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Part III

Department of the Interior

Fish and Wildlife Service

50 CFR Part 17

Endangered and Threatened Wildlife and Plants; Final Listing Determination for the Gunnison Sage-Grouse as Threatened or Endangered; Final Rule

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Endangered and Threatened Wildlife and Plants; Final Listing Determination for the Gunnison Sage-Grouse as Threatened or Endangered

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Final listing determination.

SUMMARY: We, the U.S. Fish and Wildlife Service (Service), announce a final listing determination for 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 listing is not warranted. Thus, we no longer consider the species to be a candidate for listing. We ask the public to submit to us any new information that becomes available concerning the status of or threats to the species. This information will help us monitor and encourage the conservation of this species.

DATES: The determination announced in this document was made on April 11, 2006. Although further listing action will not result from this determination, we request that you submit new information concerning the status of or threats to this species whenever it becomes available.

ADDRESSES: Comments and materials received, as well as supporting documentation used in the preparation of this final listing determination, will be available for inspection, by appointment, during normal business hours at the Western Colorado Ecological Services Field Office, U.S. Fish and Wildlife Service, 764 Horizon Drive, Building B, Grand Junction, Colorado 81506–3946. Submit new information, materials, comments, or questions concerning this species to the Service at the above address.

FOR FURTHER INFORMATION CONTACT: Allan Pfister, Western Colorado Supervisor (see **ADDRESSES** section), by telephone at (970) 243–2778, by facsimile at (970) 245–6933, or by electronic mail at *fw6_sagegrouse@fws.gov*.

SUPPLEMENTARY INFORMATION:

Previous Federal Action

On January 18, 2000, the Director of the Service designated the Gunnison sage-grouse as a candidate species under the Act, with a listing priority of 5. The **Federal Register** notice regarding this decision was not published until December 28, 2000 (65 FR 82310, December 28, 2000). Candidates are species for which the Service has determined that the species warrants listing as a threatened or endangered species, but listing is precluded by higher listing priorities for other species. A listing priority of 5 indicates that there is a high magnitude of threats, but they are considered non-imminent.

On January 26, 2000, The American Lands Alliance, Biodiversity Legal Foundation, and others petitioned the Service to list the species (Webb 2000). On January 10, 2001, some of the same plaintiffs sued the Service alleging the Service had not made required petition findings. In 2003, the U.S. District Court ruled that the Service's determination that the Gunnison sage-grouse was a candidate constituted a 12-month finding on the petition (*American Lands Alliance* v. *Gale A. Norton*, C.A. No. 00–2339, (D.D.C., 2003).

The 2003 Candidate Notice of Review elevated the species' listing priority number to 2 (69 FR 24876), as the imminence of the perceived threats had increased. The 2004 Candidate Notice of Review (70 FR 24870) maintained the listing priority number as a 2.

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 includes a provision that the Service would make a listing determination by March 31, 2006. On March 28, 2006, the plaintiffs agreed to a one week extension (April 7, 2006) for this determination.

Section 4(b)(1)(A) of the Act requires us to consider the best scientific and commercial data available as well as efforts being made by States or other entities to protect a species when making a listing decision. To meet this standard we collected information on the Gunnison sage-grouse, its habitats, threats, and environmental factors affecting the species from a wide array of sources. Most of the available scientific literature on Gunnison sage-grouse is summarized in the Gunnison Sage-grouse Rangewide Conservation Plan, a document published in April 2005 under the auspices of the Gunnison Sage-grouse Rangewide Steering Committee [GSRSC]. The GSRSC is comprised of biologists from state and Federal agencies with responsibility for managing the Gunnison sage-grouse or its habitat. The scientific literature on Gunnison sage-grouse and its sagebrush habitats is limited. Where information on Gunnison sage-grouse life history was lacking, we used, as appropriate information on greater sage-grouse to analyze habitat usage, threats, and environmental factors affecting the Gunnison sage-grouse. In addition we received a substantial amount of unpublished information from other Federal agencies, States, counties, environmental organizations, and individuals. We also solicited information on all Federal, State, or local conservation efforts currently in operation or planned for the Gunnison sage-grouse or its habitats.

In April 2005, Colorado Division of Wildlife (CDOW) applied to the Service for a Gunnison sage-grouse Enhancement of Survival Permit 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). Public comments and other internal comments from the Service and CDOW were incorporated into revisions of the CCAA and Environmental Assessment; the documents are scheduled to be finalized shortly. 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. These participants provide certain Gunnison sage-grouse 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. Although we strongly encourage continued conservation of the Gunnison sage-

grouse, we did not rely upon this CCAA to support our listing determination.

Species Information

In this determination, we use information specific to the Gunnison sage-grouse where available. However, where such information is lacking we use information on life history, habitat requirements, and effects of threats on greater sage-grouse. Except where referenced, the following life history information is taken from the Schroeder *et al.* (1999) literature review on sage-grouse (*Centrocercus* spp.).

The sage-grouse is the largest grouse in North America and was first described by Lewis and Clark in 1805 (Schroeder *et al.* 1999). Sage-grouse 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).

For many years sage-grouse were considered a single species. Young *et al.* (2000) identified Gunnison sage-grouse (*Centrocercus minimus*) as a distinct species based on morphological (Hupp and Braun 1991; Young *et al.* 2000), genetic (Kahn *et al.* 1999; Oyler-McCance *et al.* 1999), and behavioral (Barber 1991; Young 1994; Young *et al.* 2000) differences and geographical isolation. Based on these differences, the American Ornithologist's Union (2000) accepted the Gunnison sage-grouse as a distinct species. The current ranges of the two species are not overlapping (Schroeder *et al.* 2004). We have considered the Gunnison sage-grouse as a distinct species consistent with the petition under review here. We acknowledge that there are questions regarding the validity of this taxon, however it is not the purpose of this action to elucidate taxonomic questions. The purpose of this action is to determine the status of the taxon within the context of the ESA.

Gunnison sage-grouse and greater sage-grouse have similar life histories and habitat requirements (Young 1994). Nesting success for Gunnison sage-grouse is highest in areas where forbs and grass covers are found below a sagebrush canopy cover of 15 to 30 percent (Young *et al.* 2000). These numbers are comparable to those reported for the greater sage-grouse (Connelly *et al.* 2000a). Connelly *et al.* (2000a) also state that nest success for greater sage-grouse is greatest where grass cover is present. Therefore, factors identified in the greater sage-grouse literature that affect nesting habitat quality can affect Gunnison sage-grouse nesting habitat in a similar manner if those factors occur within the range of the Gunnison sage-grouse. Characteristics of sage-grouse winter habitats are also similar through the range of both species (Connelly *et al.* 2000a). 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; Young *et al.* 2000). However, they may also use areas with more deciduous shrubs during the winter (Young *et al.* 2000).

Dietary requirements of the two species also are similar, being composed of nearly 100 percent sagebrush in the winter (Schroeder *et al.* 1999; Young *et al.* 2000). Forbs and insects are important during the summer and early fall. Gunnison and greater sage-grouse do not possess muscular gizzards and, therefore, lack the ability to grind and digest seeds (Rasmussen and Griner 1938; Leach and Hensley 1954). Gunnison sage-grouse chick dietary requirements of insects and forbs also are expected to be similar to greater sage-grouse and other grouse species (Tony Apa, CDOW, pers. comm. 2005).

In the spring, sage-grouse gather on traditional breeding areas referred to as leks (Patterson 1952). Lek displaying occurs from mid-March through late May, depending on elevation (Rogers 1964). For Gunnison sage-grouse, 87 percent of all nests were located less than 6 kilometers (km) (4 miles (mi)) from the lek of capture (Apa 2004). Mean clutch size for Gunnison sage-grouse is 6.8 ± 0.7 eggs (Young 1994). Most eggs hatch in June, with a peak between June 10 and June 20. Renesting rates following the loss of the original nest appear very low in Gunnison sage-grouse, with one study reporting 4.8 percent (Young 1994).

During the pre-egg laying period, female sage-grouse select forbs that have generally higher amounts of calcium and crude protein than sagebrush has (Barnett and Crawford 1994). Chicks are precocial and leave the nest with the hen shortly after hatching. Females with chicks move to areas containing succulent forbs and insects, often in wet meadow habitat, where cover is sufficiently tall to conceal broods and provide shade. 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; Klebenow and Gray 1968; Peterson 1970; Johnson and Boyce 1990; Johnson and Boyce 1991; Drut *et al.* 1994b; Pyle and Crawford 1996; Fischer *et al.* 1996b). Diets of 4- to 8-week-old greater sage-grouse chicks were found to have more plant material (Peterson 1970). 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; Connelly and Markham 1983; Connelly *et al.* 1988; Fischer *et al.* 1996b).

During late summer and early fall, 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. From late autumn through early spring the diet of greater and Gunnison sage-grouse is almost exclusively sagebrush (Rasmussen and Griner 1938; Batterson and Morse 1948; Patterson 1952; Leach and Hensley 1954; Barber 1968; Wallestad *et al.* 1975; Young *et al.* 2000). Many species of sagebrush can be consumed (Remington and Braun 1985; Welch *et al.* 1988, 1991; Myers 1992). Flock size in winter is variable (15 to 100+), and flocks frequently consist of a single sex (Beck 1977; Hupp 1987). During particularly severe winters, sage-grouse are dependent on tall sagebrush, which is exposed even above deep snow, providing a consistently available food source. In response to severe winters, Gunnison sage-grouse have been documented to move as far as 27 km (17 mi) (Root 2002). 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. Movements in fall and early winter (September–December) exceed 3 km (2 mi).

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). Higher survival rate of female sage-grouse may be due to sexual dimorphism (Schroeder *et al.* 1999). 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). Other factors affecting survival rates include year and age (Zablan 1993).

Habitat

Sage-grouse are sagebrush obligates (Patterson 1952; Connelly *et al.* 2000a). They depend on a variety of shrub-steppe habitats throughout their life cycle and are considered obligate users of several species of sagebrush (Patterson 1952; Braun *et al.* 1976; Schroeder *et al.* 1999; Connelly *et al.* 2000a; Connelly *et al.* 2004). Sagebrush serves as a primary food for adults year-round (Wallestad *et al.* 1975) and also provides cover for nests (Connelly *et al.* 2000a). Sage-grouse move between seasonal ranges based on suitable habitat availability. Connelly *et al.* (2000a) 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.

Breeding habitat includes leks and pre-laying, nesting, and early brood-rearing areas. Male Gunnison sage-grouse attend leks from mid-March to mid-May. Leks are typically in the same location from year to year; some Gunnison sage-grouse leks have been used since the 1950s (Rogers 1964). Leks are usually flat to gently sloping areas of less than 15 percent grade in broad valleys or on ridges (Hanna 1936; Patterson 1952; Giezentanner and Clark 1974; Wallestad 1975; Autenrieth 1981; Klott and Lindzey 1989). Leks have good visibility and low vegetation structure (Tate *et al.* 1979; Connelly *et al.* 1981; Gates 1985), and acoustical qualities that allow sounds of breeding displays to carry (Patterson 1952; Wiley 1973, 1974; Bergerud 1988; Phillips 1990). Leks are often surrounded by denser shrub-steppe cover, which is used for escape, thermal, and feeding cover. Leks can be formed opportunistically at any appropriate site within or adjacent to nesting habitat (Connelly *et al.* 2000a) and, therefore, lek habitat availability is not considered to be a limiting factor for sage-grouse (Schroeder 1997). A relatively small number of dominant males accounts for the majority of breeding on each lek (Schroeder *et al.* 1999).

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; Connelly *et al.* 2000a).

Nesting occurs from mid-April to June. Gunnison sage-grouse typically select nest sites under sagebrush cover with some forb and grass cover (Young 1994), and successful nests were found in higher shrub density and greater forb and grass cover than unsuccessful nests (Young 1994). The sagebrush 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; Connelly *et al.* 2000a; Connelly *et al.* 2004). Shrub canopy and grass cover provide concealment for sage-grouse nests and young, and are critical for reproductive success (Barnett and Crawford 1994; Gregg *et al.* 1994; DeLong *et al.* 1995; Connelly *et al.* 2004). 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).

Young (1994) found that radio-tracked Gunnison sage-grouse nested an average of 4.3 km (2.7 mi) from the lek nearest to their capture site, with almost half nesting within 3 km (2 mi) of their capture site. 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). Female sage-grouse have been documented to travel more than 20 km (13 mi) to their nest site after mating (Connelly *et al.* 2000a). Female Gunnison and greater sage-grouse exhibit fidelity to nesting locations (Connelly *et al.* 1988; Young 1994; Lyon 2000, Connelly *et al.* 2004, Holloran and Anderson 2005). 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; Connelly *et al.* 2004). However, there is no statistical indication that movement to new nesting areas results in increased nesting success (Connelly *et al.* 2004).

Early brood-rearing habitat is found close to nest sites (Connelly *et al.* 2000a), although individual females with broods may move large distances (Connelly 1982; as cited in Connelly *et al.* 2000a). Young (1994) 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 hay meadows, but were often flushed from interfaces of wet meadows and habitats providing more cover, such as sagebrush or willow-alder (*Salix-Alnus).* Forbs and insects are essential nutritional components for sage-grouse chicks (Klebenow and Gray 1968; Johnson and Boyce 1991; Connelly *et al.* 2004). Therefore, early brood-rearing habitat must provide adequate cover adjacent to areas rich in forbs and insects to assure chick survival during this period (Connelly *et al.* 2004).

As fall approaches sage-grouse move from riparian to upland areas and start to shift to a winter diet (GSRSC 2005). By late summer and into the early fall, individuals become more social, and flocks are more concentrated (Patterson 1952). This is the period when Gunnison sage-grouse can be observed in atypical habitat such as agricultural fields (Commons 1997). However, radio-tracking studies in the Gunnison Basin have found that broods typically do not use hay meadows further away than 50 meters (m) (165 feet [ft]) of the edge of sagebrush stands (Gunnison Basin Conservation Plan 1997).

Movements to winter ranges are slow and meandering. Sagebrush stand selection in winter is influenced by snow depth (Patterson 1952; Connelly 1982 as cited in Connelly *et al.* 2000a) and in some areas, topography (Beck 1977; Crawford *et al.* 2004). 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) associated with drainages, ridges, or southwest aspects with slopes less than 15 percent (Wallestad 1975; Beck 1977). 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 roosts'' (Back *et al.* 1987).

Hupp and Braun (1989) 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. In these conditions, the tall and vigorous sagebrush typical in drainages was an especially important food source.

Historical Distribution

Based on historical records, museum specimens, and potential sage-grouse habitat, Schroeder *et al.* (2004) concluded that Gunnison sage-grouse historically occurred in southwestern Colorado, northwestern New Mexico, northeastern Arizona, and southeastern Utah. Accounts of Gunnison sage-grouse in Kansas and Oklahoma, as suggested by Young *et al.* (2000), are not

supported with museum specimens, and Schroeder *et al.* (2004) found inconsistencies with the historical records and the sagebrush habitat currently available in those areas. Applegate (2001) 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). The GSRSC (2005) modified the historic range from Schroeder *et al.* (2004), based on more complete knowledge of historic and current habitat and the distribution of the species (GSRSC 2005). Based on this information, the maximum Gunnison sage-grouse historical (presettlement) range is estimated to have been 55,350 square kilometers (sq km) (21,370 square miles [sq mi]) (GSRSC 2005). 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 occupied, or what the total population was.

Rogers (1964) qualitatively discussed a decrease in sagebrush range due to overgrazing from the 1870's until about 1934. Additional 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 (Rogers 1964). Rogers (1964) discussed sagebrush eradication (by spraying and burning) in the 1950s, and used two examples (Uncompaghre Plateau, Flattop Mountain in Gunnison County, CO) within the current range to illustrate the large acreages (3–5,000 acres) treated, but stated that long-term effects were yet to be determined. Rogers (1964) demonstrated a much broader distribution of sagebrush in Colorado than what currently exists. Rogers (1964) also presents maps that show decreases in distribution from previous literature.

Much of what was once sagebrush was already lost prior to 1958. Through the use of low-level aerial photography, Oyler-McCance *et al.* (2001) documented a loss of only or 155,673 ha (20 percent) of sagebrush habitat from 1958 to 1993 within Gunnison sage-grouse range. Thirty-seven percent of the plots sampled underwent substantial fragmentation of sagebrush vegetation during that same time period. Oyler-McCance *et al.* (2001) stated that sage-grouse habitat in southwestern Colorado (the range of Gunnison sage-grouse) has been more severely impacted than sagebrush habitat elsewhere in Colorado. However, the Gunnison Basin was not as significantly affected as other areas.

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 throughout the range of Gunnison sage-grouse.

Riebsame *et al* (1996) discussed a greater rural growth rate in Colorado from the 1970s through the 1990s, compared to the rest of the U.S., which has resulted in land use conversion. They noted a pattern of private ranches shifting to residential communities within Gunnison sage-grouse habitat. The Gunnison Basin Working Group Research Sub-committee (February, 2006) cited two regions within the Basin to be of the highest priority for conservation easements due to development pressures.

In summary, a substantial amount of sagebrush habitat within the range of the Gunnison sage-grouse had been lost prior to 1960. In the years since, habitat loss and fragmentation has slowed, although development pressures have been on the rise. Conservation efforts are being developed to help address development-related issues.

Current Distribution and Population Estimates

Gunnison sage-grouse currently occur in seven widely scattered and isolated populations in Colorado and Utah, occupying 4,720 sq km (1,820 sq mi) (GSRSC 2005). The seven populations are Gunnison Basin, San Miguel Basin, Monticello-Dove Creek, Piñon Mesa, Crawford, Cerro Summit-Cimarron-Sims Mesa, and Poncha Pass (Figure 1). A comparative summary of the seven populations is presented in Table 1.

