority, International Affairs Program, to the Endangered Species Program. Starting in FY 2010, a portion of our funding is being used to work on the actions described above as they apply to listing actions for foreign species. This has the potential to further reduce funding available for domestic listing actions. Although there are currently no foreign species issues included in our high-priority listing actions at this time, many actions have statutory or court-

approved settlement deadlines, thus increasing their priority. The allocations for each specific listing action are identified in the Service's FY 2010 Allocation Table (part of our administrative record).

Based on our September 21, 1983, guidance for assigning an LPN for each candidate species (48 FR 43098), we have a significant number of species with a LPN of 2. Using this guidance, we assign each candidate an LPN of 1 to 12, depending on the magnitude of threats (high vs. moderate to low), immediacy of threats (imminent or nonimminent), and taxonomic status of the species (in order of priority: monotypic genus (a species that is the sole member of a genus); species; or part of a species (subspecies, distinct population segment, or significant portion of the range)). The lower the listing priority number, the higher the listing priority (that is, a species with an LPN of 1 would have the highest listing priority). Because of the large number of high-priority species, we have further ranked the candidate species with an LPN of 2 by using the following extinction-risk type criteria: International Union for the Conservation of Nature and Natural Resources (IUCN) Red list status/rank, Heritage rank (provided by NatureServe), Heritage threat rank (provided by NatureServe), and species currently with fewer than 50 individuals, or 4 or fewer populations. Those species with the highest IUCN rank (critically endangered), the highest Heritage rank (G1), the highest Heritage threat rank (substantial, imminent threats), and currently with fewer than 50 individuals, or fewer than 4 populations, originally comprised a group of approximately 40 candidate species ("Top 40"). These 40 candidate species have had the highest priority to receive funding to work on a proposed listing determination. As we work on proposed and final listing rules for those 40 candidates, we apply the ranking criteria to the next group of candidates with an LPN of 2 and 3 to determine the next set of highest priority candidate species.

To be more efficient in our listing process, as we work on proposed rules for the highest priority species in the next several years, we are preparing multi-species proposals when appropriate, and these may include species with lower priority if they overlap geographically or have the same threats as a species with an LPN of 2. In addition, available staff resources are also a factor in determining high-priority species provided with funding. Finally, proposed rules for reclassification of threatened species to endangered are lower priority, since as listed species, they are already afforded the protection of the Act and implementing regulations.

We assigned the Gunnison sage-grouse an LPN of 2, based on our finding that the species faces immediate and high magnitude threats from the present or threatened destruction, modification, or curtailment of its habitat; predation; the inadequacy of existing regulatory mechanisms; and other natural or man-made factors affecting its continued existence. One or more of the threats discussed above occurs in each known population. These threats are ongoing and, in some cases, considered irreversible. Under our 1983 Guidelines, a "species" facing imminent high-magnitude threats is assigned an LPN of 1, 2, or 3 depending on its taxonomic status. Because the Gunnison sage-grouse is a species, we assigned it an LPN of 2 (the highest category available for a species). Therefore, work on a proposed listing determination for the Gunnison sage-grouse is precluded by work on higher priority candidate species; listing actions with absolute statutory, court ordered, or court-approved deadlines; and final listing determinations for those species that were proposed for listing with funds from previous fiscal years. This work includes all the actions listed in the tables below under expeditious progress.

As explained above, a determination that listing is warranted but precluded must also demonstrate that expeditious progress is being made to add or remove qualified species to and from the Lists of Endangered and Threatened Wildlife and Plants. (Although we do not discuss it in detail here, we are also making expeditious progress in removing species from the Lists under the Recovery program, which is funded by a separate line item in the budget of the Endangered Species Program. As explained above in our description of the statutory cap on Listing Program funds, the Recovery Program funds and actions supported by them cannot be considered in determining expeditious progress made in the Listing Program.) As with our "precluded" finding, expeditious progress in adding qualified species to the Lists is a function of the resources available and the competing demands for those funds. Given that limitation, we find that we are making progress in FY 2010 in the Listing Program. This progress included preparing and publishing the following determinations:

FY 2010 COMPLETED LISTING ACTIONS

Publication Date	Title	Actions	FR Pages
10/08/2009	Listing *Lepidium papilliferum* (Slickspot Peppergrass) as a Threatened Species Throughout Its Range	Final Listing Threatened	74 FR 52013-52064
10/27/2009	90-day Finding on a Petition To List the American Dipper in the Black Hills of South Dakota as Threatened or Endangered	Notice of 90–day Petition Finding, Not substantial	74 FR 55177-55180
10/28/2009	Status Review of Arctic Grayling (*Thymallus arcticus*) in the Upper Missouri River System	Notice of Intent to Conduct Status Review	74 FR 55524-55525
11/03/2009	Listing the British Columbia Distinct Population Segment of the Queen Charlotte Goshawk Under the Endangered Species Act: Proposed rule.	Proposed Listing Threatened	74 FR 56757-56770

FY 2010 COMPLETED LISTING ACTIONS—Continued

Publication Date	Title	Actions	FR Pages
11/03/2009	Listing the Salmon-Crested Cockatoo as Threatened Throughout Its Range with Special Rule	Proposed Listing Threatened	74 FR 56770-56791
11/23/2009	Status Review of Gunnison sage-grouse *(Centrocercus minimus)*	Notice of Intent to Conduct Status Review	74 FR 61100-61102
12/03/2009	12-Month Finding on a Petition to List the Black-tailed Prairie Dog as Threatened or Endangered	Notice of 12–month petition finding, Not warranted	74 FR 63343-63366
12/03/2009	90-Day Finding on a Petition to List Sprague's Pipit as Threatened or Endangered	Notice of 90–day Petition Finding, Substantial	74 FR 63337-63343
12/15/2009	90-Day Finding on Petitions To List Nine Species of Mussels From Texas as Threatened or Endangered With Critical Habitat	Notice of 90–day Petition Finding, Substantial	74 FR 66260-66271
12/16/2009	Partial 90-Day Finding on a Petition to List 475 Species in the Southwestern United States as Threatened or Endangered With Critical Habitat	Notice of 90–day Petition Finding, Not substantial and Subtantial	74 FR 66865-66905
12/17/2009	12–month Finding on a Petition To Change the Final Listing of the Distinct Population Segment of the Canada Lynx To Include New Mexico	Notice of 12–month petition finding, Warranted but precluded	74 FR 66937-66950
1/05/2010	Listing Foreign Bird Species in Peru and Bolivia as Endangered Throughout Their Range	Proposed Listing Endangered	75 FR 605-649
1/05/2010	Listing Six Foreign Birds as Endangered Throughout Their Range	Proposed Listing Endangered	75 FR 286-310
1/05/2010	Withdrawal of Proposed Rule to List Cook's Petrel	Proposed rule, withdrawal	75 FR 310-316
1/05/2010	Final Rule to List the Galapagos Petrel and Heinroth's Shearwater as Threatened Throughout Their Ranges	Final Listing Threatened	75 FR 235-250
1/20/2010	Initiation of Status Review for *Agave eggersiana* and *Solanum conocarpum*	Notice of Intent to Conduct Status Review	75 FR 3190-3191
2/09/2010	12–month Finding on a Petition to List the American Pika as Threatened or Endangered	Notice of 12–month petition finding, Not warranted	75 FR 6437-6471
2/25/2010	12-Month Finding on a Petition To List the Sonoran Desert Population of the Bald Eagle as a Threatened or Endangered Distinct Population Segment	Notice of 12–month petition finding, Not warranted	75 FR 8601-8621
2/25/2010	Withdrawal of Proposed Rule To List the Southwestern Washington/ Columbia River Distinct Population Segment of Coastal Cutthroat Trout *(Oncorhynchus clarki clarki)* as Threatened	Withdrawal of Proposed Rule to List	75 FR 8621-8644
3/18/2010	90-Day Finding on a Petition to List the Berry Cave salamander as Endangered	Notice of 90–day Petition Finding, Substantial	75 FR 13068-13071