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

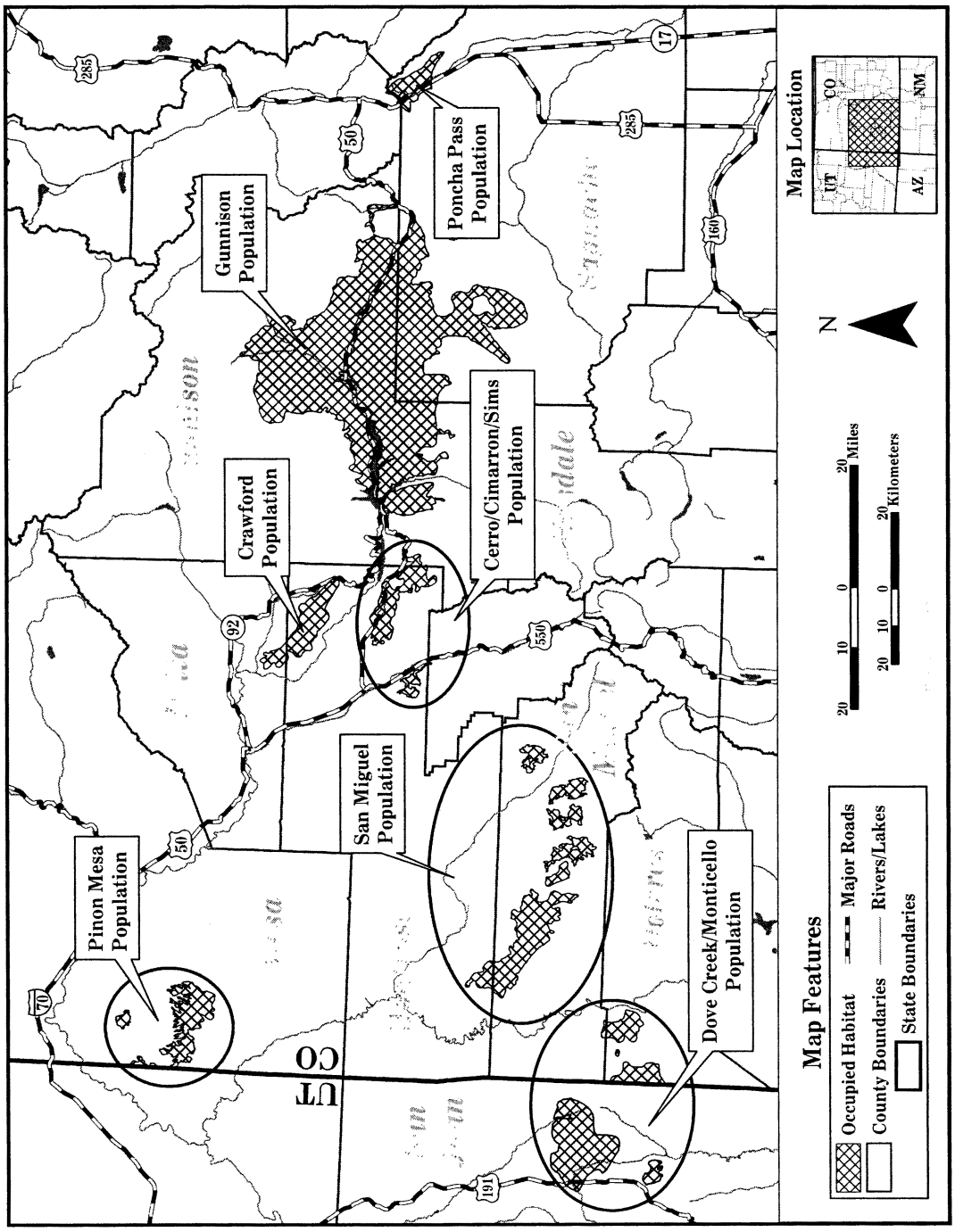

TABLE 1.—POPULATION SIZE, EXTENT OF OCCUPIED HABITAT, LAND OWNERSHIP, AND URBAN DEVELOPMENT PRESSURES

Name of population	Population size range 1995–2005*	2005 population estimate	Currently occupied area	Land ownership	Development pressure
Gunnison Basin Population.	2,203–4,763	4,763	240,000 hectares (ha) 593,000 (ac).	51 percent BLM, 14 percent USFS, 2 percent NPS, 1 percent CDOW, 1 percent Colorado State Land Board, 31 percent private (GSRSC 2005).	Gunnison County currently has a low population density of 5 people/sq mi in 2000 (GSRSC 2005), with projected growth rates ranging from .1 to 1.6 percent per year. These rates result in a population increase of about 5700 people by 2030 (41 percent or 7 people/sq mi) (CDLA 2004). A 30 percent housing increase is projected from 2000–2020 (GSRSC 2005).
San Miguel Basin Population.	206–446	334	40,500 ha (100,500 ac).	*Dry Creek*—57 percent BLM, 12 percent, CDOW, 1 percent, Colorado State Land Board, 30 percent private. *Hamilton Mesa*—85 percent private, 11 percent Colorado State Land Board, 4 percent BLM. *Miramonte*—76 percent private, 15 percent CDOW, 7 percent USFS, 2 percent BLM. *Gurley Reservoir*—91 percent private, USFS 4 percent, BLM 3 percent, the Colorado State Land Board 2 percent. *Beaver Mesa*—99.5 percent private, 0.5 percent BLM. *Iron Springs*—89 percent private, 6 percent USFS, 5 percent Colorado State Land Board (GSRSC 2005).	The population in San Miguel County is expected to double to 18 people/sq mi between 2000 and 2030 (CDLA 2004), accompanied by a 62 percent increase in housing units by 2020 (GSRSC 2005).
Monticello-Dove Creek Population.	162–510 (Combined). 123–280 (Monticello). 10–358 (Dove Creek).	196 (162 Monticello and 34 Dove Creek).	40,000 ha (98,920 ac) (Combined). Monticello—28,500 ha (71,000 ac). Dove Creek—11,500 ha (28,000 ac).	Monticello—95 percent private, 4 percent BLM, 1 percent State of Utah land. Dove Creek—87 percent privately owned, 13 percent BLM (GSRSC 2005).	The Monticello, UT group has approximately 2 people/sq mi (GSRSC 2005) with a projected increase of roughly 18% to 2600 people (2.4 people/sq mi) by 2030 (Utah Governor's Office of Planning and Budget 2005).
Piñon Mesa Population.	79–206	167	16,000 ha (39,000 ac).	70 percent private, 28 percent BLM, 2 percent USFS (GSRSC 2005).	Population density of 55 people/sq mi in 2000 (GSRSC 2005) with a projected increase to 105 people/sq mi by 2030 (CDLA 2004).

TABLE 1.—POPULATION SIZE, EXTENT OF OCCUPIED HABITAT, LAND OWNERSHIP, AND URBAN DEVELOPMENT PRESSURES—Continued

Name of population	Population size range 1995–2005*	2005 population estimate	Currently occupied area	Land ownership	Development pressure
Crawford Population.	118–314	191	14,000 ha (35,000 ac).	63 percent BLM, 13 percent NPS, 24 percent private (GSRSC 2005).	Estimate of 24 people/sq mi living in and near this population in 2000 (GSRSC 2005). Montrose County contains the southeastern 75 percent of the current range of the Crawford population. The county was identified as one of the fastest growing counties in the country, with human population expected to double from 2000–2030 (CDLA 2004) and housing expected to increase by 68 percent by 2020. The northwestern 25 percent of the current range is in Delta County, which is projected to increase in population by 79 percent by 2030 (CDLA 2004) with an increase in housing of 58 percent by 2020 (GSRSC 2005).
Cerro Summit-Cimarron-Sims Mesa Population.	25–83	25	15,000 ha (37,000 ac).	43 percent private, 51 percent BLM, 6 percent CDOW (GSRSC 2005).	Population threats not evaluated.
Poncha Pass Population.	5–44	44	8,300 ha (20,400 ac).	48 percent BLM, 26 percent USFS, 24 percent in private holdings, 2 percent Colorado State Land Board (GSRSC 2005).	Population threats not evaluated.

*The numbers presented are the lowest and highest population estimates during the 11-year period. The lows and highs did not all fall in the same years for each population.

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). Big sagebrush (*Artemesia tridentata*) dominates the upland vegetation and has a highly variable growth form depending on local site conditions. Up to 84 leks have been surveyed annually for breeding activity in the Gunnison Basin (CDOW, unpubl. lit. 2005a). Approximately 37 percent of these leks occur on private land and 63 percent on public land, primarily BLM (GSRSC 2005). In 2005, 44 of these leks were active, 38 inactive, and 2 are of unknown status. Rogers (1964) stated that Gunnison County had one of the largest sage-grouse populations in Colorado.

San Miguel Basin Population—The San Miguel Basin population is in Montrose and San Miguel Counties in Colorado, and is composed of six groups using different areas—Dry Creek Basin, Hamilton Mesa, Miramonte Reservoir, Gurley Reservoir, Beaver Mesa, and Iron Springs. Some of these six areas are used year-round by sage-grouse, and others are used seasonally. Recent radiotelemetry studies have suggested that sage-grouse in the San Miguel Basin move widely and between these areas (Apa 2004; Stiver, unpubl. lit. 2005).

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). Gunnison sage-grouse use the Hamilton Mesa area in the summer, but use during other seasons is unknown. Miramonte Reservoir occupied sage-grouse habitat is approximately 4,700 ha (11,600 ac) (GSRSC 2005). Sagebrush stands are generally contiguous with a mixed grass and forb understory. Occupied habitat at the Gurley Reservoir area is heavily fragmented 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 now are restricted primarily to the seasonal irrigation 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). Sagebrush stands in the Iron Springs and Beaver Mesa areas are contiguous with a mixed grass understory. The Beaver Mesa area has numerous scattered patches of oakbrush (*Quercus gambelii*).

The 2005 population estimate for the entire San Miguel Basin was 334 (CDOW, unpubl. lit. 2005b) on 9 leks. Rogers (1964) reported that all big sagebrush-dominated habitats in San Miguel and Montrose Counties were historically used by sage-grouse. The historic distribution was highly fragmented by forests, rocky canyons and dry basins void of sagebrush habitats.

Monticello-Dove Creek Population—This population has two disjunct groups of Gunnison sage-grouse. Currently, the largest group is near the town of Monticello, Utah. Gunnison sage-grouse in this group 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) estimates that Gunnison sage-grouse currently occupy about 24,000 ha (60,000 ac) in the Monticello group. The 2005 population estimate for Monticello was 162 individuals with 2 active and 2 inactive leks (G. Wallace, UDWR pers. comm. 2005). Leks in the Monticello area were first identified and counted in 1968.

The Dove Creek group 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 7 males in 2005 (CDOW, unpubl. lit. 2005c). All leks are located in agricultural fields on private lands. 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; Apa 2004). Rogers (1964) reported that all sagebrush-dominated habitats in Dolores and Montezuma Counties within Gunnison sage-grouse range in Colorado were historically used by sage-grouse.

Piñon Mesa Population—The Piñon Mesa population occurs on the northwest end of the Uncompahgre Plateau in Mesa County, about 35 km (22 mi) southwest of Grand Junction, Colorado. Eight leks are known (CDOW, unpubl. lit. 2004). However, one is inactive and another was not active in 2005 (CDOW unpubl. lit. 2005d). The Piñon Mesa area may have additional leks, but the high percentage of private land, a lack of roads, and heavy snow cover during spring makes locating additional leks difficult. Gunnison sage-grouse likely occurred historically in all suitable sagebrush habitat in the Piñon Mesa area, including the Dominguez Canyon area of the Uncompaghre Plateau, southeast of Piñon Mesa proper (Rogers 1964). Their current distribution has been substantially reduced from historic levels (GSRSC 2005).

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 (*A. t. tridentata*) and black sagebrush (*A. nova*) dominate the mid-elevation uplands (GSRSC 2005). The 2005 population estimate for Crawford is 191 (CDOW, unpubl. lit. 2005e). Currently there are four active leks 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).

Cerro Summit-Cimarron-Sims Mesa Population—This population is in Montrose County, Colorado. The Cerro Summit-Cimarron group is centered about 24 km (15 mi) east of Montrose. The habitat consists of patches of sagebrush habitat fragmented by oakbrush and irrigated pastures. Three leks are known in the Cerro Summit-Cimarron group, but only one was verified to be active in 2005. Rogers (1964) 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 is inactive. Rogers (1964) counted eight males in a lek count at Sims Mesa in 1960. It is not known if sage-grouse move between the Cerro-Summit-Cimarron and Sims Mesa groups.

Poncha Pass Population—The Poncha Pass sage-grouse population is located in Saguache County, approximately 16 km (10 mi) northwest of Villa Grove, Colorado. This population was established through the introduction of 30 birds from the Gunnison Basin in 1971 and 1972 during efforts to reintroduce the species to the San Luis Valley (GSRSC 2005). The known population distribution is in 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 extensive and continuous with little fragmentation; sagebrush habitat quality throughout the area is adequate (Nehring and Apa 2000). San Luis Creek runs through the area, providing a year-round water source and lush, wet meadow riparian habitat for brood-rearing. The 2005 Poncha Pass sage-grouse population estimate is 44 (CDOW, unpubl. lit. 2005f). 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 transplanted 24 additional birds from the Gunnison Basin (Nehring and Apa 2000). In 2001 and 2002, 20 and 7 birds respectively also were moved to the Poncha Pass by CDOW (GSRSC 2005). Transplanted females have bred successfully (Apa, CDOW, pers. comm. 2004) and display activity resumed on the historic lek in spring 2001.

Population Trends

Trends in abundance were analyzed for individual populations and the species rangewide using male lek count data from CDOW and UDWR (Garton 2005). Due to inconsistencies in data collection over time, trend analyses were conducted for two time periods—the entire number of years lek data have been collected (1957–2005), and from 1995–2005 when sampling methodologies have been more consistent. Raw data collected for 2005 show a large increase in the numbers of males attending leks. Because of this, the analyses were conducted both with and without 2005 data; estimates did not change significantly when the 2005 lek counts were omitted in this analysis. Statistical analyses of the Cerro Summit-Cimarron-Sims Mesa and Dove Creek populations could not be completed due to low lek counts and inconsistencies in sampling over time. Similarly, the small Poncha Pass population was not analyzed because it has been surveyed for only 6 years and in that time the population was augmented with birds from Gunnison Basin.

The long-term analysis (1957–2005) found that the rangewide population of Gunnison sage-grouse was neither increasing nor decreasing during that time period. Annual rates of change were highly variable, most likely as a result of sampling error rather than actual changes in population sizes. The shorter analysis period (1995–2005) yielded the same results, although the variability was reduced, likely due to more consistent data collection methods. Individual populations reflected the trends in the rangewide analysis, in that some populations were slightly increasing and some were slightly decreasing (Table 2). As with similar analyses conducted for the

greater sage-grouse (Connelly *et al.* 2004), density-dependent models appeared to more accurately describe observed population trends (Garton 2005).

TABLE 2.—SUMMARY OF POPULATION TRENDS FOR THE GUNNISON SAGE-GROUSE [1]

Population	Finite rate of change
Rangewide	1.049
Gunnison Basin	1.05
Piñon Mesa	1.09
San Miguel Basin	0.9
Crawford	0.999
Monticello	0.99

[1] Values are the finite rate of change in the population, where 1 is no change, numbers less than 1 indicate a decline, and numbers greater than 1 indicate an increase. The analysis is for 1995–2005 (data from Garton 2005).

Because we relied on the population trend analyses conducted by Garton (2005), we asked six peer reviewers to evaluate the report. We received comments from five of the reviewers, three generally favorable towards the report and its conclusions and two expressing concerns regarding limitations in the data sets, assumptions, and/or analyses. For example, one would have to assume that habitat availability over time would remain stable in order to conclude that Gunnison sage-grouse numbers are unlikely to experience a substantial decline in the future. Also, while the conclusions showed that the number of males per lek remained relatively stable over time, the proportion of leks on which males were counted appeared to have declined, which could be indicative of an overall population decline. In discussing the historic distribution of Gunnison sage-grouse, we concluded that much of the habitat loss, and by inference population decline, occurred prior to 1958.

It was also suggested that more appropriate statistical tests would need to be applied to come to any conclusion about potential population trends and that emphasis should be on an independent analysis of each geographically isolated population because each population exhibits independent population dynamics. Population trend analyses were conducted on a population basis (as well as rangewide). However, to further subdivide the data analyzed into smaller units (*i.e.* subpopulations) would have compromised the statistical integrity of the analysis due to small sample sizes. There was concern expressed that habitat loss over time was not accounted for, that population declines would go unnoticed, and that population trends would appear far too optimistic.

An identical population trend analysis was peer reviewed by the Ecological Society of America in the ''Conservation Assessment of Greater Sage-grouse and Sagebrush Habitats'' (Connelly *et al.* 2004). Additional clarifying information regarding model assumptions, the primary concern of the peer reviewers, was provided by Garton after the peer review was complete. Based on this late submission, and after careful review of the analysis, we believe that Garton (2005) constitutes the best currently available information.

Summary of Factors Affecting the Species

Section 4 of the Act (16 U.S.C. 1533) and regulations (50 CFR part 424) promulgated to implement the listing provisions of the Act set forth the procedures for adding species to the Federal lists. A species may be determined to be an endangered or threatened species due to one or more of the five factors described in section 4(a)(1). As part of our analysis, we chose, out of an abundance of caution, not to rely on the Cerro Summit-Cimarron-Sims Mesa and Poncha Pass populations and the Dove Creek group of the Monticello-Dove Creek population for the longterm conservation of the species because of their small, isolated status. We also determined that these populations do not comprise a significant portion of the Gunnison sage-grouse range. Therefore, these populations/group were not evaluated further for future threats. Although we are not relying on these populations/group for the longterm conservation of the species, we nonetheless believe that conservation of these populations is worthwhile, and we will continue to support and encourage those efforts. However, we analyze the threats applicable to the remaining populations/group to determine whether the species as a whole meets the definition of threatened or endangered.