FY 2010 COMPLETED LISTING ACTIONS—Continued

Publication Date	Title	Actions	FR Pages
3/23/2010	90-Day Finding on a Petition to List the Southern Hickorynut Mussel *(Obovaria jacksoniana)* as Endangered or Threatened	Notice of 90–day Petition Finding, Not substantial	75 FR 13717-13720
3/23/2010	90-Day Finding on a Petition to List the Striped Newt as Threatened	Notice of 90–day Petition Finding, Substantial	75 FR 13720-13726
3/23/2010	12-Month Findings for Petitions to List the Greater Sage-Grouse *(Centrocercus urophasianus)* as Threatened or Endangered	Notice of 12–month petition finding, Warranted but precluded	75 FR 13910-14014
3/31/2010	12-Month Finding on a Petition to List the Tucson Shovel-Nosed Snake *(Chionactis occipitalis klauberi)* as Threatened or Endangered with Critical Habitat	Notice of 12–month petition finding, Warranted but precluded	75 FR 16050-16065
4/5/2010	90-Day Finding on a Petition To List Thorne's Hairstreak Butterfly as or Endangered	Notice of 90–day Petition Finding, Substantial	75 FR 17062-17070
4/6/2010	12–month Finding on a Petition To List the Mountain Whitefish in the Big Lost River, Idaho, as Endangered or Threatened	Notice of 12–month petition finding, Not warranted	75 FR 17352-17363
4/6/2010	90-Day Finding on a Petition to List a Stonefly *(Isoperla jewetti)* and a Mayfly *(Fallceon eatoni)* as Threatened or Endangered with Critical Habitat	Notice of 90–day Petition Finding, Not substantial	75 FR 17363-17367
4/7/2010	12-Month Finding on a Petition to Reclassify the Delta Smelt From Threatened to Endangered Throughout Its Range	Notice of 12–month petition finding, Warranted but precluded	75 FR 17667-17680
4/13/2010	Determination of Endangered Status for 48 Species on Kauai and Designation of Critical Habitat	Final ListingEndangered	75 FR 18959-19165
4/15/2010	Initiation of Status Review of the North American Wolverine in the Contiguous United States	Notice of Initiation of Status Review	75 FR 19591-19592
4/15/2010	12-Month Finding on a Petition to List the Wyoming Pocket Gopher as Endangered or Threatened with Critical Habitat	Notice of 12–month petition finding, Not warranted	75 FR 19592-19607
4/16/2010	90-Day Finding on a Petition to List a Distinct Population Segment of the Fisher in Its United States Northern Rocky Mountain Range as Endangered or Threatened with Critical Habitat	Notice of 90–day Petition Finding, Substantial	75 FR 19925-19935
4/20/2010	Initiation of Status Review for Sacramento splittail *(Pogonichthys macrolepidotus)*	Notice of Initiation of Status Review	75 FR 20547-20548
4/26/2010	90-Day Finding on a Petition to List the Harlequin Butterfly as Endangered	Notice of 90–day Petition Finding, Substantial	75 FR 21568-21571
4/27/2010	12-Month Finding on a Petition to List Susan's Purse-making Caddisfly *(Ochrotrichia susanae)* as Threatened or Endangered	Notice of 12–month petition finding, Not warranted	75 FR 22012-22025

FY 2010 COMPLETED LISTING ACTIONS—Continued

Publication Date	Title	Actions	FR Pages
4/27/2010	90–day Finding on a Petition to List the Mohave Ground Squirrel as Endangered with Critical Habitat	Notice of 90–day Petition Finding, Substantial	75 FR 22063-22070
5/4/2010	90-Day Finding on a Petition to List Hermes Copper Butterfly as Threatened or Endangered	Notice of 90–day Petition Finding, Substantial	75 FR 23654-23663
6/1/2010	90-Day Finding on a Petition To List *Castanea pumila* var. *ozarkensis*	Notice of 90–day Petition Finding, Substantial	75 FR 30313-30318
6/1/2010	12–month Finding on a Petition to List the White-tailed Prairie Dog as Endangered or Threatened	Notice of 12–month petition finding, Not warranted	75 FR 30338-30363
6/9/2010	90-Day Finding on a Petition To List van Rossem's Gull-billed Tern as Endangered orThreatened.	Notice of 90–day Petition Finding, Substantial	75 FR 32728-32734
6/16/2010	90-Day Finding on Five Petitions to List Seven Species of Hawaiian Yellow-faced Bees as Endangered	Notice of 90–day Petition Finding, Substantial	75 FR 34077-34088
6/22/2010	12-Month Finding on a Petition to List the Least Chub as Threatened or Endangered	Notice of 12–month petition finding, Warranted but precluded	75 FR 35398-35424
6/23/2010	90-Day Finding on a Petition to List the Honduran Emerald Hummingbird as Endangered	Notice of 90–day Petition Finding, Substantial	75 FR 35746-35751
6/23/2010	Listing *Ipomopsis polyantha* (Pagosa Skyrocket) as Endangered Throughout Its Range, and Listing *Penstemon debilis* (Parachute Beardtongue) and *Phacelia submutica* (DeBeque Phacelia) as Threatened Throughout Their Range	Proposed Listing Endangered Proposed Listing Threatened	75 FR 35721-35746
6/24/2010	Listing the Flying Earwig Hawaiian Damselfly and Pacific Hawaiian Damselfly As Endangered Throughout Their Ranges	Final Listing Endangered	75 FR 35990-36012
6/24/2010	Listing the Cumberland Darter, Rush Darter, Yellowcheek Darter, Chucky Madtom, and Laurel Dace as Endangered Throughout Their Ranges	Proposed Listing Endangered	75 FR 36035-36057
6/29/2010	Listing the Mountain Plover as Threatened	Reinstatement of Proposed Listing Threatened	75 FR 37353-37358
7/20/2010	90-Day Finding on a Petition to List *Pinus albicaulis* (Whitebark Pine) as Endangered or Threatened with Critical Habitat	Notice of 90–day Petition Finding, Substantial	75 FR 42033-42040
7/20/2010	12-Month Finding on a Petition to List the Amargosa Toad as Threatened or Endangered	Notice of 12–month petition finding, Not warranted	75 FR 42040-42054
7/20/2010	90-Day Finding on a Petition to List the Giant Palouse Earthworm *(Driloleirus americanus*) as Threatened or Endangered	Notice of 90–day Petition Finding, Substantial	75 FR 42059-42066
7/27/2010	Determination on Listing the Black-Breasted Puffleg as Endangered Throughout its Range; Final Rule	Final Listing Endangered	75 FR 43844-43853