The Service considers the foreseeable future in Gunnison sage-grouse to be between 30 and 100 years based on 10 Gunnison sage-grouse generations to 2 sagebrush habitat regeneration cycles. This is consistent with our 12-month finding for the greater sage-grouse (70 FR 2244). Because the Gunnison sage-grouse has the same generation time and occupies habitat similar to the greater sage-grouse, we consider it prudent to use the same definition for the foreseeable future.

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

Data indicate that the Gunnison sage-grouse was found in central and southwest Colorado, southeast Utah, northwestern New Mexico, and northeastern Arizona prior to European settlement (GSRSC 2005, modified from Schroeder *et al.* 2004). Gunnison sage-grouse currently occupy 4,719 sq km (1,822 sq mi) in southwestern Colorado and southeastern Utah (GSRSC 2005, modified from Schroeder *et al.* 2004). The following describes the issues affecting Gunnison sage-grouse within their current range.

Current Threats Due to Habitat Fragmentation: Habitat fragmentation is the separation or splitting apart of previously contiguous, functional habitat. Fragmentation of sagebrush habitats has been cited as a primary cause of the decline of sage-grouse populations (Patterson 1952; Connelly and Braun 1997; Braun 1998; Johnson and Braun 1999; Connelly *et al.* 2000a; Miller and Eddleman 2000; Schroeder and Baydack 2001; Aldridge and Brigham 2003; Connelly *et al.* 2004; Schroeder *et al.* 2004). While sage-grouse are dependent on interconnected expanses of sagebrush (Patterson 1952; Connelly *et al.* 2004), data are not available regarding optimum or even minimum sagebrush patch sizes necessary to support sage-grouse populations. In addition, there is a lack of data to assess how fragmentation influences specific sage-grouse life-history parameters such as productivity, density, and home range.

Oyler-McCance *et al.* (2001) documented loss and fragmentation of sagebrush vegetation in southwestern Colorado. In a genetic study of Gunnison sage-grouse populations, Oyler-McCance *et al.* (2005) concluded that gene flow among populations of Gunnison sage-grouse is limited.

Notwithstanding the lack of specificity on effects of fragmentation, it is clear that as a whole, fragmentation can have an adverse effect on sage-grouse populations. The following sections examine activities that can contribute to habitat fragmentation to determine whether they threaten Gunnison sage-grouse habitat.

Conversion to Agriculture and Water Development

In the mid-1800s, western rangelands were converted to agricultural lands on a large scale beginning with the series of Homestead Acts in the 1800s (Braun 1998; Hays *et al.* 1998), especially where suitable deep soil terrain and

water were available (Rogers 1964). Influences resulting from agricultural activities adjoining sagebrush habitats extend into those habitats, and include increased predation and reduced nest success due to predators associated with agriculture (Connelly *et al.* 2004).

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 sage-grouse (C. Braun, CDOW, pers. comm. 1998). However, crop monocultures do not provide adequate year-round food or cover (GSRSC 2005). Gunnison sage-grouse will use hay pastures for foraging within about 50 m (165 ft) of the edge of the field but do not forage further into the pasture due to lack of suitable habitat (Gunnison Basin Conservation Plan 1997).

In the Gunnison Basin approximately 17,328 ha (42,800 ac) or 8 percent of the current range was converted to agricultural activities in the past and for the most part is no longer occupied (GSRSC 2005). Approximately 5,700 ha (14,000 ac) or 7 percent of the current range in the San Miguel Basin has been converted to agriculture and for the most part is unoccupied (GSRSC 2005). The arrangement of these converted lands has contributed to habitat fragmentation in these areas, although it is not negatively influencing sage-grouse numbers in this population (Garton 2005).

Approximately 30 percent of the 40,048 ha (98,920 ac) of the current range in the Monticello-Dove Creek population has been converted to agriculture and for the most part is no longer occupied (GSRSC 2005). In the Monticello group, 43 percent has been converted to pasture (GSRSC 2005). San Juan County, Utah, where the Monticello group resides, also has approximately 15,000 ha (37,000 ac) enrolled in Conservation Reserve Program (CRP), of which about half is within current sage-grouse range (San Juan County Gunnison Sage-grouse Work Group [GSWG], unpubl. lit. 2005; GSRSC 2005). Under CRP, cropland is planted to pastureland and, except in emergency situations, not hayed or grazed. The CRP fields are used heavily by grouse as brood-rearing areas but vary greatly in plant diversity and forb abundance, and generally lack any shrub cover (GSRSC 2005). Sagebrush patches have progressively become smaller and more fragmented limiting the amount of available winter habitat for the Monticello group (GSRSC 2005). Significant use of CRP as nesting or winter habitat will require establishment of sagebrush stands in these fields. The CRP has protected this area from more intensive agricultural use and development, and approximately 16,000 ha (40,000 ac) of CRP are up for renewal under the Farm Bill in the next 2–3 years.

Conversion to agriculture is limited in the Piñon Mesa area, with only 5 percent (500 ha (1,214 ac)) of the current range planted to grass/forb rangeland and for the most part no longer occupied (GSRSC 2005). Sagebrush occurs in some areas that may be converted to grassland for livestock (BLM, unpubl. lit. 2005a), but the continued conversion is considered to be a minor impact in the foreseeable future. Habitat conversion in the Crawford area due to agricultural activities has been limited (GSRSC 2005).

Although past conversion to agriculture has resulted in the loss of sagebrush habitat, we have no evidence to conclude that ongoing or anticipated agricultural conversion of sagebrush habitats is likely to threaten or endanger the Gunnison sage-grouse. Existing agricultural activities may fragment the species current range, but we have no data to determine that this is actually occurring, or is likely to occur.

Past development of irrigation projects has also resulted in loss of sage-grouse habitat (Braun 1998). Reservoir development in the Gunnison Basin flooded 3,700 ha (9,200 ac or 1.5 percent) of likely sage-grouse habitat (S. McCall, Bureau of Reclamation, pers. comm. 2005), and three other reservoirs inundated approximately 2 percent of habitat in the San Miguel Basin population area (J. Garner, CDOW, pers. comm. 2005). We are unaware of any plans for additional reservoir construction in the foreseeable future and do not consider water development a threat to the species.

Roads

Impacts from roads may include direct habitat loss, direct mortality, creation of barriers to migration to seasonal habitats (Forman and Alexander 1998), facilitation of mammalian (Forman and Alexander 1998; Forman 2000) and corvid predation (Connelly *et al.* 2000b; Aldridge and Brigham 2003; Connelly *et al.* 2004) and expansion into previously unused areas, spread of invasive weeds (Forman and Alexander 1998; Forman 2000; Gelbard and Belnap 2003; Knick *et al.* 2003; Connelly *et al.* 2004), noise in the vicinity of leks (Braun 1986; Forman and Alexander 1998; Holloran 2005), and increased recreational use and associated human disturbances (Forman and Alexander 1998; Massey 2001; Wyoming Game and Fish Department 2003). Specific effects of these factors on sage-grouse are discussed below.

Lyon (2000) suggested that roads may be the primary impact of oil and gas development to greater sage-grouse, due to their persistence and continued use even after drilling and production have ceased. Braun *et al.* (2002) suggested that daily vehicular traffic along road networks for oil wells can impact Gunnison and greater sage-grouse breeding activities based on a documented decrease in males at leks. Modeling done in Connelly *et al.* (2004) found that the number of active leks, lek persistence and lek activity increased with increasing distance from an interstate highway. Other than this single predictive model output, we have no quantitative information on the current impact of roads to Gunnison sage-grouse. It is unclear what specific factor relative to roads sage-grouse are responding to, and Connelly *et al.* (2004) caution that they have not included other potential sources of disturbance (e.g., powerlines) in their analyses.

Roads may have additional indirect effects that result from birds' behavioral avoidance of road areas because of noise, visual disturbance, pollutants, and predators moving along them. The absence of screening vegetation in arid and semiarid regions further exacerbates any problems (Suter 1978). Male sage-grouse depend on acoustical signals to attract females to leks (Gibson and Bradbury 1985; Gratson 1993). If noise interferes with mating displays, and thereby female attendance, it is possible that younger males will not be drawn to the lek and eventually leks will become inactive (Braun 1986; Holloran 2005). Dust from roads and exposed roadsides can damage vegetation through interference with photosynthetic activities; the actual amount of potential damage depends on winds, wind direction, the type of surrounding vegetation and topography (Forman and Alexander 1998). Chemicals used for road maintenance, particularly in areas with snowy or icy precipitation, can affect the composition of roadside vegetation (Forman and Alexander 1998). While all of these potential effects are actually occurring or whether they have actually affected sage-grouse populations individually or at a species level.

Gunnison sage-grouse habitat is currently fragmented by a number of roads (BLM, unpubl. lit. 2005b, Colorado Department of Transportation (CDOT) 2004, Jim Ferguson, BLM, pers. comm. 2005, San Juan County GSWG,

unpubl. lit. 2005), and road development within Gunnison sage-grouse habitats has precluded sage-grouse movement between the resultant patches (Oyler-McCance *et al.* 2001). New roads and increased traffic on existing roads may cause some impact to the Dry Creek Basin birds in the San Miguel Basin, primarily due to ongoing gas field development and exploration on both the eastern and western edges of the current range. Increases in truck traffic have been noted on 24 km (15 mi) of roads that cross the center of the current range in Dry Creek Basin. However, only two sage-grouse have been killed on the roads in Dry Creek Basin since 2003 (CDOW, unpubl. lit. 2006). No paved roads occur in the current range for the Piñon Mesa population, but with projected human population increases of 91 percent by 2030 (Colorado Department of Local Affairs [CDLA] 2004), we anticipate that new or existing roads will be paved in the foreseeable future.

This information suggests new roads may result in additional habitat loss and fragmentation. It may also increase disturbance and chance of direct mortality. However, based on the data available to us, we have no data to support that the effects of existing roads in general, and the new roads specifically will impact Gunnison sage grouse at the species level.

Powerlines

The most detrimental effect that powerlines have is to provide a convenient perch for predators. There are reports that they can also directly affect sage-grouse by posing a collision and electrocution hazard (Braun 1998; Connelly *et al.* 2000a), and can have indirect effects by increasing predation (Connelly *et al.* 2004), fragmenting habitat (Braun 1998), and facilitating the invasion of exotic annual plants (Knick *et al.* 2003; Connelly *et al.* 2004). However, although death through collision and electrocution are widely referenced, only one citation actually provides data to support the claim with a report of three adult sage-grouse dying as a result of colliding with a telegraph line in Utah (Borell 1939). Both Braun (1998) and Connelly *et al.* (2000a) report that sage-grouse collisions with powerlines occur, although no specific instances were presented.

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 (Steenhof *et al.* 1993; Connelly *et al.* 2000a; Manville 2002; Vander Haegen *et al.* 2002). 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; Manville 2002). Raptors may actively seek out power poles where natural perches are limited. For example, within 1 year of construction of a 596-km (373-mi) transmission line in southern Idaho and Oregon, raptors and common ravens (*Corvus corax*) began nesting on the supporting poles (Steenhof *et al.* 1993). Within 10 years of construction, 133 pairs of raptors and ravens were nesting along this stretch (Steenhof *et al.* 1993). The increased abundance of raptors and corvids within the current Gunnison sage-grouse range could result in increased predation (Oyler-McCance *et al.* 2001). Ellis (1985) reported that golden eagle predation on greater sage-grouse increased from 26–73 percent after completion of a transmission line within 200 m (656 ft) of an active sage-grouse lek in northeastern Utah. The lek was eventually abandoned. Ellis (1985) concluded that the presence of the powerline resulted in changes in sage-grouse dispersal patterns and fragmentation of the habitat. 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 (Braun *et al.* 2002). The presence of a powerline may fragment sage-grouse habitats even if raptors are not present. Braun (1998) found that use of otherwise suitable habitat by sage-grouse near powerlines increased as distance from the powerline increased for up to 600 m (1,969 ft) and reported that the presence of powerlines may limit sage-grouse use within 1 km (0.6 mi) in otherwise suitable habitat.

Linear corridors through sagebrush habitats can facilitate the spread of invasive species, such as cheatgrass (*Bromus tectorum*) (Connelly *et al.* 2004). However, we were unable to find any information regarding the amount of invasive species incursion as a result of powerline construction.

On 121,000 ha (300,000 ac) of BLM land in Gunnison Basin there are 36 rights-of-way for power facilities, power lines, and transmission lines, which have resulted in the direct loss of 350 ha (858 ac) of occupied habitat (BLM, unpubl. lit. 2005c). A transmission line runs through the Dry Creek Basin group in the San Miguel Basin population, and the Beaver Mesa group has two. None of the transmission lines in the San Miguel Basin have raptor proofing (BLM, unpubl. lit. 2005d), nor do most distribution lines (Jim Ferguson, BLM, pers. comm. 2005). One major electric transmission line runs east-west in the northern portion of the current range of the Monticello group (San Juan County GSWG, unpubl. lit. 2005). Powerlines do not appear to be present in sufficient density to pose a significant threat to Gunnison sage-grouse in the Piñon 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 (J. Ferguson, BLM, pers. comm. 2005). The projected human population growth rate in and near Gunnison sage-grouse populations is low (see discussion under urban development). Therefore we expect a low rate of increase in powerlines with a concomitant small increase in predation from raptors and corvids. We do not expect these to be substantial threats at the population level.

Fences

Fences are used to delineate property boundaries and to manage livestock (Braun 1998; Connelly *et al.* 2000a). The effects of fencing on sage-grouse include direct mortality through collisions, creation of predator (raptor) perch sites, the potential creation of a predator corridor along fences (particularly if a road is maintained next to the fence), and incursion of exotic species along the fencing corridor (Call and Maser 1985; Braun 1998; Connelly *et al.* 2000a; Knick *et al.* 2003; Connelly *et al.* 2004).

Sage-grouse frequently fly low and fast across sagebrush flats and new fences can create a collision hazard (Call and Maser 1985). Thirty-six carcasses of greater sage-grouse were found near Randolph, Utah, along a 3.2-km (2-mi) fence within 3 months of its construction (Call and Maser 1985). Twenty-one incidents of mortality through fence collisions near Pinedale, Wyoming, were reported in 2003 to the BLM (Connelly *et al.* 2004). Fence collisions continue to be identified as a source of mortality for both Gunnison and greater sage-grouse (Braun 1998; Connelly *et al.* 2000a; Oyler-McCance *et al.* 2001; Connelly *et al.* 2004, San Juan County GSWG, unpubl. lit. 2005), although effects on populations are not understood. Braun (1998) suggested that collision with fences, especially woven wire fences, was a potential factor in sage-grouse decline. Connelly *et al.* (2000a) noted that grouse have been observed hitting or narrowly missing fences and that grouse remains are frequently found next to fences. The impact of collisions on populations of grouse has not been investigated.

Fences provide perch sites for avian predation and, depending on their design, may also cause habitat loss and fragmentation. Where there are maintained trails alongside the fence, invasive weeds may increase (Connelly *et al.* 2000a; Oyler-McCance *et al.* 2001; Braun *et al.* 2002; Gelbard and Belnap 2003; Knick et al 2003; Connelly *et al.* 2004). Where sage-grouse avoid habitat adjacent to fences, presumably to minimize the risk of predation, habitat fragmentation occurs even if the actual habitat is not removed (Braun 1998).

There are at least 1,540 km (960 mi) of fence within BLM lands within the Gunnison Basin (BLM, unpubl. lit. 2005e) and an unquantified amount on other land ownerships. While these fences contribute to habitat fragmentation in this area 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. Because we do not expect a major increase in the number of fences and Gunnison sage-grouse populations are relatively stable in the affected areas, we do not believe fencing is a significant threat to Gunnison sage-grouse at the species level.

Urban Development

It is estimated that 3–5 percent of all sage-grouse historical habitat in Colorado has been converted into urban areas (Braun 1998). Interrelated effects from urban/suburban development include construction of associated infrastructure (roads, powerlines, and pipelines), which has been discussed, as well as predation threats from the introduction of domestic pets and increases in predators subsidized by human activities (*e.g.*, landfills). Urban expansion into rural areas also is resulting in direct habitat loss and conversion, as well as alteration of remaining sage-grouse habitats around these areas due to the presence of humans and pets (Braun 1998; Connelly *et al.* 2000a). Specific affects of these factors on sage-grouse are discussed below.

U.S. Census Bureau projections show that human population growth varies widely across the current distribution of Gunnison sage-grouse (CDLA 2004). Public ownership in the Crawford area and Gunnison Basin, and portions of the San Miguel Basin will limit potential impacts from development in those particular areas. However, even these public lands are intersected by private lands. ''No development'' conservation easements may help alleviate potential impacts of the expansion effects of urban and suburban development (existing and contemplated conservation easements in the Gunnison sage-grouse range are addressed in more detail under State regulatory protection considerations in Factor D).

Aldridge (2005) used spatial modeling to determine various habitat, climatic, and anthropogenic factors that influence greater sage-grouse nest and brood habitat selection and to determine nest and brood success. He determined that broods avoided habitats with a high density of urban development and areas close to cropland. A single human-use feature did not appear to affect nest occurrence but sage-grouse strongly avoided nesting in areas when roads, well sites, urban habitats, and cropland were analyzed in combination. Aldridge (2005) agreed with Fuhlendorf *et al.* (2002) that this may be due to predator avoidance behavior.

It is possible that residential development that is not managed to account for the needs of the Gunnison sage-grouse could destroy and fragment habitat for the Gunnison Basin population. Gunnison County currently has a low population density of 5 people/sq mi in 2000 (GSRSC 2005), with projected growth rates ranging from .1 to 1.6 percent per year. These rates result in a population increase of about 5,700 people by 2030 (41% or 7 people/sq mi) (CDLA 2004). A 30 percent housing increase is projected from 2000–2020 (GSRSC 2005). Growth from the town of Crested Butte, on the northern end of the Gunnison Basin population, is expanding southward. Population growth estimates are not available for the portion of Saguache County that comprises approximately 25 percent of the Gunnison Basin population's current range, although county-wide the projected population growth from 3 people/sq mi in 2000 (GSRSC 2005) to 2030 is 45 percent (CDLA 2004). Currently, an estimated 100–500 people live in the Gunnison Basin portion of Saguache County so the estimated population in 2030 will be between 145 and 725 people.