FY 2010 COMPLETED LISTING ACTIONS—Continued

Publication Date	Title	Actions	FR Pages
7/27/2010	Final Rule to List the Medium Tree-Finch *(Camarhynchus pauper)* as Endangered Throughout Its Range	Final Listing Endangered	75 FR 43853-43864
8/3/2010	Determination of Threatened Status for Five Penguin Species	Final ListingThreatened	75 FR 45497- 45527
8/4/2010	90-Day Finding on a Petition To List the Mexican Gray Wolf as an Endangered Subspecies With Critical Habitat	Notice of 90–day Petition Finding, Substantial	75 FR 46894- 46898
8/10/2010	90-Day Finding on a Petition to List *Arctostaphylos franciscana* as Endangered with Critical Habitat	Notice of 90–day Petition Finding, Substantial	75 FR 48294-48298
8/17/2010	Listing Three Foreign Bird Species from Latin America and the Caribbean as Endangered Throughout Their Range	Final Listing Endangered	75 FR 50813-50842
8/17/2010	90-Day Finding on a Petition to List Brian Head Mountainsnail as Endangered or Threatened with Critical Habitat	Notice of 90–day Petition Finding, Not substantial	75 FR 50739-50742
8/24/2010	90-Day Finding on a Petition to List the Oklahoma Grass Pink Orchid as Endangered or Threatened	Notice of 90–day Petition Finding, Substantial	75 FR 51969-51974
9/1/2010	12-Month Finding on a Petition to List the White-Sided Jackrabbit as Threatened or Endangered	Notice of 12–month petition finding, Not warranted	75 FR 53615-53629
9/8/2010	Proposed Rule To List the Ozark Hellbender Salamander as Endangered	Proposed Listing Endangered	75 FR 54561-54579
9/8/2010	Revised 12-Month Finding to List the Upper Missouri River Distinct Population Segment of Arctic Grayling as Endangered or Threatened	Notice of 12–month petition finding, Warranted but precluded	75 FR 54707-54753
9/9/2010	12-Month Finding on a Petition to List the Jemez Mountains Salamander *(Plethodon neomexicanus)* as Endangered or Threatened with Critical Habitat	Notice of 12–month petition finding, Warranted but precluded	75 FR 54822-54845

Our expeditious progress also includes work on listing actions that we funded in FY 2010 but have not yet been completed to date. These actions are listed below. Actions in the top section of the table are being conducted under a deadline set by a court. Actions in the middle section of the table are being conducted to meet statutory timelines, that is, timelines required under the Act. Actions in the bottom section of the table are high-priority listing actions. These actions include work primarily on species with an LPN of 2, and selection of these species is partially based on available staff resources, and when appropriate, include species with a lower priority if they overlap geographically or have the same threats as the species with the high priority. Including these species together in the same proposed rule results in considerable savings in time and funding, as compared to preparing separate proposed rules for each of them in the future.

ACTIONS FUNDED IN FY 2010 BUT NOT YET COMPLETED

Species	Action
Actions Subject to Court Order/Settlement Agreement	
6 Birds from Eurasia	Final listing determination

ACTIONS FUNDED IN FY 2010 BUT NOT YET COMPLETED—Continued

Species	Action
African penguin	Final listing determination
Flat-tailed horned lizard	Final listing determination
Mountain plover[4]	Final listing determination
6 Birds from Peru	Proposed listing determination
Sacramento splittail	12–month petition finding
Pacific walrus	12–month petition finding
Gunnison sage-grouse	12–month petition finding
Wolverine	12–month petition finding
Agave eggergsiana	12–month petition finding
Solanum conocarpum	12–month petition finding
Sprague's pipit	12–month petition finding
Desert tortoise – Sonoran population	12–month petition finding
Pygmy rabbit (rangewide)[1]	12–month petition finding
Thorne's Hairstreak butterfly[3]	12–month petition finding
Hermes copper butterfly[3]	12–month petition finding
Actions with Statutory Deadlines	
Casey's june beetle	Final listing determination
Georgia pigtoe, interrupted rocksnail, and rough hornsnail	Final listing determination
7 Bird species from Brazil	Final listing determination
Southern rockhopper penguin – Campbell Plateau population	Final listing determination
5 Bird species from Colombia and Ecuador	Final listing determination
Queen Charlotte goshawk	Final listing determination
5 species southeast fish (Cumberland darter, rush darter, yellowcheek darter, chucky madtom, and laurel dace)	Final listing determination
Salmon crested cockatoo	Proposed listing determination
CA golden trout	12–month petition finding
Black-footed albatross	12–month petition finding
Mount Charleston blue butterfly	12–month petition finding
Mojave fringe-toed lizard[1]	12–month petition finding
Kokanee – Lake Sammamish population[1]	12–month petition finding
Cactus ferruginous pygmy-owl[1]	12–month petition finding
Northern leopard frog	12–month petition finding
Tehachapi slender salamander	12–month petition finding
Coqui Llanero	12–month petition finding
Dusky tree vole	12–month petition finding
3 MT invertebrates (mist forestfly *(Lednia tumana)*, *Oreohelix* sp.3, *Oreohelix* sp. 31) from 206 species petition	12–month petition finding

ACTIONS FUNDED IN FY 2010 BUT NOT YET COMPLETED—Continued

Species	Action
5 UT plants *(Astragalus hamiltonii*, *Eriogonum soredium*, *Lepidium ostleri*, *Penstemon flowersii*, *Trifolium friscanum*) from 206 species petition	12–month petition finding
2 CO plants *(Astragalus microcymbus*, *Astragalus schmolliae*) from 206 species petition	12–month petition finding
5 WY plants *(Abronia ammophila*, *Agrostis* rossiae, *Astragalus proimanthus*, *Boechere (Arabis) pusilla*, *Penstemon gibbensii*) from 206 species petition	12–month petition finding
Leatherside chub (from 206 species petition)	12–month petition finding
Frigid ambersnail (from 206 species petition)	12–month petition finding
Gopher tortoise – eastern population	12–month petition finding
Wrights marsh thistle	12–month petition finding
67 of 475 southwest species	12–month petition finding
Grand Canyon scorpion (from 475 species petition)	12–month petition finding
Anacroneuria wipukupa (a stonefly from 475 species petition)	12–month petition finding
Rattlesnake-master borer moth (from 475 species petition)	12–month petition finding
3 Texas moths *(Ursia furtiva*, *Sphingicampa blanchardi*, *Agapema galbina*) (from 475 species petition)	12–month petition finding
2 Texas shiners *(Cyprinella* sp., *Cyprinella lepida*) (from 475 species petition)	12–month petition finding
3 South Arizona plants *(Erigeron piscaticus*, *Astragalus hypoxylus*, *Amoreuxia gonzalezii*) (from 475 species petition)	12–month petition finding
5 Central Texas mussel species (3 from 474 species petition)	12–month petition finding
14 parrots (foreign species)	12–month petition finding
Berry Cave salamander[1]	12–month petition finding
Striped Newt[1]	12–month petition finding
Fisher – Northern Rocky Mountain Range[1]	12–month petition finding
Mohave Ground Squirrel[1]	12–month petition finding
Puerto Rico Harlequin Butterfly	12–month petition finding
Western gull-billed tern	12–month petition finding
Ozark chinquapin *(Castanea pumila* var. *ozarkensis*)	12–month petition finding
HI yellow-faced bees	12–month petition finding
Giant Palouse earthworm	12–month petition finding
Whitebark pine	12–month petition finding
OK grass pink *(Calopogon oklahomensis*)[1]	12–month petition finding
Southeastern pop snowy plover & wintering pop. of piping plover[1]	90–day petition finding
Eagle Lake trout[1]	90–day petition finding
Smooth-billed ani[1]	90–day petition finding
Bay Springs salamander[1]	90–day petition finding
32 species of snails and slugs[1]	90–day petition finding
42 snail species (Nevada & Utah)	90–day petition finding