Dry Creek Basin is the only group within the San Miguel Basin population with significant Federal and State land ownership (70 percent). This population is made up of six disjunct sage-grouse groups. San Miguel County had 9 people/sq mi in 2000 (GSRSC 2005); most residents live in the town of Telluride or several smaller communities, including Norwood. The population in San Miguel County is expected to double to 18 people/sq mi between 2000 and 2030 (CDLA 2004), accompanied by a 62 percent increase in housing units by 2020 (GSRSC 2005). Based upon the location of current subdivided areas, expansion into sage-grouse habitat is certain without some action by local government (GSRSC 2005). Residential development is likely to affect the Iron Springs Mesa and Gurley Reservoir groups (GSRSC 2005). Subdivision development increased during 2003 and 2004 and at Gurley Reservoir, a 260-ha+ (640-ac+) area has been broken up into 16, 16-ha (40-ac) tracts for development. Approximately 8 percent of the current range for this portion of the San Miguel Basin population will be developed. Continued development in the area threatens to cause habitat loss, fragmentation, and future connection of the San Miguel Basin population to other Gunnison sage-grouse populations. The Miramonte Reservoir group has a long-term threat of housing development (GSRSC 2005). However, the Dry Creek Basin group, which is the largest and principally in Federal ownership, has little expected threat from development (GSRSC 2005).

The Monticello group of the Monticello-Dove Creek population is in San Juan County, Utah, which has approximately 2 people/sq mi (GSRSC 2005) with a projected increase to 3.6 people/sq mi by 2030 (Utah Governor's Office of Planning and Budget 2005) and a 54 percent increase in housing by 2020 (GSRSC 2005). Almost all the current range in both States is in private ownership.

The Piñon Mesa population is in Mesa County, which had a population density of 55 people/sq mi in 2000 (GSRSC 2005) with a projected increase to 105 people/sq mi by 2030 (CDLA 2004) and 56 percent in housing units by 2020 (GSRSC 2005). Approximately 70 percent of the current range is in private ownership. Expansion of growth from the nearby city of Grand Junction poses a threat of permanent habitat loss and fragmentation. The eastern 33 percent of the current range (approximately 13,000 ha or 32,000 ac) is privately-owned and contains 810 ha (2,000 ac) in tracts, each less than 65 ha (160 ac), and an additional 1,500 ha (3,600 ac) in tracts between 65 and 130 ha (160 and 320 ac), all of which can be further subdivided (GSRSC 2005). However, 19 percent of the private land containing all occupied habitat is currently in conservation easements with additional lands being negotiated for conservation easements with the landowners, thereby limiting the threat of development (See Factor D for further discussion of easements).

There were an estimated 24 people/sq mi living in and near the Crawford Area population in 2000 (GSRSC 2005).

Montrose County contains the southeastern 75 percent of the current range of the Crawford population. The county was identified as one of the fastest growing counties in the country, with human population expected to double from 2000–2030 (CDLA 2004) and housing expected to increase by 68 percent by 2020. Growth will likely fragment and destroy current habitat and potential linkages to the San Miguel population (GSRSC 2005), creating further isolation of this population (see Factor E for further discussion). The northwestern 25 percent of the current range is in Delta County, which is projected to increase in population by 79 percent by 2030 (CDLA 2004) with an increase in housing of 58 percent by 2020 (GSRSC 2005).

Human population growth and housing development is occurring in all of the Gunnison sage-grouse populations and is projected to continue to do so over the next 2 decades. Some populations (Gunnison and Crawford) have public lands as potential buffers for the anticipated human population growth. Additionally, with the exception of the Piñon Mesa population, projected human population densities in all sage-grouse populations are low and do not appear to pose a significant threat. At Piñon Mesa, the threat of development may be diminished by current conservation easements with additional easements planned.

Energy Development

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 and electrical facilities (Connelly *et al.* 2004). Surveys for recoverable resources occur primarily through seismic activities, using vibroesis trucks or shothole explosives. Well pads vary in size from 0.10 ha (0.25 ac) for coalbed natural gas wells in areas of level topography to greater than 7 ha (17 ac) for deep gas wells (Connelly *et al.* 2004). Pads for compressor stations require 5–7 ha (12–17 ac) (Connelly *et al.* 2004). Well densities and spacing are typically designed to maximize recovery of the resource and are administered by State agencies (Connelly *et al.* 2004). Well densities and spacing on Federal lands are governed by land management plans which include resource analysis and mitigation requirements. All the sage grouse are considered species of special concern and effects on grouse and habitat are part of the considerations for permit conditions imposed by the BLM.

Direct habitat losses result from construction of well pads, roads, pipelines, powerlines, and the crushing of vegetation during seismic surveys. As disturbed areas are reclaimed, sage-grouse may repopulate the area. However, re-population may take 20–30 years, as habitat conditions are not immediately restored (Braun 1998). For most developments, return to pre-disturbance population levels is not expected due to a net loss and fragmentation of habitat (Braun *et al.* 2002). After 20 years, sage-grouse have not recovered to pre-development numbers in Alberta, even though well pads in these areas have been reclaimed (Braun *et al.* 2002). In some reclaimed areas, sage-grouse have not returned (Aldridge and Brigham 2003). However in Jackson County, Colorado, sage-grouse have repopulated, although not to the pre-development levels.

Noise can drive away wildlife, cause physiological stress, and interfere with auditory cues and intraspecific communication, as discussed previously. Aldridge and Brigham (2003) reported that, in the absence of stipulations to minimize the effects, mechanical activities at well sites may disrupt sage-grouse breeding and nesting activities. Greater sage-grouse hens that bred on leks within 3 km (2 mi) of oil and gas development in the upper Green River Basin of Wyoming selected nest sites with higher total shrub canopy cover and average live sagebrush height than hens nesting away from disturbance (Lyon 2000). The author hypothesized that exposure to road noise associated with oil and gas drilling may have been one cause for the difference in habitat selection. However, noise could not be separated from the potential effects of increased predation resulting from the presence of a new road. Above-ground noise is typically not regulated to mitigate effects to sage-grouse or other wildlife (Connelly *et al.* 2004). Gunnison sage-grouse were observed flushing from a lek when a compressor station switched on, disrupting breeding behavior (Jim Garner, CDOW, pers. comm. 2004). However, this was a single incident, and we have no information to conclude that noise from energy development poses a significant threat to the species.

Water quality and quantity may be affected in oil and gas development areas. However, since, sage-grouse do not require free water (Schroeder *et al.* 1999) we anticipate that impacts to water quality from mining activities would have minimal effects on them.

Increased human presence resulting from oil and gas development also can impact sage-grouse either through avoidance of suitable habitat, disruption of breeding activities, or increased hunting and poaching pressure (Aldridge and Brigham 2003; Braun *et al.* 2002; BLM 2003). Sage-grouse also may be at increased risk for collision with vehicles simply due to the increased traffic associated with oil and gas activities (BLM 2003).

Only a few studies have examined the effects of oil and gas development on sage-grouse. While each of these studies reported sage-grouse population declines, specific causes for the negative impacts were not determined. In Alberta, Canada, the development of well pads and associated roads in the mid-1980s resulted in the abandonment of three greater sage-grouse lek complexes within 200 m (656 ft) of these features (Braun *et al.* 2002). Those leks have not been active since that time. A fourth lek complex has gone from three to one lek with fewer numbers of sage-grouse on it (Braun *et al.* 2002). The well pads have since been reclaimed, but greater sage-grouse numbers have not recovered (we do not have information on post-reclamation vegetation). Subsequent to the development of the Manyberries Oil Field in high quality greater sage-grouse habitat in Alberta, male sage-grouse counts fell to the lowest known level (Braun *et al.* 2002). Two additional leks were directly disturbed, and neither of these leks has been active within the past 10 years (Braun *et al.* 2002). The development of oil reserves in Jackson County, Colorado, was concurrent with decline of greater sage-grouse numbers in the oil field area (Braun 1998). Sage-grouse populations still occur in at least one long-term oil field development in Colorado where leks are not within line-of-sight of an active well or powerline (Braun *et al.* 2002). Although the number of active leks has declined in this field, sage-grouse have been consistently documented there since 1973.

Of particular relevance to estimating oil and gas development impacts is the fidelity of sage-grouse hens to nesting and summer brood-rearing areas demonstrated by Lyon and Anderson (2003). Hens that have successfully nested will return to the same areas to nest every year. If these habitats are affected by oil and gas development, there is a strong potential that previously successful hens will return but not initiate nesting (Lyon 2000). Depending on the number of hens affected, local populations could decline.

The reauthorization of the Energy Policy and Conservation Act in 2000 dictated reinventory of Federal oil and gas reserves, which identified extensive reserves in the Greater Green River Basin of Colorado, Utah, and Wyoming, and the San Juan Basin of New Mexico and Colorado (Connelly *et al.* 2004). 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) 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 8 out of 64 in counties producing natural gas in 2002 (Colorado Oil and Gas Conservation Commission 2004).

In the current sage-grouse range in the Gunnison Basin, 33 percent of the area ranked as low potential with the remainder having no potential for oil and gas development (BLM 1999; GSRSC 2005). No federally-leased lands exist within the population area (BLM, unpubl. lit. 2005f). However, one active well and six inactive wells are on non-Federal lands in the current range in the northern part of the Gunnison Basin (BLM, unpubl. lit. 2005f).

The entire San Miguel Basin population area is classified as having high potential for oil and gas development (BLM 1999; GSRSC 2005)). Natural gas exploration in the San Miguel Basin has increased in recent months (CDOW, unpubl. lit. 2005g), with 49 percent of the current range on public and private land with Federal leases for gas development (BLM, unpubl. lit. 2005f). As a general practice, all currently unleased BLM lands within the current sage-grouse range in the San Miguel Basin are being deferred for oil and gas leasing until completion of the Resource Management Plans (RMPs) covering the habitat for this population (anticipated in 2007 and 2008).

The Colorado State Land Board (CSLB) offered four sections of State school section land for oil and gas leasing in the San Miguel Basin population in February 2006. One of these is in occupied habitat of the Miramonte Reservoir group and the other three are in the Dry Creek Basin group. The San Miguel County Board of Commissioners requested that they withdraw those sections or at least place a ''no surface occupancy'' prescription on the land with adherence to conservation measures in the RCP (San Miguel County, unpubl. lit. 2006). The CSLB stipulated that well pads would be placed out of Gunnison sage-grouse habitat [to the extent possible] on one parcel in Dry Creek Basin where the surface and the mineral rights are owned by the CSLB (Linda Luther, San Miguel County, pers. comm. 2006). However, the other three parcels are split estate (private surface, CSLB-owned minerals) and the CSLB was unwilling to, or believed they could not, put stipulations for sage-grouse on those parcels. San Miguel County will continue to work with the landowners, CSLB, and oil and gas companies to place stipulations on the parcels (Linda Luther, San Miguel County, pers. comm. 2006) but whether stipulations will occur is uncertain. Nonetheless, this illustrates a strong conservation commitment by the County for the San Miguel Basin population.

One oil and gas operator, who holds several leases in the San Miguel Basin, has decided to temporarily abandon drilling on its leases in the Hamilton Mesa, Miramonte Reservoir, Gurley Reservoir, Beaver Mesa, and Iron Springs Mesa areas because they are not expected to be economically feasible. However, exploration and production may continue in the future (CDOW, unpubl. lit. 2005g). Fifty-one oil and gas wells have been developed in the current range in the San Miguel Basin. All but 1 is in the Dry Creek Basin and 47 are on federally-leased land (BLM, unpubl. lit. 2005f). Additional wells on existing leases are proposed for this area in the next 10 years. Five gas pipelines are proposed for this development, one of which is expected to transect winter habitat and another will remove habitat in places (BLM, unpubl. lit. 2005g). 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, unpubl. lit. 2005g).

The Monticello group is in an area of high energy potential (GSRSC 2005). Oil and gas leases with State and Federal mineral rights have been acquired or applied for on over 2,000 ha (5,000 ac) (6 percent) in the current range (Tammy Wallace, BLM, pers. comm. 2005). One new well pad was constructed in 2005 (San Juan County GSWG, unpubl. lit. 2005) and additional drilling is expected to occur in the next few years. However, BLM is currently deferring new leases in the current range.

No oil and gas wells are within the current range in the Pinon Mesa area, although oil and gas leases occupy 17 percent of this habitat (BLM, unpubl. lit. 2005f). The remaining portion of the current range has no potential for oil or gas in this area except for a small portion on the eastern edge of the largest habitat block (BLM 1999; GSRSC 2005). The Crawford population is in an area with high to medium potential for oil and gas development (BLM 1999; GSRSC 2005). However, no Federal leases and only one well (on non-Federal lease property) are in the current range (BLM, unpubl. lit. 2005f). The BLM has deferred Federal oil and gas leases in the current range in this population until resource management plans addressing Gunnison Sage Grouse are adopted. Future development could occur on State and private land in the Crawford area under Colorado Oil and Gas Commission regulation and on BLM land if their future RMP allows it.

In summary, some Gunnison sage-grouse habitat is in areas with high potential for oil and gas development, particularly in the San Miguel Basin. A few studies on greater sage-grouse reported population declines in response to oil and gas development (Braun *et al.* 2002; Lyon and Anderson 2003), although specific causes for the declines were not determined. A recent study of greater sage-grouse in Wyoming found that as oil and gas development increased (Holloran 2005). Negative impacts to active leks extended to a distance of 5 km (3 mi) from an active drilling rig. Similarly, juvenile male recruitment to impacted leks also fell. Nesting females avoided areas with high well densities, although site fidelity to previous nesting locations may result in delayed population response to the habitat changes associated with development. While some birds were displaced by the disturbance, Holloran (2005) also found that many sage-grouse discontinued breeding attempts, and others died at a higher rate than birds from unaffected areas. He concluded that natural gas field development contributes to localized greater sage-grouse extirpations, but that regional populations levels, although negatively impacted, are not as severely influenced.

Application of these impacts from gas development to the San Miguel and Crawford populations and Monticello group could threaten their long-term persistence. However, the immediate threat to Gunnison sage-grouse is curtailed by BLM lease deferments. Additionally, available information suggests that economic infeasibility of extraction will act to minimize the likelihood this development will occur at a significant enough level to imperil Gunnison sage-grouse.

Colorado has been the largest producer of coalbed methane in the

country since 2002, and production has increased (Cappa *et al.* 2005). Deposits exist under the current range of the San Miguel and Crawford populations (Cappa *et al.* 2005), although no wells have been drilled to date in those areas (D. Spencer, BLM, pers. comm. 2005) leading us to believe this does not represent a significant threat to these populations and therefore to the species.

Renewable energy resources, such as windpower, require many of the same features for construction and operation as do nonrenewable energy resources. Therefore, we anticipate that potential impacts from direct habitat losses, habitat fragmentation through roads and powerlines, noise, and increased human presence (Connelly *et al.* 2004) will generally be the same as already discussed for nonrenewable energy development. Windpower may have additional mortalities resulting from sage-grouse flying into turbine rotors or meteorological towers (Erickson *et al.* 2001), although the magnitude of such losses is unquantified. One greater sage-grouse was found dead within 45 m (148 ft) of a turbine on the Foote Creek Rim wind facility in south-central Wyoming, presumably from flying into a turbine (Young *et al.* 2003). During 3 years of monitoring operation, this is the only known sage-grouse mortality at this facility.

Current interest and speculation in wind energy exists in the Monticello area. A wind test tower (anemometer) has been erected at a site approximately 2.4 km (1.5 mi) from a lek (GSRSC 2005), and landowners in the area have been contacted by power company contractors about leases for wind power development. If wind turbines are placed near leks and other important habitat in the Monticello group, depending on the location and number of turbines, Gunnison sage-grouse in this area may be affected. We are not aware of any other wind energy development proposed throughout the rest of the Gunnison sage-grouse current range. We have no evidence that current or future wind energy development threatens or endangers the long-term persistence of the species.

Mining

Surface mining for any mineral resource (coal, uranium, copper, bentonite, gypsum, oil shale, phosphate, limestone, gravel, etc.) will result in direct habitat loss for Gunnison sage-grouse if the mining occurs in current sagebrush range. Direct loss of sage-grouse habitat also can occur if the overburden and/or topsoil resulting from mining activities are stored in sagebrush habitats. The actual effect of this loss depends on the quality, amount, and type of habitat disturbed, the scale of the disturbance, and the availability of adjacent habitats (Proctor *et al.* 1983; Remington and Braun 1991).

Regulation of non-coal mining in the United States is at the discretion of the individual States. New vegetation types including exotic species may become established on mined areas (Moore and Mills 1977), altering their suitability for sage-grouse. If reclamation plans call for the permanent conversion of the mined area to a different habitat type (e.g., agriculture) the habitat loss becomes permanent. Invasive exotic plants also may establish on the disturbed surfaces. Removal of the overburden and target mineral may result in changes in topography, subsequently resulting in changes in microclimates and microhabitats (Moore and Mills 1977). Additional habitat losses can occur if supporting infrastructure, such as roads, railroads, utility corridors, buildings, etc., become permanent landscape features after mining and reclamation are completed (Moore and Mills 1977), which is allowed in Colorado (Colorado Statute Title 34, Article 32) and Utah (R647–4–110).

Other indirect effects from mining can include reduced air quality from fugitive dust, degradation of surface water quality and quantity, disturbance from noise, human presence, and mortality from collision with mining equipment (Moore and Mills 1977; Brown and Clayton 2004). Fugitive dust could affect local vegetative and insect resources (Moore and Mills 1977). Most large surface mines are required to control fugitive dust, so these impacts are probably limited.

Since sage-grouse do not require free water (Schroeder *et al.* 1999), we anticipate that impacts to water quality from mining activities would have minimal population-level effects. The possible exception is degradation or loss of riparian areas, which could result in brood habitat loss. The effects on sage-grouse of noise from mining are unknown, but sage-grouse also depend on acoustical signals to attract females to leks (Gibson and Bradbury 1985; Gratson 1993). If noise does interfere with mating display and thereby female attendance, younger males will not attend the lek, and eventually leks will become inactive (Amstrup and Phillips 1977; Braun 1986). Mining also can impact sage-grouse through the increased presence of human activity, either through avoidance of suitable habitat adjacent to mines or through collisions with vehicles associated with mining operations (Moore and Mills 1977; Brown and Clayton 2004). However, we were unable to find any information regarding increased mortality of Gunnison sage-grouse as a result of this effect.

Within Gunnison sage-grouse current range, coal, uranium, and vanadium are the most commonly mined minerals and have begun to attract increased interest in recent years (Cappa *et al.* 2005). These minerals were mined historically in the San Miguel area and affected an unknown amount of the historical range of the Gunnison sage-grouse. Uranium deposits are within the current range of the San Miguel Basin population and Monticello group (Coker 2001; Cappa *et al.* 2005) and three mines near the San Miguel Basin population were reopened in 2004 (Cappa *et al.* 2005). Due to the exploratory nature of this mineral activity to date and the somewhat speculative nature of its occurrence in the future, we do not believe that this activity will be a significant threat to the species in the foreseeable future.

Six active hardrock, gravel or road fill mines are located on BLM land in sage-grouse habitat in the Gunnison Basin (BLM, unpubl. lit. 2005c). Total disturbance, excluding roads, is 39 ha (96 ac). Two hundred ninety-one inactive or abandoned mines and numerous miles of roads have caused unquantified past habitat loss and fragmentation (BLM, unpubl. lit. 2005b), but future impact of hardrock, gravel, or road fill mines are likely limited.

We conclude that present and future mining activities appear to be limited and do not pose a significant threat to Gunnison sage-grouse.

Grazing

Grazing is the dominant use of sagebrush rangelands in the West (Connelly *et al.* 2004); almost all sagebrush areas are managed for livestock grazing (Knick *et al.* 2003). Although we lack information on the proportion of occupied Gunnison sage-grouse habitat that is grazed, we expect that it is a vast majority. Excessive grazing by domestic livestock during the late 1800s and early 1900s, along with severe drought, significantly affected sagebrush ecosystems (Knick *et al.* 2003). Although current livestock stocking rates are substantially lower than high historical levels (Laycock *et al.* 1996), long-term effects from this overgrazing, including changes in plant communities and soils, persist today. Although it is likely that livestock grazing and associated land treatments have altered plant composition, increased topsoil loss, and increased spread of exotic plants, the impacts on sage-grouse are not clear. Few studies have directly addressed the effect of

livestock grazing on sage-grouse (Beck and Mitchell 2000; Wamboldt *et al.* 2002; Crawford *et al.* 2004), and there is little direct experimental evidence linking grazing practices to sage-grouse population levels (Braun 1987, Connelly and Braun 1997). Rowland (2004) conducted a literature review and found no experimental research that demonstrates grazing alone is responsible for reduction in sage-grouse numbers.

The GSRSC (2005) could not find a direct correlation between historic grazing and reduced sage-grouse numbers. It has been demonstrated that the reduction of grass heights due to livestock grazing of sage-grouse nesting and brood-rearing habitat negatively affects nesting success by reducing cover necessary for predator avoidance (Gregg *et al.* 1994; Delong *et al.* 1995; Connelly *et al.* 2000a). Nest success in Gunnison sage-grouse habitat is related to greater grass and forb height and shrub density (Young 1994). In addition, livestock consumption of forbs may reduce food availability for sage-grouse. This is particularly important for pre-laying hens, as forbs provide essential calcium, phosphorus, and protein. A hen's nutritional condition affects nest initiation rate, clutch size, and subsequent reproductive success (Connelly *et al.* 2000a). Livestock grazing can reduce the forage availability in breeding and brood-rearing habitat, with possible subsequent negative effects on sage-grouse populations (Braun 1987; Young 1994; Dobkin 1995; Beck and Mitchell 2000). Exclosure studies have demonstrated that domestic livestock grazing also reduces water infiltration rates and cover of herbaceous plants and litter, as well as compacting soils and increasing soil erosion (Braun 1998). This results in a change in the proportion of shrub, grass, and forb components in the affected area, and an increased invasion of exotic plant species that do not provide suitable habitat for sage-grouse (Miller and Eddleman 2000). Hulet (1983, as cited in Connelly *et al.* 2000a) found that heavy grazing could lead to increases in ground squirrel numbers; ground squirrel depredate sage-grouse nests. Thus, livestock stocking levels and season and duration of use are important factors of livestock operations related to impacts on sage-grouse include

Other consequences of grazing include several related to livestock trampling. Outright nest destruction by livestock trampling does occur, and the presence of livestock can cause sage-grouse to abandon their nests (Rasmussen and Griner 1938; Patterson 1952; Call and Maser 1985; Crawford *et al.* 2004). Call and Maser (1985) indicate that forced movements of cattle and sheep could have significant effects on nesting hens and young broods caught in the path of these drives. Livestock also may trample sagebrush seedlings thereby removing a source of future sage-grouse food and cover (Connelly *et al.* 2000a), and trampling of soil by livestock can reduce or eliminate biological soil crusts making these areas susceptible to cheatgrass invasion (Mack 1981 as cited in Miller and Eddleman 2000; Young and Allen 1997; Forman and Alexander 1998).

Livestock grazing also may compete directly with sage-grouse for rangeland resources. Aldridge and Brigham (2003) suggest that poor livestock management in mesic sites results in a reduction of forbs and grasses available to greater sage-grouse chicks, thereby affecting chick survival. The effects of direct competition between livestock and sage-grouse depend on condition of the habitat and grazing practices.

Development of springs and other water sources to support livestock in upland shrub-steppe habitats can artificially concentrate domestic and wild ungulates in important sage-grouse habitats, thereby exacerbating grazing impacts in those areas through vegetation trampling, etc. (Braun 1998). Diverting water sources has the secondary effect of changing the habitat present at the water source before diversion. This could result in the loss of either riparian or wet meadow habitat important to sage-grouse as sources of forbs or insects.

Sagebrush removal to increase herbaceous forage and grasses for domestic and wild ungulates is a common practice in sagebrush ecosystems (Connelly *et al.* 2004). Herbicide, especially Tebuthiuron applications were commonly used to kill large expanses of sagebrush, but it also killed many forbs used for brood-rearing (Crawford *et al.* 2004). Thinning, rather than removal, of sagebrush using Tebuthiuron has been the focus of some treatments (Emmerich 1985; Olson and Whitson 2002).

Sage-grouse response to herbicide treatments depends on the extent to which forbs and sagebrush are killed. Chemical control of sagebrush has resulted in declines of sage-grouse breeding populations through the loss of live sagebrush cover (Connelly *et al.* 2000a). Herbicide treatment also can result in sage-grouse emigration from affected areas (Connelly *et al.* 2000a), and has been documented to have a negative effect on nesting, brood carrying capacity (Klebenow 1970), and winter shrub cover essential for food and thermal cover (Pyrah 1972 and Higby 1969 as cited in Connelly *et al.* 2000a). Carr and Glover (1970) found that greater sage-grouse would use block-sprayed areas for strutting but not for other activities. They found that adults would move the 1.6 km (1.0 mi) across the sprayed areas but believed that movement across the area may cease as dead standing sagebrush deteriorated. They also determined that broods were impeded from moving to a previously used riparian area due to killing of the sagebrush between nesting sites and the riparian area. Winter use also did not occur in the area due to lack of live sagebrush for forage.

Small treatments interspersed with non-treated sagebrush habitats did not affect sage-grouse use, presumably due to minimal effects on food or cover (Braun 1998). Also, application of herbicides in early spring to reduce sagebrush cover may enhance some brood-rearing habitats by increasing the coverage of herbaceous plant foods (Autenrieth 1981).

Mechanical treatments are designed to either remove the above-ground portion of the sagebrush plant (mowing, roller chopping, and rotobeating), or to uproot the plant from the soil (grubbing, bulldozing, anchor chaining, cabling, railing, raking, and plowing; Connelly *et al.* 2004). These treatments were begun in the 1930s and continued at relatively low levels to the late 1990s (Braun 1998). Mechanical treatments, if carefully designed and executed, can be beneficial to sage-grouse by improving herbaceous cover, improving forb production, and resprouting sagebrush (Braun 1998). However, adverse effects also have been documented (Connelly *et al.* 2000a). Mechanical treatments in blocks greater than 100 ha (247 ac), or of any size seeded with exotic grasses, degrade sage-grouse habitat by altering the structure and composition of the vegetative community (Braun 1998).

For Gunnison sage-grouse, the best measure of potential grazing impacts is derived from monitoring habitat conditions in grazing allotments and comparing that information to grouse habitat objectives. BLM developed habitat objectives for Gunnison sage-grouse from habitat objectives in each of the local conservation plans. They are similar to the grazing management guidelines that were later developed for the RCP (GSRSC 2005). Where information is available, the comparison between BLM's habitat conditions and habitat objectives is presented below.

Within the current range in the Gunnison Basin, 23 of 66 BLM grazing

allotments have sage-grouse habitat objectives incorporated into the allotment management plans or Records of Decision for permit renewals (BLM, unpubl. lit. 2005h). In 2002, 50 percent of the Wyoming big sagebrush/Indian ricegrass (*Achnathrum hymenoides*) vegetation, which accounts for a significant portion of the nesting/early brood-rearing habitat, met the desired condition on BLM lands in the area (GSRSC 2005). In 2003, 75 percent of 32,000 ha (80,000 ac) of nesting/early brood-rearing habitat monitored met habitat objectives (BLM, unpubl. lit. 2004). Under 50 percent of the 579 km (360 mi) of riparian areas, which are important for brood-rearing, met desired conditions identified in the Gunnison Basin Conservation Plan (1997) and 85 percent met short-term stubble height objectives (nesting cover) (BLM, unpubl. lit. 2004). In 2004, 23,000 ha (56,000 ac) were monitored within a 3-km (2-mi) radius of a lek, and less than 2 percent met the local (Gunnison Basin Conservation Plan 1997) objectives for grass stubble height (BLM, unpubl. lit. 2005i). However, grass growth may have been suppressed by effects of drought, which appeared to be impacting habitat in most populations in 2004 (See Factor E for further drought discussion).

We were able to acquire information on grazing intensity for only the Dry Creek Basin group of the San Miguel Basin population. No sage-grouse habitat objectives or conservation measures are in allotment management plans or grazing permits for BLM allotments in that area (BLM, unpubl. lit. 2005d and 2005g). Sagebrush patches there continue to succeed to a late-seral sagebrush community lacking in understory.

Eight BLM grazing allotments totaling 2,700 ha (6,700 ac) occur within the current range in the Monticello group (San Juan County GSWG, unpubl. lit. 2005). Few or no habitat objectives have been incorporated into BLM allotment management plans, nor have changes in grazing intensity been implemented for sage-grouse in the group. No data are available on whether grazing lands on BLM or private land are meeting sage-grouse habitat objectives for the Monticello group. The CRP has provided a considerable amount of brood-rearing habitat in the Monticello group because of its forb component. Grazing of CRP in Utah occurred in 2002 under emergency Farm Bill provisions due to drought. Radio-collared males and non-brood-rearing females exhibited temporary avoidance of grazed fields during and after grazing (San Juan County GSWG, unpubl. lit. 2005), although one hen with a brood continued to use a grazed CRP field.

Fifty grazing allotments on BLM land are within the current range in the Piñon Mesa population (BLM, unpubl. lit. 2005a). We do not know the extent of grazing on the private land within the Piñon Mesa sage-grouse range. Only three BLM allotments (6 percent) have Gunnison sage-grouse habitat objectives incorporated into the allotment management plan or grazing permit in this area. We have no information on habitat conditions in any of the allotments in the population area.

In the Crawford population there are nine BLM grazing allotments, totaling about 8,500 ha (21,000 ac) or 60 percent of the habitat. Sage-grouse conservation measures have been incorporated into seven of the allotment plans. On BLM land in the Crawford population, Animal Unit Months have been reduced and grazing management was recently changed (BLM unpubl. lit. 2005d). The Gunnison Gorge Land Health Assessment showed that 34,000 out of 44,000 ha (84,000 out of 110,000 ac), or 76 percent of the current range, met the land health standard for threatened and endangered species (including Gunnison sage-grouse habitat). The extent of livestock grazing on private land is unknown.

In conclusion, habitat manipulations to improve livestock forage can affect sage-grouse habitat. In the Gunnison Basin, BLM habitat conditions are adequate for approximately 50 to 75 percent of the area measured, depending on the parameters and year they were measured. The Gunnison Basin population has been stable over time (see Table 2 and Garton 2005), suggesting that grazing is not negatively affecting the population in this area. In the Crawford area 76 percent of the current range met standards, so we do not consider grazing to be a threat there. Although we do not have specific information on the remaining BLM lands, it is reasonable to assume similar conditions exist on the remainder of the BLM lands. In the Monticello area, private lands enrolled in CRP are usually left ungrazed. We lack data on the extent of private land grazing on Gunnison Sage-Grouse habitat in the remainder of its range. However, based on the data available to us, we conclude that there is insufficient data that demonstrates grazing is a threat to the species.

We lack adequate information on the effect of deer and elk grazing on Gunnison sage-grouse and their habitat to fully address this potential impact. 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) documented a decline in available perennial grasses as elk densities increased. Such grazing could negatively impact nesting cover for sage-grouse. Excessive but localized deer and elk grazing has been documented in the Gunnison Basin (BLM, unpubl. lit. 2005i; Paul Jones, CDOW, pers. comm. 2005). The winter range of deer and elk overlaps the year-round range of the Gunnison sage-grouse. Deer and elk herds were above the carrying capacity of their winter range before the 2002 drought and were not significantly reduced during or after (BLM, unpubl. lit. 2005i). However, no evidence exists that competition for resources is limiting Gunnison sage-grouse in the Gunnison Basin. Although grazing by deer and elk occurs in all population areas, information on overgrazing by deer or elk and its potential effect on other populations has not been reported.

Invasive Weeds

Invasive species have been defined as those that are not native to an ecosystem and whose introduction causes, or is likely to cause, economic or environmental harm or harm to human health (Executive Order 13112, 1999). Invasive species often cause declines in native plant populations by reducing light, water, and nutrients, and they grow so quickly that they outcompete other species (Wooten *et al.* 1996). Exotic plants can reduce and eliminate populations of plants that sage-grouse use for food and cover. Frequent fires with short intervals within sagebrush habitats favor invasion of cheatgrass, which is unsuitable as sage-grouse habitat (Schroeder *et al.* 1999). Cheatgrass then shortens the fire interval (from approximately 30 years down to 5 years), perpetuating its own persistence and spread, and exacerbating the effects of fire in remaining sage-grouse habitats (Whisenant 1990; Billings 1994; Grahame and Sisk 2002; Connelly *et al.* 2004). A cheatgrass invasion into sagebrush habitat can lead to an eventual conversion of sagebrush/perennial grass community to sagebrush/annual grass or annual grass rangeland (Connelly *et al.* 2000a; Miller and Eddleman 2000). Rehabilitation of an area to sagebrush after cheatgrass becomes established is extremely difficult (Connelly *et al.* 2004). In some cases cheatgrass invasion encourages other exotic species such as knapweed and thistle (Grahame and Sisk 2002).

Cheatgrass has invaded areas in Gunnison sage-grouse range, supplanting sagebrush habitat. Connelly

et al. (2000a) indicated that some greater sage-grouse populations have been affected and some will decline due to projected, continuing spread of cheatgrass domination in the absence of effective management. There has not been a demonstrated change in fire cycle in any population of Gunnison sage-grouse, so they may not be as threatened as greater sage-grouse. While all of the Colorado Gunnison sage-grouse counties have noxious weed programs, none identify cheatgrass as a noxious weed for control purposes (Colorado Department of Agriculture 2003). The BLM, on whose land many acres of cheatgrass occur, is currently restricted to application of 6 ha (15 ac) of an effective herbicide per Field Office per year, limiting their ability to control this noxious weed (BLM, unpubl. lit. 2005i).

Approximately 14,249 ha (35,200 ac) have been invaded by cheatgrass in the Gunnison Basin, equaling 6 percent of the current range (BLM, unpubl. lit. 2005i) with 405 ha (1,000 ac) considered dominated by cheatgrass (Sandy Borthwick, BLM, pers. comm. 2005) despite past treatments to control this weed (Gunnison Watershed Noxious Weed Program, unpubl. lit. 2005). In addition, cheatgrass has been found at 50 other locations and 21 roads or road segments throughout the Gunnison Basin population's range. Although disturbed areas contain the most weeds, they can readily spread into undisturbed habitat. Given its invasive nature, cheatgrass may increase in the Gunnison Basin in the future, but the actual extent or rate of increase is uncertain. Cheatgrass is present throughout much of the current range in the San Miguel Basin (BLM, unpubl. lit. 2005d). It is sparsely scattered in the five Gunnison sage-grouse groups east of Dry Creek Basin, which are at higher elevation, and does not appear to pose a serious threat to them (CDOW, unpubl. lit. 2005g). Because cheatgrass can readily dominate native plant communities at lower elevations (CDOW, unpubl. lit. 2005g), it may affect the Dry Creek Basin group, which comprises 62 percent of the San Miguel Basin population. Invasive species are present at low levels in the Monticello groups (San Juan County GSGWG, unpubl. lit. 2005). 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 Piñon Mesa population (R. Lambeth, BLM, pers. comm. 2005). It occurs in the lower elevation areas below Piñon Mesa that were formerly Gunnison sage-grouse range. It invaded two small prescribed burns in or near occupied habitat conducted in 1989 and 1998 (BLM, unpubl. lit. 2005a), and continues to be a concern with any ground disturbing projects. Four invasive weedy forbs also occur in the area, but occupy less than 4 ha (10 ac) (BLM, unpubl. lit. 2005a). Invasive weeds, especially cheatgrass, occur primarily along roads, other disturbed areas, and isolated areas of untreated vegetation in the Crawford population. No current estimates of the extent of weed invasion are available (BLM, unpubl. lit. 2005d).