ACTIONS FUNDED IN FY 2010 BUT NOT YET COMPLETED—Continued

Species	Action
Red knot *roselaari* subspecies	90–day petition finding
Peary caribou	90–day petition finding
Plains bison	90–day petition finding
Spring Mountains checkerspot butterfly	90–day petition finding
Spring pygmy sunfish	90–day petition finding
Bay skipper	90–day petition finding
Unsilvered fritillary	90–day petition finding
Texas kangaroo rat	90–day petition finding
Spot-tailed earless lizard	90–day petition finding
Eastern small-footed bat	90–day petition finding
Northern long-eared bat	90–day petition finding
Prairie chub	90–day petition finding
10 species of Great Basin butterfly	90–day petition finding
6 sand dune (scarab) beetles	90–day petition finding
Golden-winged warbler	90–day petition finding
Sand-verbena moth	90–day petition finding
404 Southeast species	90–day petition finding
High-Priority Listing Actions[3]	
19 Oahu candidate species[2] (16 plants, 3 damselflies) (15 with LPN = 2, 3 with LPN = 3, 1 with LPN =9)	Proposed listing
19 Maui-Nui candidate species[2] (16 plants, 3 tree snails) (14 with LPN = 2, 2 with LPN = 3, 3 with LPN = 8)	Proposed listing
Dune sagebrush lizard (formerly Sand dune lizard)[3] (LPN = 2)	Proposed listing
2 Arizona springsnails[2] *(Pyrgulopsis bernadina* (LPN = 2), *Pyrgulopsis trivialis* (LPN = 2))	Proposed listing
New Mexico springsnail[2] *(Pyrgulopsis chupaderae* (LPN = 2)	Proposed listing
2 mussels[2] (rayed bean (LPN = 2), snuffbox No LPN)	Proposed listing
2 mussels[2] (sheepnose (LPN = 2), spectaclecase (LPN = 4),)	Proposed listing
Altamaha spinymussel[2] (LPN = 2)	Proposed listing
8 southeast mussels (southern kidneyshell (LPN = 2), round ebonyshell (LPN = 2), Alabama pearlshell (LPN = 2), southern sandshell (LPN = 5), fuzzy pigtoe (LPN = 5), Choctaw bean (LPN = 5), narrow pigtoe (LPN = 5), and tapered pigtoe (LPN = 11))	Proposed listing

[1] Funds for listing actions for these species were provided in previous FYs.
[2] Although funds for these high-priority listing actions were provided in FY 2008 or 2009, due to the complexity of these actions and competing priorities, these actions are still being developed.
[3]Partially funded with FY 2010 funds; also will be funded with FY 2011 funds.

We have endeavored to make our listing actions as efficient and timely as possible, given the requirements of the relevant law and regulations, and constraints relating to workload and personnel. We are continually considering ways to streamline processes or achieve economies of scale, such as by batching related actions together. Given our limited budget for implementing section 4 of the Act, these actions described above collectively constitute expeditious progress.

The Gunnison sage-grouse will be added to the list of candidate species upon publication of this 12–month finding. We will continue to monitor the status of this species as new information becomes available. This review will determine if a change in status is

warranted, including the need to make prompt use of emergency listing procedures.

We intend that any proposed listing action for the Gunnison sage-grouse will be as accurate as possible. Therefore, we will continue to accept additional information and comments from all concerned governmental agencies, the scientific community, industry, or any other interested party concerning this finding.

References Cited

A complete list of references cited is available on the Internet at *http://www.regulations.gov* and upon request from the Western Colorado Ecological Services Field Office (see **ADDRESSES** section).

Author(s)

The primary authors of this notice are the staff members of the Western Colorado Ecological Services Field Office.

Authority

The authority for this section is section 4 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*).

Dated: September 7, 2010

Paul R. Schmidt,

Acting Director, Fish and Wildlife Service.

[FR Doc. 2010–23430 Filed 9–27–10; 8:45 am]

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