Although invasive weeds, especially cheatgrass, have affected some sage-grouse habitat, the impacts do not appear to be threatening individual populations or the species rangewide. We have no basis for expecting on the potential spread of cheatgrass into sage grass habitat, and we have not information that suggests that it will be a threat in the future.

Fire and Fire Management

There have been significant changes in fire frequency, distribution, and intensity since European settlement (Young *et al.* 1979; Miller and Eddleman 2000). The effects of fire on sagebrush habitats vary according to the species and subspecies of sagebrush and other plant species present (e.g., the understory) and the frequency, size and intensity of fires. Widely variable estimates of mean fire intervals have been described in the literature—35–100 years (Brown 2000), greater than 50 years for big sagebrush communities (McArthur 1994), 12–15 years for mountain big sagebrush (*Artemesia tridentata vaseyana*) (Miller and Rose 1999), 20–100 years (Peters and Bunting 1994), 10–110 years depending on sagebrush species or subspecies and specific geographic area (Kilpatrick 2000), and 13–25 years (Frost 1998 cited in Connelly *et al.* 2004).

Fire tends to extensively reduce the sagebrush component within the burned areas. Time needed for most sagebrush species and subspecies to reestablish after burning suggests they evolved in an environment where wildfire was infrequent (interval of 30–50 years) and patchy in distribution (Braun 1998). Prior to European settlement, fire patterns in sagebrush communities were patchy, particularly in Wyoming big sagebrush, due to the discontinuous and limited fuels and unburned islands that remained after a fire (Miller and Eddleman 2000). Huff and Smith (2000) noted that these unburned islands appear to be important to the future recolonization of the sagebrush community by providing sources of sagebrush seed. Where sagebrush habitat has become fragmented and limited, there is potential for fire to eliminate the existing seed source, reducing the likelihood of natural regeneration.

A variety of techniques have been attempted at re-establishing sagebrush post-fire, with mixed success (Quinney *et al.* 1996, Livingston 1998). Restoration of the sagebrush biome following a fire has been complicated not only by the invasion of exotic annual plant species, but the difficulty associated with establishing sagebrush seedlings (Boltz 1994). Wirth and Pyke (2003) reported that forb response post-fire is dependant on the forb community pre-burn.

A clear positive response of sage-grouse to fire has not been demonstrated (Braun 1998). A number of studies have found adverse effects to sage grouse populations resulting from fire. (Call and Maser 1985; Rowland and Wisdom 2002; Nelle *et al.* 2000; Byrne 2002; Connelly *et al.* 2000c; Fischer *et al.* 1996a). However, Klebenow (1970), Gates (1983, as cited in Connelly *et al.* 2000c), Sime (1991 as cited in Connelly *et al.* 2000a), and Pyle and Crawford (1996) all indicated that fire could improve brood-rearing habitat.

Three prescribed burns have occurred in the Gunnison Basin since 1984, totaling 700 ha (1,700 ac). The fires created large sagebrush-free areas that were further degraded by poor post-burn livestock management (BLM, unpubl. lit. 2005i). 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 Land Health Assessments in 2004, noted that sagebrush had died and largely been replaced with weeds (BLM, unpubl. lit. 2005g). The 2002 Burn Canyon fire in the Dry Creek Basin and Hamilton Mesa areas created a short-term habitat loss of 890 ha (2,200 ac). Fire has apparently not occurred recently in the Monticello group.

One wildfire in the Gunnison Basin burned 445 ha (1,098 ac) in June 2002 (Sandy Borthwick, BLM, pers. comm. 2006). There appears to be a good response to the fire from grass and forbs. Mountain big sagebrush also appears to have responded well based on seedling establishment in seeded and non-seeded areas. Some cheatgrass, suspected to have come in with the sagebrush seed, was observed on the seeded sites but was sparse (Sandy Borthwick, BLM, pers. comm. 2006). At least four

wildfires in the last 20 years burned 39,300 ha (97,200 ac) in the current range in the Piñon Mesa area and created large expanses almost devoid of sagebrush and invaded by cheatgrass and Russian thistle (Salsola spp) (BLM, unpubl. lit. 2005a). Some wildfire suppression has occurred in sage-grouse habitat in the vicinity of residences. Fire occurs infrequently in the Crawford area. The Fruitland wildfire burned 240 ha (600 ac) of pinyon-juniper and old sagebrush in 1996. Two efforts to reseed the area with sagebrush and native forbs and grasses failed and the area is now dominated by cheatgrass (BLM, unpubl. lit. 2005d). Spread of cheatgrass into other areas is an increasing threat due to its establishment in the burned area.

Where fire suppression has occurred, sagebrush communities may advance successionally to pinyon pine and juniper (Burkhardt and Tisdale 1969; Young and Evans 1981; Miller and Rose 1995; Miller *et al.* 2000; Wrobleski and Kauffman 2003), eventually resulting in a near total loss of shrubs and sage-grouse habitat (Miller and Eddleman 2000). Gambel oak invasion as a result of fire suppression also has been identified as a potential threat to Gunnison sage-grouse (CDOW, unpubl. lit. 2002). Trees provide perches for raptors; consequently, Gunnison sage-grouse avoid areas with pinyon-juniper (Commons *et al.* 1999).

Native tree or shrub encroachment on 11,336 ha (28,000 ac) or 5 percent of the current range has occurred in the Gunnison Basin. Oakbrush encroachment is a potential threat in the San Miguel Basin, especially in the five easterly and higher elevation groups. Approximately 2,955 ha (7,300 ac) or 9 percent of the current range in these areas are dominated by oakbrush. Mountain shrubs also have encroached on about 3,280 ha (8,100 ac) or 9 percent of habitat in the San Miguel Basin population (GSRSC 2005). No pinyon-juniper dominated areas are within the current range.

The Monticello area has 1,170 ha (2,889 ac) or 5 percent of the current range dominated by oakbrush (GSRSC 2005). Pinyon 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 there has been no quantification or mapping of the encroachment (San Juan County GSWG, unpubl. lit. 2005). A relatively recent invasion of pinyon and juniper trees between the Dove Creek and Monticello groups appears to be contributing to their isolation from each other (GSRSC 2005).

About 1,600 ha (3,935 ac) of trees and shrubs dominate 16 percent of the current range in the Piñon Mesa area (GSRSC 2005). In addition to limiting habitat, tree and shrub encroachment is further isolating Piñon Mesa from the Crawford and San Miguel populations, thereby impacting connectivity and maintenance of genetic diversity (see discussion under Factor E). Approximately 9 percent of the 1,300 ha (3,200 ac) of the current range in the Crawford population is classified as dominated by pinyon-juniper (GSRSC 2005). However, BLM (unpubl. lit. 2005d) estimates that as much as 20 percent of the population area is occupied by pinyon-juniper. The Crawford population also has about 400 ha (953 ac) or 3 percent of oakbrush-dominated land in the current range (GSRSC 2005).

Although fire suppression has likely caused low to moderate levels of native tree and shrub encroachment in the populations we considered, none of the encroachment is sufficient to pose a significant threat to the Gunnison sage-grouse at a population or rangewide level. Fires can cause spread of weeds and burn suitable sage-grouse habitat, but they do not threaten the species currently and we do not anticipate that they will in the future. Fires can be beneficial by rejuvenating forbs and grasses and reducing encroachment of native trees and shrubs.

Conclusion for Factor A

Habitat fragmentation has affected the exchange of individuals among populations of Gunnison sage-grouse. Population isolation is most pronounced in Pinon Mesa and Monticello. There also is some evidence that the Monticello and Dove Creek groups have recently been separated from each other by habitat changes; however, there is no evidence that habitat fragmentation has limited exchange of sage-grouse within other populations, including the San Miguel Basin population which has six groups separated by 1–4 air miles.

Forty-three percent of the occupied habitat in the Monticello group was converted to agriculture in the past, but little conversion is expected there in the future. Other occupied population areas have had lower percentages of past conversions with no current or future conversion expected. There is evidence that Gunnison sage-grouse will not use agricultural fields further than about 50 m (160 ft) from the edge for foraging but no evidence that agricultural conversion currently threatens the sage-grouse rangewide. Reservoirs caused fragmentation and/or loss of a small percentage of habitat in the Gunnison Basin population and the Gurley and Miramonte groups in the San Miguel Basin population. However, there is no evidence that reservoir development has caused range-wide or population-wide threats to the Gunnison sage-grouse.

Other than two direct mortalities in the San Miguel Basin population, we were unable to find any data substantiating effects of roads to impacts on Gunnison sage-grouse populations. Based on the stable population trend, the current network of roads does not appear to be a threat to the species, and we have no information that indicates that future road development will pose a threat to the species rangewide. Despite the presence of powerlines in all populations there also is no evidence that they are threatening Gunnison sage-grouse populations rangewide or within populations.

Urban or exurban development does not appear to be a threat to the sage-grouse based on the low human population densities in all but one county with Gunnison sage-grouse. Projections of human population growth and housing development are not known to be a rangewide threat.

High potential for oil and gas development only exists in the San Miguel Basin population and Monticello group; high to medium potential exists in the Crawford population. Low or no potential exists in the Gunnison Basin and Pinon Mesa populations. Energy development on Federal lands can contain conservation measures for wildlife species (see Factor D for a more thorough discussion). We have no evidence that oil and gas development will threaten the Gunnison sage-grouse rangewide in the foreseeable future. Other energy development activities, such as wind turbine development, are not expected to cause a threat to the Gunnison sage-grouse rangewide in the foreseeable future. Additionally, coal or hardrock mining appears to pose little threat to occupied habitat.

Although overgrazing can affect habitat, it is unclear whether effects from current livestock grazing management practices, such as reduction of vegetation below suitable conditions or spread of weeds threaten the Gunnison sage-grouse at a population or rangewide level. Cheatgrass may impact sage-grouse habitat in nearly all Gunnison sage-grouse populations. However, there has not been a demonstrated change in fire cycle in any population, nor is it documented that cheatgrass, at its current distribution and density, will threaten the Gunnison sage-grouse in the foreseeable future. Invasive weeds

other than cheatgrass occur in some populations but at levels that do not cause a threat to the Gunnison sage-grouse.

Fires can cause spread of weeds and burn suitable sage-grouse habitat, but also may be beneficial by rejuvenating forbs and grasses and reducing encroachment of native trees and shrubs. Fire can be both beneficial and detrimental depending on location, size, and intensity and is not expected to be a rangewide threat in the foreseeable future. Although there has been low to moderate levels of native tree and shrub encroachment in nearly all the populations, most likely as a result of fire suppression, none of the encroachment is great enough to cause a documented threat to the Gunnison sage-grouse at a rangewide level.

Although various factors discussed in this section are believed to, or could potentially be, impacting the populations, these factors have not caused significant declines in the species rangewide. Thus, based on the best scientific and commercial data available, we have concluded that destruction, modification, or curtailment of its habitat or range does not threaten or endanger the Gunnison sage-grouse throughout all or a significant portion of its range in the foreseeable future.

Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

Hunting

Studies suggest that recreational hunting of sage-grouse may be compensatory (i.e., harvest replaces mortality that would have happened otherwise due to causes such as predation; or mortality is compensated by increased productivity (Crawford 1982)), have no measurable effect on sage-grouse densities (Braun and Beck 1996), or may be additive (i.e., harvest adds more deaths per year to the total otherwise attributable to other causes, and is not compensated by increased productivity (Zunino 1987; Connelly *et al.* 2000a)). Johnson and Braun (1999) concluded that harvest mortality may be additive for sage-grouse if adult females and young birds sustain the highest hunting mortality within a population. No studies have demonstrated that regulated hunting is a primary cause of widespread reduced numbers of greater sage-grouse (Connelly *et al.* 2004).

Hunting of Gunnison sage-grouse is regulated by the State wildlife agencies (GSRSC 2005). Hunting in the Gunnison Basin appears to have been compensatory, as it had little if any impact on the population (CDOW, unpubl. lit. 2005g). However, sage-grouse hunting was eliminated in the Gunnison Basin in 2000 due to concerns with meeting population objectives as suggested in the Gunnison Basin Conservation Plan (1997). It is not known if hunting contributed to the failure to meet these objectives. Hunting has not occurred in the other Colorado populations of Gunnison sage-grouse since 1995 when the Pinon Mesa area was closed (GSRSC 2005). Utah has not allowed hunting since 1989. Both States have committed to disallow hunting until the species is no longer a candidate for listing or no longer federally-listed and will only consider hunting if populations can be sustained (GSRSC 2005). With this finding that situation will no longer be applicable. However, the Gunnison Basin Plan calls for a minimum of 500 birds before hunting will occur. Although that level is substantially exceeded in the Gunnison Basin, we believe the States sensitivity to the status of the species would preclude them from opening a hunting season until at least a majority of the populations have achieved such a status. We do not anticipate hunting to be opened in the foreseeable future in the smaller populations, or in the near future in the Gunnison Basin. Furthermore, any hunting will be restricted to only 5–10 percent of the fall population, and will be structured to limit harvest of females to the extent possible (GSRSC 2005). Public input will be considered when determining if hunting seasons should be reinstated (GSRSC 2005). We are not aware of any studies or other data that demonstrate that poaching (illegal harvest) has contributed to Gunnison sage-grouse population declines in either State.

Lek Viewing

The Gunnison sage-grouse is a newly designated species, which prompts bird watchers to view it for their ''life lists'' and may lead to disturbance in commonly known leks. Daily human disturbances on sage-grouse leks could cause a reduction in mating, and some reduction in total production (Call and Maser 1985). Boyko *et al.* (2004, as cited in GSRSC 2005) determined that 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. Smaller lek sizes have been hypothesized to be less attractive to females, thereby conceivably reducing the numbers of females mating there. Disturbance during the peak of mating also could result in some females not breeding (GSRSC 2005). Lek viewing might affect nesting habitat selection by females (GSRSC 2005), 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).

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 activities, although no scientific studies were conducted (BLM, unpubl. lit. 2005i; GSRSC 2005). A comparison of male counts on a designated viewing lek versus male counts on other leks in the general area, show that the viewing lek's counts followed the same trend line as leks in the rest of the area (GSRSC 2005). Lek viewing protocols on designated leks have generally been followed (GSRSC 2005). Two lek-viewing tours are organized and led by UDWR per year in the Monticello group without noticeable effects (Guy Wallace, UDWR, pers. comm. 2006). Data collected by CDOW indicates that controlled lek visitation also has not impacted greater sage-grouse (GSRSC 2005).

Scientific Research

Gunnison sage-grouse have been the subject of scientific research studies, some of which included the capture and handling of the species. Few, direct mortalities have occurred during recent studies and it does not appear that research is having any significant impacts on the sage-grouse (Apa 2004; CDOW, unpubl. lit. 2005g). Most research is conducted in the Gunnison and San Miguel Basin populations; the two largest populations. Based on the available information, we believe scientific research on Gunnison sage-grouse is a relatively minor impact, with only short-term effects to individuals in localized areas.

Conclusion for Factor B

We have no evidence suggesting that hunting has resulted in overutilization of Gunnison sage-grouse. Future hunting restrictions should adequately conserve Gunnison sage-grouse. Based on limited data it appears that lek viewing has not affected the Gunnison sage-grouse and lek viewing protocols designed to reduce disturbance have generally been followed. Scientific research appears to be limited to short-

term impacts of individuals in localized areas and is not a rangewide 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 threaten or endanger the sage-grouse throughout all or a significant portion of its range in the foreseeable future.

C. Disease or Predation

Disease

Nothing 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; Schroeder *et al.* 1999). Some early studies have suggested that greater sage-grouse populations are adversely affected by parasitic infections (Batterson and Morse 1948). 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 (Connelly *et al.* 2004). 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).

Parasites also have been implicated in greater sage-grouse mate selection, with potentially subsequent effects on the genetic diversity of this species (Boyce 1990; Deibert 1995). Connelly *et al.* (2004) note that while these relationships may be important to the long-term ecology of greater sage-grouse, they have not been shown to be significant to the immediate status of populations. However, Connelly *et al.* (2004) have suggested that diseases and parasites may limit isolated sage-grouse populations such as most of the Gunnison sage-grouse populations. However, we have no evidence indicating that bacterial or parasitic diseases are affecting Gunnison sage-grouse individuals or populations.

Greater sage-grouse also are subject to a variety of bacterial, fungal, and viral pathogens. The bacteria *Salmonella* spp., has caused mortality in the greater sage-grouse; the bacteria is apparently contracted through exposure to contaminated water supplies around livestock stock tanks (Connelly *et al.* 2004). Other bacteria found in 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). We have no reason to expect that mortality and exposure risk are different in Gunnison sage-grouse.

West Nile virus (WNv; *Flavivirus*) was first diagnosed in greater sage-grouse in 2003, and has been shown to affect their survival rates. Experimental results, combined with field data, suggest that a widespread WNv infection could negatively affect greater sage-grouse (Naugle *et al.* 2004; Naugle *et al.* 2005). Summer habitat requirements of sage-grouse potentially increase their exposure to WNv. Sage-grouse hens and broods congregate in mesic habitats in the mid- to late summer, thereby placing them in the same potential habitats as the WNv mosquito (*Culex* spp.), vector when the mosquitoes are likely to be active. Surface water sources that have been created for agricultural, livestock, and energy and mining activities may increase the contact between sage-grouse and the mosquito vector. To date, WNv has not been documented in Gunnison sage-grouse despite the presence of WNv-positive mosquitoes in all counties throughout their range (Colorado Department of Public Health 2004; U.S. Centers for Disease Control and Prevention 2004). Although WNv may be a potential threat, the data available to date suggest that it is not a significant threat to Gunnison sage-grouse.

Predation

Predation is the most commonly identified cause of mortality in sage-grouse (Bergerud 1988; Schroeder *et al.* 1999; Connelly *et al.* 2000b). The composition and density of predator communities can vary greatly across space and time (Greenwood 1986; Johnson *et al.* 1989; Sargeant *et al.* 1993; Sovada *et al.* 1995). The effect of predation on the demographic structure and population fluctuations of Gunnison sage-grouse is unknown will depend on the composition of the predator community, grouse population levels, and habitat condition. In a study of nesting Gunnison sage-grouse, Young (1994) documented only 1 predation event in 37 nesting attempts. Predation on greater sage-grouse has been well documented. Predators of adult greater sage-grouse include coyotes (*Canis latrans*), bobcats (*Lynx rufus*), weasels (*Mustela* spp.), golden eagles, red-tailed hawks (*Buteo jamaicensis*), Swainson's hawks (*B. swainsoni*), and ferruginous hawks (*B. regalis*) (Hartzler 1974; Schroeder *et al.* 1999; Schroeder and Baydack 2001). Avian predators, primarily corvids (*Corvus* spp.), were major predators of greater sage-grouse nests in Idaho (Autenrieth 1981) and Washington (Vander Haegen 2002), while ground squirrels and badgers (*Taxidea taxus*) were major nest predators in Wyoming (Patterson 1952). Most mammalian predation is on eggs; only coyotes and red foxes (*Vulpes vulpes*) are likely to prey on all sage-grouse life stages (GSRSC 2005). Young (1994) found that the most common predators of Gunnison sage-grouse eggs were weasels, ground squirrels, coyotes, and corvids. Most other raptor predation of sage-grouse is on juveniles and older age classes (GSRSC 2005).

Predation rates vary seasonally. The period of highest mortality for yearling and adult males occurs during the lekking season, as they are very conspicuous while performing their mating display. Adult female greater sage-grouse are most susceptible to predators while on the nest or during brood-rearing when they are with young chicks (Schroeder and Baydack 2001). Autenrieth (1981) concluded that predation of eggs was the most important population constraint in Idaho at that time, and this appears to be the case for Gunnison sage-grouse, based on limited data (Young 1994). Schroeder and Baydack (2001) suggest that high variation in nest success may be due to nest predators. Nest predation may be higher, more variable, and have a greater impact on small, fragmented Gunnison sage-grouse populations (GSRSC 2005).

The population viability analysis of Gunnison sage-grouse (GSRSC 2005) found that mortality of chicks and breeding-age hens contributed substantially to increasing the relative probability of extinction because these two groups contribute most significantly to population productivity. Gregg *et al.* (2003a, 2003b) found that chick predation mortality in greater sage-grouse ranged from 10 to 51 percent from 2002–2003 on three study sites in Oregon. The juvenile mortality rate, during the first few weeks after hatching, has been estimated to be 63 percent (Wallestad 1975 in Schroeder and Baydack 2001). While chicks are very vulnerable to predation during this period, other causes of mortality, such as weather, are included in this estimate.

Female Gunnison sage-grouse with nests that were predated nested in sites with lower shrub density and lower forb and grass cover (Young 1994). Habitat alteration that reduces cover for young greater sage-grouse chicks can increase

the rate of predation on this age class (Schroeder and Baydack 2001).

Increasing residential development increases the likelihood that feral cats (*Felis domesticus*) and dogs (*Canis domesticus*) will be introduced into local Gunnison sage-grouse populations. Development also can contribute to increased populations of predators (*e.g.*, red foxes, American crows (*Corvus americanus*)) that are frequently associated with altered landscapes (GSRSC 2005). Agricultural development, landscape fragmentation, and human populations have the potential to increase predation pressure by forcing birds to nest in marginal habitats, by increasing travel time through habitats where they are vulnerable to predation, and by increasing the diversity and density of predators (Ritchie *et al.* 1994; Schroeder and Baydack 2001; Connelly *et al.* 2004; Summers *et al.* 2004). Where greater sage-grouse habitat has been altered in localized areas, the influx of predators can limit populations (Gregg *et al.* 1994; Braun 1998; DeLong *et al.* 1995; Schroeder and Baydack 2001). Habitat fragmentation and the resultant predation increase may be a limiting factor for the Gunnison sage-grouse (Oyler-McCance *et al.* 2001).

Municipal solid waste landfills have been shown to contribute to increases in common raven populations (Knight *et al.* 1993; Restani *et al.* 2001). Ravens are known to prey on sage-grouse and have been considered a restraint on sage-grouse population growth in some locations (Batterson and Morse 1948; Autenrieth 1981). However, no studies could be found that linked landfill presence, common raven populations, and sage-grouse population levels.

The effect of predation on the fluctuations and viability of sage-grouse populations has never been investigated (Connelly and Braun 1997; Connelly *et al.* 2000b; Schroeder and Baydack 2001). Research conducted to determine survival and nest success in greater sage-grouse concluded that predation typically does not limit sage-grouse numbers (Connelly and Braun 1997; Connelly *et al.* 2000a; Connelly *et al.* 2000b; Wambolt *et al.* 2002). This conclusion is supported by evidence showing that predator removal does not have long-lasting effects on sage-grouse population size or stability over large regions (Cote and Sutherland 1997; Schroeder *et al.* 1999; Wambolt *et al.* 2002). For example, Slater (2003) demonstrated that coyote control failed to produce an effect on greater sage-grouse nesting success in southwestern Wyoming. In their review of literature regarding predation, Connelly *et al.* (2004) 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. However, both studies indicated that low nest success due to predation was ultimately related to poor nesting habitat. Connelly *et al.* (2004) further noted that the idea that predation is not a widespread factor depressing sage-grouse populations is supported by studies of nest success rates, by the relatively high survival of adult birds, and by the lack of an effect on nesting success as a result of coyote control.

In a study of 28 radio-collared Gunnison sage-grouse in the Monticello group, 11 birds died, but only 4 of these could be attributed to predation by coyotes or eagles (San Juan County GSWG, unpubl. lit. 2005). However, demographic studies of Gunnison sage-grouse in the San Miguel Basin population suggests, but does not conclusively prove, that predation may be affecting this population (CDOW, unpubl. lit. 2005g). No information is available for the other populations considered.

Conclusion for Factor C

No rangewide or population level impacts of bacterial, viral, fungal, or parasitic diseases on Gunnison sage-grouse have been reported, including WNv. Predation is occurring at some level in all populations, but we have no evidence to suggest that it is a population or rangewide threat to Gunnison sage-grouse. Thus, based on the best scientific and commercial data available, we have concluded that disease and predation do not threaten or endanger the sage-grouse throughout all or a significant portion of its range in the foreseeable future.

D. The Inadequacy of Existing Regulatory Mechanisms

Local Laws and Regulations

Approximately 43 percent of occupied Gunnison sage-grouse habitat is privately owned (GSRSC 2005). Gunnison County and San Miguel County, Colorado, are the only entities that have ordinances within the species' range that provide a level of conservation consideration specifically for the Gunnison sage-grouse or their habitats on private land (Dolores County 2002; Mesa County, unpubl. lit. 2003; Montrose County 2003). In 2001, Gunnison County, Colorado developed Land Use Resolutions (LUR) to be consistent with the Memorandum of Agreement (MOA) signed for the Gunnison Basin Conservation Plan in 1998 (Gunnison County 2001). In the MOA, Gunnison County agreed to ''* * * reasonably consider sage-grouse conservation actions in its regulation of land use * * *'' and to implement the Gunnison Basin Conservation Plan to the best of their ability. The County is attempting to utilize this LUR to optimize sage-grouse conservation. In 2003, the LUR was revised slightly to allow two houses on 35 acres rather than one house without County review, thereby increasing the housing density that could occur in sage-grouse habitat. In 2005, San Miguel County amended its Land Use Codes to include consideration and implementation, to the extent possible, of conservation measures for the sage-grouse when considering land use activities and development located in Gunnison sage-grouse habitat (San Miguel County, unpubl. lit. 2005). In addition to the county protections, Gunnison County has hired a Gunnison Sage-grouse Coordinator and organized a Strategic Committee to facilitate implementation of conservation measures in the Gunnison Basin under both the local Conservation Plan and RCP. San Miguel County has recently hired a Gunnison Sage-grouse Coordinator for the San Miguel Basin population. The efforts of these two counties reflect positively on their willingness to conserve Gunnison sage-grouse.

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 can only restrict developments with housing densities greater than one house per 14 ha (35 ac). This situation allows some parcels to be exempt from county regulation and may negatively affect some sage-grouse. However, we have no data to indicate that this is threatening individual populations or individuals. We could find no data on the precise threshold of the number of acres per house that will affect Gunnison sage-grouse.

Habitat loss is not regulated or monitored in Colorado counties where Gunnison sage-grouse occurs. 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.

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 were unable to obtain information regarding the nature or extent of zoning

efforts and their direct or indirect effects on populations and habitats.

State Laws and Regulations

Colorado Revised Statutes, Title 33 Article 1 give 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. 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.

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. However, 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 and a sensitive species in Utah providing heightened priority for management (Gary Skiba, CDOW, pers. comm. 2006; Guy Wallace, UDWR pers. comm. 2006).

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 3). Some of the easements include conservation measures that are specific for Gunnison sage-grouse, while most are directed at other species, such as big game (GSRSC 2005). We are aware that some of these easements do protect existing sage-grouse habitat. However, we do not have information on the location or size of the easements with sage-grouse specific conservation measures and, therefore, cannot assess their overall value to Gunnison sage-grouse.

TABLE 3.—ACRES OF CONSERVATION EASEMENTS BY POPULATION AND PERCENTAGES OF OCCUPIED HABITAT PROTECTED BY EASEMENTS (GSRSC 2005)

Population	Number of acres	Occupied habitat (percent)
Gunnison Basin	26,145	4
San Miguel Basin	844	1
Monticello	2,560	1
Piñon Mesa	7,314	19
Crawford	523	2

The CDOW has been gathering information from landowners who may be interested in signing up under the CCAA referenced earlier in this document. As of January 2006, 72 landowners owning 41,278 ha (102,000 ac) have expressed an interest in enrolling their lands under the CCAA.

States regulate non-coal mining in the United States. Colorado law (State Statute Title 34, Article 32) contains language intended to protect wildlife resources through appropriate reclamation and encourages revegetation using native species. Utah mining regulations (R647–4–110) allow reclamation to wildlife resource use.

We are not aware of any conservation measures 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 Colorado Oil and Gas Conservation Commission or the Utah Division of Oil, Gas, and Mining. 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. We are not aware of any conservation measures established 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 to four sections available for oil and gas leasing in the San Miguel Basin population (see Factor A for further discussion). State school section lands account for only 1 percent of occupied habitat in Colorado and 1 percent in Utah so impacts may be considered negligible. The UDWR does not own any land within occupied habitat in Utah. The CDOW owns 2 percent of the occupied habitat in Colorado, with some management for Gunnison sage-grouse on those lands.

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). Federal agencies are responsible for managing 55 percent of the total Gunnison sage-grouse habitat (GSRSC 2005). The Federal agencies with the most sagebrush habitat are BLM, an agency of the Department of the Interior, and USFS, an agency of the U.S. Department of Agriculture. The NPS in the Department of the Interior also has responsibility for lands that contain sage-grouse habitat.

About 42 percent of occupied habitat is on BLM-administered land (GSRSC 2005). 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.*; 43 CFR 4180 *et seq.*

Resource Management Plans (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, and wildlife habitat management. Activity plan decisions normally require additional planning and National Environmental Policy Act (NEPA) analysis. Within the Gunnison Basin population 56 percent of the BLM allotment acreage in occupied habitat

currently has Gunnison sage-grouse habitat objectives incorporated into the allotment management plans (BLM, unpubl. lit. 2005h). Rangewide, only 20 percent of BLM grazing allotments have thus far incorporated Gunnison sage-grouse conservation measures and/or habitat objectives into the allotment management plans or in permit renewals.

On November 16, 2004, BLM Instruction Memorandum (IM) 2005–024 transmitted information to all BLM field and Washington Office officials regarding the development of a National BLM Sage-grouse Habitat Conservation Strategy for BLM-administered lands. This strategy is described as the framework to address the conservation of sage-grouse and risk to sagebrush habitats on lands and activities administered by BLM. It commits BLM to work with States and local interests on this issue. The IM instructed BLM State Directors to develop a process and schedule to update deficient RMPs to adequately address sage-grouse and sagebrush conservation needs. The BLM has developed a process to update RMPs in Colorado, and has notified the Service of general timeframes for RMP updates but specific deadlines have not been provided. The BLM continues to update applicable RMPs and activity plans.

The BLM has regulatory authority for oil and gas leasing, 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). 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). The BLM has regulatory authority to condition ''Application for Permit to Drill'' authorizations, conducted under a lease that does not contain sage-grouse conservation stipulations (BLM 2004). Also, oil and gas leases have a 200 m (650 ft) stipulation, which allows movement of the drilling area by that distance (BLM 2004). The BLM states that many of their field offices work with the operators to move a proposed drilling site farther or justify such a move through the site-specific NEPA process (BLM 2004).

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 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 acreages in the Crawford Area and Gunnison Basin populations are covered by this policy. However, leases already exist in 17 percent in the Piñon Mesa population, and 49 percent in the San Miguel Basin population.

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 a significant number of waivers of stipulations pertaining to the Gunnison sage-grouse and/or 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, section 6217(a)). On May 18, 2001, the President signed Executive Order 13212—Actions to Expedite Energy-Related Projects (66 FR 28357, May 22, 2001), which states that it is the Administration's policy 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. The BLM has responded to these declarations with the issuance of several IMs to their staff that may influence sage-grouse conservation during these actions, including providing guidance for planning relative to oil and gas operations and focusing efforts for resource recovery in seven areas, two of which are within Gunnison sage-grouse habitats (IM 2003–137, April 3, 2003; IM 2003–233, July 28, 2003; IM CO–2005–038, July 12, 2005).

The BLM regulatory authority for grazing management is provided at 43 CFR part 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 part 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. Since Gunnison sage-grouse habitats are a special status species, these standards will specifically address the habitat requirements of the Gunnison Sage Grouse and help to minimize any threats and improve existing habitats.

On December 8, 2003, BLM issued a proposed rule (68 FR 68452) to modify the current grazing management regulation in two ways: (1) It provides that assessment and monitoring standards are needed to support a determination that livestock grazing significantly contributes to not meeting a standard or conforming with a guideline; and (2) it requires BLM to analyze, formulate and propose appropriate action within 24 months of the determination rather than before the start of the next grazing year.

In signing the RCP (GSRSC 2005), BLM has agreed to follow

recommendations for conservation efforts addressing the effects of grazing, oil and gas development and other threats, within the constraints of existing laws, policies, regulations, and management plans, and while considering the needs or implications to other species and multiple uses. It will take time for BLM to address the time requirement necessary to revise and formally incorporate Gunnison sage-grouse conservation measures and habitat objectives in all of their RMPs through a rulemaking. In the meantime, the Colorado Office of the BLM issued IM CO–2005–038, which provides an interim policy to implement the RCP. The IM directs that the RCP guidance and strategies be applied through site-specific analysis consistent with NEPA for all projects or actions in Gunnison sage-grouse habitat. For surface disturbing activities such as oil and gas development the IM directs BLM staff to work with the operator to minimize habitat loss and fragmentation. Moreover, if the local conservation plans for each population have additional measures that address local conditions the IM directs BLM staff to consider if they are more effective than guidance in the RCP and, if so, to implement them. Full implementation of the RCP, according to the IM, will occur as guidance and strategies are considered and analyzed during RMP revisions and/or amendments. These actions will contribute to the conservation of the Gunnison Sage Grouse and help to minimize any potential threat from activities on Federal lands in the Gunnison's range.

The USFS has management authority for 10 percent of the occupied Gunnison sage-grouse habitat (GSRSC 2005). Management of Federal activities on 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). This has historically been done through a NEPA process, including 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 1982 NFMA implementing regulation for land and resource management planning (1982 rule, 36 CFR part 219), under which all existing forest plans were prepared, requires USFS to manage habitat to maintain viable populations of existing native vertebrate species on National Forest System lands (1982 rule, 36 CFR 219.19). A new USFS planning regulation was promulgated on January 5, 2005 (70 FR 1023). Under the new regulation a desired condition description and guidelines will be provided, rather than a set of prescriptive standards that apply to projects. Planning, and decisions for projects and activities, will address site-specific conditions and identify appropriate conservation measures to take for each project or activity.

Under the new regulation, the purpose of forest plans is to establish goals and to set forth guidance to follow in pursuit of those goals. The rule calls for five components of plans: Desired conditions; objectives; guidelines; suitability of areas; and special areas (36 CFR 219.7(a)(2)). The rule states that these components are intended to provide general guidance and goals or other information to be considered in subsequent project and activity decisions, and that none of these components are commitments or final decisions approving projects and activities (36 CFR 219.7(a)(2)). Approval of a plan, plan amendment, or plan revision comprised of these five components may be categorically excluded from NEPA documentation (36 CFR 219.4(b)).

The new regulation requires plans to provide a framework to contribute to sustaining native ecological systems by providing ecological conditions to support diversity of native plants and animal species in the plan area (36 CFR 219.10 (b)). Ecosystem diversity is described as being the primary means by which a plan contributes to sustaining ecological systems (36 CFR 219.10 (b)), and USFS states that this focus is expected to conserve most species. The regulation defines species-of-concern as ''Species for which the Responsible Official determines that management actions may be necessary to prevent listing under the Endangered Species Act'' (36 CFR 219.16).

For each unit of the National Forest System, the transition period for the new regulation is 3 years (36 CFR 219.14). A document approving a plan developed, revised, or amended using the new regulation must include a description of the effects of the plan on existing permits, contracts, or other instruments implementing approved projects and activities (36 CFR 219.8(a)).

The Gunnison sage-grouse is designated as a USFS sensitive species in Region 2 (Colorado) and Region 4 (Utah), thereby ensuring and enhancing the management awareness of the species under the new planning rule. The forests within the range of sage-grouse provide important seasonal habitats for the species, particularly the Grand Mesa, Uncompahgre, and Gunnison National Forests. While the 1982 planning regulation, including its provision for population viability, was used in the development of the existing Forest Plans, no information has been provided regarding specific implementation of the above new regulations and policies for the Gunnison sage-grouse. However, any agency action taken under the new planning rule will require consideration of Gunnison Sage Grouse habitat.

We did not receive information from the USFS on whether habitat objectives and conservation measures have yet been incorporated into grazing allotments and whether local conservation plan sage-grouse habitat objectives and conservation measures have been incorporated into Forest Plans or LRMPs.

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 with USFS lands that are 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).

The NPS is responsible for managing 2 percent of occupied Gunnison sage-grouse habitat (GSRSC 2005). 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 wildlife 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 Recreation Area include portions of occupied habitat of the Crawford and Gunnison Basin populations. Gunnison sage-grouse conservation measures are not included in the General Management Plan, but

are included in current RMPs. They also will be incorporated when the RMPs are revised or amended. The NPS is currently following conservation measures in the local conservation plans and the RCP (Myron Chase, NPS, pers. comm. 2005).

The NRCS of the U.S. Department of Agriculture assists farmers, ranchers, and other private landowners in reducing threats to sage-grouse habitat by providing technical assistance and financial resources to support management and habitat restoration efforts, helping farmers and ranchers maintain and improve habitat as part of larger management efforts, and developing technical information to assist NRCS field staff with sage-grouse considerations when working with private landowners. The NRCS has the Wildlife Habitat Incentive Program and Environmental Quality Incentive Program that can be used to fund projects implementing conservation measures in Gunnison sage-grouse habitat. The Service's Partners for Fish and Wildlife Program also can fund conservation measures for Gunnison sage-grouse. All of these programs have contributed to Gunnison Sage Grouse conservation within its range by converting croplands to habitat improving habitat or restoring habitat.

Conclusion for Factor D

Gunnison sage-grouse conservation has been addressed through numerous local, State, and Federal plans, laws, regulations, and policies. Current county regulations provide some ability to limit impacts to sage-grouse habitat from housing developments where the area is zoned for under 14 ha (35 ac) per house. Both counties where the largest populations of Gunnison sage-grouse occur have Land Use Resolutions or Codes to promote Gunnison sage-grouse conservation. The CDOW and UDWR have implemented and continue to pursue conservation easements in Colorado and Utah, respectively, to conserve Gunnison sage-grouse habitat and the species' needs. State wildlife regulations provide opportunities to address other conservation needs of the species.

Impacts resulting from current leases for oil and gas development on Federal lands are regulated at the ''Application for Permit to Drill'' stage as protective stipulations are applied through guidance in IM CO–2005–038. Grazing impacts are regulated with existing laws, regulations, and policies. Laws, regulations, and policies guiding development and implementation of land management plans for all the Federal agencies, address conservation of Gunnison sage-grouse habitat. In light of the fact that implementation of the aforementioned laws, regulations, and policies has not resulted in a decline within recent timeframes, as analyzed by Garton (2005) and, based on the best scientific and commercial data available we have concluded that inadequacy of existing regulatory mechanisms does not threaten or endanger the sage-grouse throughout all or a significant portion of its range in the foreseeable 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, and pesticides.

Genetics

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 (Charlesworth and Charlesworth 1987) or by reducing the overall fitness of individuals in the population. Estimates for how large populations must be to prevent inbreeding depression vary dramatically. For example, Lande (1995b), Lynch *et al.* (1995), and Charlesworth *et al.* (1993) suggested that populations will need to have a genetic effective population size of 1,000, 100, and 12 individuals, respectively, to avoid accumulating deleterious mutations. However, if mutation accumulation is a threat to small populations, it is expected to take hundreds to thousands of generations to occur (GSRSC 2005).

Oyler-McCance *et al.* (2005) investigated population structure of Gunnison sage-grouse using mitochondrial DNA sequence data from seven geographic areas (Cerro Summit-Cimarron-Sims Mesa, Crawford, Gunnison Basin, Curecanti area of the Gunnison Basin, Monticello-Dove Creek, Piñon Mesa, and San Miguel Basin). They found that levels of genetic diversity were highest in the Gunnison Basin, which consistently had more alleles and contained most of the alleles present in other populations. All other populations had much lower levels of diversity. These 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 possible that 24 percent of the genetic diversity is important to future rangewide survival of the species. All populations sampled were found to be genetically discrete units (Oyler-McCance *et al.* 2005), 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 drought), 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).

Historically, the Monticello-Dove Creek, San Miguel, Crawford, and Piñon Mesa populations were larger and were connected through more contiguous areas of sagebrush habitat. Oyler-McCance *et al.* (2001) documented a 20 percent loss and 37 percent fragmentation of sagebrush habitat in southwestern Colorado between the late 1950s and the early 1990s, 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). However, Oyler-McCance *et al.* (2005) 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 suggests that the San Miguel population may act as a conduit of gene flow among the satellite populations surrounding the larger population in Gunnison. Additionally, Oyler-McCance *et al.* (2005) found that another potential disperser into Crawford was from the Gunnison Basin. This is not surprising given their close geographic proximity.

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), suggestions range from 500–5,000 individuals (Franklin 1980; Lande and Barrowclough 1987; Lande 1995a). Similarly, population sizes in the upper 100s–1,000s are reported to be required for a higher probability of persistence over 100 years (Shaffer 1987). 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 1995a).

Population Viability Analysis

The CDOW contracted for a population viability analysis (PVA) for the Gunnison sage-grouse (Miller 2004). The PVA is a tool used to predict the probability of extinction for a wildlife population under various management scenarios. They are typically based on available population data which are often inadequate for a complete understanding of complex systems. Therefore, PVAs only provide an approximation of how a species may respond to various management alternatives without consideration of threats, since data are not available to determine how demographic rates will be affected by factors such as habitat loss or fragmentation. Also, since a PVA is a model, it does not present a complete picture of the system (GSRSC 2005 and references therein).

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 current conditions (i.e. the risk of extinction if nothing changes) and 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). The results of this 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 suggest that the Gunnison Basin population is likely to persist long term and, 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 may be extirpated (GSRSC 2005). Loss of genetic diversity from the extirpation of the two populations and the group would not result in a substantial effect to the species as a whole, because their genetic composition is largely represented in the other populations. The remaining populations currently have estimated numbers between 150 and 350 birds, up from 125–250 in 2004, and their relative extinction risk as determined by the PVA is between those extremes.

Garton's (2005) analysis of population trends also supports a relatively stable rangewide population, as well as a stable Gunnison Basin population for the last 10 years and longer. The RCP (GSRSC 2005) identified the need to increase gene flow among populations by improving corridors for between-population movement or translocation of selected genotypes from the Gunnison Basin to smaller populations, and vice-versa for population augmentation and maintenance of genetic diversity.

Oyler-McCance *et al.* (2005) conducted a genetic analysis of Gunnison sage-grouse populations using mitochondrial DNA sequence and nuclear microsatellite data. The Cerro Summit-Cimarron-Sims Mesa population was not included in this analysis due to inadequate sample sizes. The Poncha Pass population also was not included as it is composed of individuals transplanted from Gunnison Basin. In general, Gunnison sage-grouse have low levels of genetic diversity when compared to the greater sage-grouse (Oyler-McCance *et al.* 2005). Within the species, the Gunnison Basin birds had higher levels of genetic diversity than the other populations. Lower genetic diversity is consistent with small population size and geographical isolation (Oyler-McCance *et al.* 2005).

In summary, although the Cerro Summit-Cimarron-Sims Mesa and Poncha Pass populations and the Dove Creek group of the Monticello-Dove Creek population may become extirpated in the near future, their genetic characteristics are largely represented in the remaining populations.

Drought/Weather

Drought is a common occurrence throughout the range of the Gunnison sage-grouse (Braun 1998). Drought reduces vegetation cover (Milton *et al.* 1994; Connelly *et al.* 2004), 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. Approximately 2,544 sq km (982 sq mi) of sagebrush shrublands died in Utah in 2003 as a result of drought and infestations with the *Aroga* (webworm) moth (Connelly *et al.* 2004). Sage-grouse are affected by drought through the potential loss of vegetative habitat components and reduced insect production (Connelly and Braun 1997). 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; Schroeder *et al.* 1999).

Greater sage-grouse populations declined during the 1930s period of drought (Patterson 1952; Willis *et al.* 1993; Braun 1998). 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). 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 that reduce cover and food (Braun 1998).

Drought began in the Gunnison Basin at least by 2001 and was most severe in 2002 (BLM, unpubl. lit. 2005i). The drought fully or partially killed approximately 40,470 ha (100,000 ac) (17 percent) of sagebrush in occupied range of the sage-grouse in the Gunnison Basin in 2002 (BLM, unpubl. lit. 2005i). About 35,000 ha (86,000 ac) had significant dieback and 5,700 ha (14,000 ac) had moderate to light dieback of sagebrush and other shrubs. An estimated 4,000 ha (10,000 ac) (2 percent) had substantial mortality of grasses and forbs. *Phlox* spp., a forb that is important sage-grouse forage in the spring and summer, had 50- to 80-percent mortality in areas where sagebrush dieback was over 50 percent (BLM, unpubl. lit. 2005i). In 2003, 48 percent of all sagebrush plants were defoliated and 17 percent were dead (Wenger *et al.* 2003). By 2004, there was only modest recovery with increased moisture (BLM, unpubl. lit. 2005i). By 2005, sagebrush plants that were partially killed were recuperating (Sandy Borthwick, BLM, pers. comm. 2005).

The drought also affected sagebrush communities in the San Miguel Basin population, particularly in the Dry Creek Basin area. During the late fall and winter of 2003–2004, CDOW conducted sagebrush transects in Dry Creek Basin to monitor drought-related impacts. Approximately 75 percent of the sagebrush canopy in Dry Creek Basin was lost to sagebrush defoliation due to drought (Wenger *et al.* 2003). Although most plants survived and exhibited signs of recovery in 2003, large areas, particularly at low elevation, lost over 90 percent of the plants (Wenger *et al.* 2003). These communities started to recover in the spring of 2004, and plants that survived had heavy seed crops in the fall of 2004. Recuperation of these communities

continued in 2005 (Kathy Nickell, BLM, pers. comm. 2005). Detrimental effects on Gunnison sage-grouse, particularly on the birds attending the Desert Lek in Dry Creek Basin were observed after the drought. This lek had the greatest number of males counted (12–18) of the 3 leks in the population from 1996 through 2002, but was reduced to 0 in 2004 and 2005 (CDOW, unpubl. lit. 2005b).

In the Monticello group, most nesting areas are in poor condition due to lack of herbaceous cover as a result of drought and grazing (GSRSC 2005). Long-term drought also has reduced the availability of wet meadow habitat for brood-rearing (GSRSC 2005). Rains in 2005 have replenished some wet meadow habitats or riparian areas (Tammy Wallace, BLM, pers. comm. 2005). In the Piñon Mesa population the recent drought may have caused some limited, but unquantified, sagebrush and herbaceous understory die-back at lower elevations. Most plants affected do not appear to have died completely and sagebrush conditions have improved in 2004 and 2005 (CDOW, unpubl. lit. 2005g). Drought has been identified as a primary threat to the Crawford population (Crawford Area Conservation Plan 1998, GSRSC 2005). Drought conditions occurred there between 1999 and 2003 (Jim Ferguson, BLM, pers. comm. 2005). No quantitative habitat data are available, but little grass, forb or sagebrush growth occurred during this period (Jim Ferguson, BLM, pers. comm. 2005). Since 1999, lek counts have declined. The BLM cut back on grazing animal unit months and there were no other identifiable negative impacts to BLM lands in the area during this timeframe, suggesting drought as the primary cause of decline (Jim Ferguson, BLM, pers. comm. 2005).

The Gunnison sage-grouse is 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. 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 (Wenger *et al.* 2003) may actually be beneficial to sagebrush habitats over the long term. As a result, we find that Gunnison Sage Grouse is not sufficiently threatened by drought.

Recreation

Studies have determined that non-consumptive 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). 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).

Recreation from off-highway vehicles, hikers, mountain bikes, campers, snowmobiles, bird watching, and other sources has affected many parts of the range, especially portions of the Gunnison Basin and Piñon Mesa population (BLM, unpubl. lit. 2005i; CDOW, unpubl. lit. 2005g). 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 land use on lands managed by BLM (Connelly *et al.* 2004) and recreational use of national forests has increased 76 percent since 1977 (Rosenberg *et al.* 2004).

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, unpubl. lit. 2005i). A comprehensive plan to manage motorized and non-motorized recreation is not available for BLM land in the Gunnison Basin, nor has there been monitoring or research on the extent of impacts (BLM, unpubl. lit. 2005i). The BLM has seasonal closures on 17 roads with 6 of these closures protecting leks, but many more roads provide access to leks (BLM, unpubl. lit. 2005i). In addition, the Gunnison Field Office of BLM and Gunnison County collectively closed numerous roads to protect leks and nesting habitat within the Gunnison Basin for April and part of May 2006. While road closures may be violated, we have no data indicating that these violations are affecting the Gunnison Sage Grouse.

Dispersed camping occurs at a low level on public lands in all of the populations, particularly during the hunting seasons for other species. A designated campground is located on BLM land near occupied habitat on Piñon Mesa (BLM, unpubl. lit. 2005a). No studies on recreational effects in the Piñon Mesa population have occurred. With its proximity to Grand Junction and expected growth in Mesa County and the Glade Park area, recreational impacts are expected to increase in the Piñon Mesa population area. However, we have no data indicating that these camping activities are adversely affecting Gunnison Sage Grouse.

Domestic dogs accompanying recreationists 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 behavior is affecting Gunnison Sage Grouse.

Pesticides

Insects are an important component of sage-grouse chick and juvenile diets (Patterson 1952, Klebenow and Gray 1968, Johnson and Boyce 1990, Fischer *et al.* 1996a). Insects, especially ants (Hymenoptera) and beetles (Coleoptera), can comprise a major proportion of the diet of juvenile sage-grouse (Patterson 1952) and are important components of early brood-rearing habitats (Drut *et al.* 1994a). 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. Infestations of Russian wheat aphids (*Diuraphis noxia*) have occurred in Gunnison sage-grouse occupied range in Colorado and Utah (GSRSC 2005). Disulfoton, a systemic organophosphate extremely toxic to wildlife, was routinely applied to over a million acres 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). One instance of greater sage-grouse mortality was reported following application of organophosphate and carbamate pesticides to cultivated crops in Idaho (Blus *et al.* 1989). More recently, an infestation of army cutworms (Euxoa auxiliaries) occurred in sage-grouse habitat along the Utah-Colorado State line. Thousands of acres of winter wheat and alfalfa fields were sprayed with insecticides such as permethrin by private landowners to control them (GSRSC 2005) but again, we have no data indicating any, adverse effects to Gunnison sage grouse.

Use of insecticides to control mosquitoes is infrequent and probably do 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).

Conclusion for Factor E

Although genetic consequences of low Gunnison sage-grouse population numbers could express themselves, there is no evidence that genetic factors have thus far caused a threat to the Gunnison sage-grouse and it is unlikely that genetic factors (even without connectivity corridors or population augmentation) will be a threat for the foreseeable future. Effects of the severe drought centered on the year 2002 appear to have been ameliorated starting in 2004, and the sage-grouse survived the drought as they have survived other droughts in the past. Despite potentially greater effects to the smaller populations we have no evidence that drought is a threat to the survival of the Gunnison sage-grouse. Although disturbance and habitat destruction, fragmentation, or degradation may result from recreational activities, we have no data indicating that recreational impacts to Gunnison sage-grouse to demonstrate that recreation is or may become a threat to the species. Based on the available information, there appears to be infrequent use of insecticides in populations of the Gunnison sage-grouse and no data indicating there are direct adverse effects. 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 do not threaten or endanger the sage-grouse throughout all or a significant portion of its range in the foreseeable future.

Listing Determination

We have assessed the best scientific and commercial information available and have determined that the Gunnison sage-grouse is not warranted for listing under the Endangered Species Act, as amended. We also no longer consider the species to be a candidate for listing. The 2004 Candidate Notice of Review retained the listing priority number at a 2 based on perceived imminent threats of high magnitude. However, based on information obtained since our 2004 review (e.g., Garton 2005), we have determined that threats to the Gunnison sage-grouse are neither imminent or of such magnitude that they threaten or endanger the existence of the species.

The PVA (GSRSC 2005) concluded that the Cerro Summit-Cimarron-Sims Mesa and Poncha Pass populations and the Dove Creek group of the Monticello-Dove Creek population have a high probability of extirpation in the foreseeable future. However, these populations do not comprise a significant portion of the Gunnison sage-grouse range, as they are small and isolated. Even though these populations have higher probabilities of extirpation, we continue to strongly encourage CDOW and other interested parties to take necessary management actions to prevent their extirpation. For the remaining populations, numerous impacts pose potential threats to the Gunnison sage-grouse when considered under the listing factors. However, there is no evidence that the impacts are causing rangewide threats such that they are likely to cause the Gunnison sage-grouse to be in danger of extinction throughout all or a significant portion of its range in the foreseeable future.

If impacts to the species rise to the level of being a threat in the future or if the Service finds that the populations are declining significantly faster than they were found to have done in the past (Garton 2005), the Service will reexamine the listing status of the Gunnison sage-grouse. We will continue to monitor the status of the Gunnison sage-grouse and its habitat and will continue to accept additional information and comments from all governmental agencies, the scientific community, industry, or any other interested party concerning this finding.

References

A complete list of references used in the preparation of this finding is available upon request from the Western Colorado Field Office (see **ADDRESSES** section).

Authority

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

Dated: April 11, 2006.

H. Dale Hall,

Director, U.S. Fish and Wildlife Service.

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