UPPER SNAKE RIVER BASIN SAGE-GROUSE CONSERVATION PLAN January 2014

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UPPER SNAKE RIVER BASIN SAGE-GROUSE CONSERVATION PLAN

January 2014

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UPPER SNAKE RIVER BASIN SAGE-GROUSE LOCAL WORKING GROUP MEMBERS

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EXECUTIVE SUMMARY

The Upper Snake River Basin Sage-grouse Local Working Group (USRBWG) was established in September 2004 to develop a local conservation plan and support the implementation of projects that benefit sage-grouse and other sagebrush obligate species in the Upper Snake River Basin Conservation Area (USRBCA). The working group's initial task was the completion of the original (2008) Conservation Plan. Because the Conservation Plan is a living document it is envisioned to be updated regularly, and this is the first full revision. The purpose of this plan is to promote management that results in functional sagebrush plant communities for sage-grouse and other species that use sagebrush environments.

This conservation plan identifies strategies and commitments to support the maintenance of sage-grouse in the USRBCA, which generally includes the entire Snake River Basin in Teton, Lincoln, and Sublette counties in Wyoming and addresses management of four small, isolated populations in Jackson Hole, the Gros Ventre Valley, Hoback Basin and an interstate population shared by Wyoming and Idaho in the Salt River drainage. According to the Conservation Assessment of Greater Sage-Grouse and Sagebrush Habitats (Connelly et al. 2004), sage-grouse have declined across their range during the past 50 years, as has the quality and distribution of the bird's requisite sagebrush-steppe habitat. Therefore, this local conservation effort is part of a larger effort in Wyoming and over the range of sage-grouse in the West. The intent of this range-wide effort is to provide local support and actions to address sage-grouse conservation issues which, when considered in the context of a larger state and regional effort, will preclude the need for listing the species under the Endangered Species Act (ESA).

Goals of the USRBWG are to: (1) Maintain, enhance, or restore sage grouse habitat to maintain or increase the abundance and distribution of sage-grouse, and improve population and habitat monitoring within the USRBCA; (2) Manage factors contributing to direct mortality of sage-grouse; (3) Identify private and state owned lands with existing or potential sage-grouse habitat value and minimize future impacts to sage grouse resulting from either transfer of ownership and/or changes in land use practices; (4) Contribute to sage-grouse research, and (5) Inform and educate the public, landowners, government agencies and others within the USRBCA about issues related to sage-grouse conservation. Objectives and action items are included in this plan to implement these goals and are categorized as commitments already made by organizations or agencies or recommendations for further actions (Table 8). It is important to understand the working group can only make recommendations to agencies, organizations, and landowners and must rely on these entities to carry out the plan.

This revision includes a ranking of risks in the USRBCA into high (habitat, fire management, infrastructure development, weather), medium (predation, invasive plants, conflicting wildlife management, recreation, livestock grazing, energy and mineral development), low (residential development, management of state lands, farming and pesticides, parasites and disease), and not applicable (hunting) categories with an explicit statement that the ranking may change with changes in circumstances - energy and mineral development activity, for example.

Significant activities of the USRBWG during 2008-2013 included the support of research to better understand seasonal sage-grouse distribution related to vegetation and other factors; a study in Jackson Hole to examine sage-grouse population parameters, habitat selection, seasonal movements, and interactions with raven populations; contributing to the Grand Teton National Park Kelly Hayfields Restoration Project; interacting with the Jackson Hole Airport regarding management conflicts with sage-grouse; and supporting genetics research at the local to range-wide level. Projects that have received at least partial funding from the group (State funds) are listed in Table 5.

Appendix 1 includes information on sagebrush management guidelines for sage-grouse habitat needs. Content in Appendix 2 is focused on grazing and is significant because of the on-going Bridger-Teton National Forest plan revision and US Fish and Wildlife Service review of the sage-grouse listing decision. Appendix 3 is a report on winter habitat availability that appeared in the original 2008 plan.

The group includes 14 members representing major interests and government agencies within the USRBCA. Working Group members represent their particular interests and provide liaison with the groups they represent. The local working group will continue to meet about 4 times annually to work on plan implementation. Working Group meetings are generally half day sessions and always include a public comment period.

INTRODUCTION

Background

The Greater Sage-Grouse *(Centrocercus urophasianus)* is a large, gallinaceous (chicken-like), upland game bird that is dependent on sagebrush habitats for much of its annual habitat requirements. Sage-grouse nest on the ground, primarily under sagebrush, and feed on sagebrush, broad-leafed flowering plants (forbs) and insects. During the winter their diet is composed almost entirely of sagebrush. Although still considered common in parts of Wyoming, available data and anecdotal accounts indicate Wyoming's populations have experienced declines over the last half century, as have populations around the western United States. The greater sage-grouse was petitioned for protection under the Endangered Species Act (ESA) multiple times in the early 2000s. In 2005, the U.S. Fish and Wildlife Service determined the Greater Sage-Grouse was not warranted for such protection but urged the recent emphasis on range wide conservation be continued. That decision was challenged in federal court. In a subsequent determination in 2010 the U.S. Fish and Wildlife Service determined Greater Sage-grouse to be warranted for listing under the ESA but precluded (U.S. Fish and Wildlife Service 2010/ Federal Register citation: 75(55)13910, 23 March 2010, 106pp.). A final listing decision is expected in 2015.

Since prehistoric time, sage-grouse have been part of Wyoming and the Wyoming way of life. Native American dances often mimicked grouse courtship displays, early travelers wrote about them in their journals and pioneers subsisted on them and other wild game. Modern residents and visitors to Wyoming view grouse courtship displays in the spring and hunt them in the fall for enjoyment and recreation.

The Upper Snake River Basin Sage-grouse Local Working Group (USRBWG) was established in September 2004 as a part of a statewide program initiated by the Wyoming Game and Fish Department to establish eight local working groups within the state (Figure 1). The purpose of local working groups is to develop local conservation plans to guide the design of projects that benefit sage-grouse and other sagebrush obligate species, and to support the implementation of on-the-ground habitat and population related projects for the species.

The group includes 14 members representing major interests within the Upper Snake River Basin Conservation Area (USRBCA). Working Group representation includes the Wyoming Game and Fish Department (WGFD); National Park Service (NPS), Grand Teton National Park; U.S. Fish and Wildlife Service (USFWS), National Elk Refuge; U.S. Department of Agriculture, Forest Service (USFS); U.S. Geological Survey (USGS); Teton Conservation District; Teton County Weed and Pest District; Teton County government; Jackson Hole Airport; conservation groups; and hunters.

Figure 1. Wyoming Local Sage-grouse Working Groups. This Plan was developed by the Upper Snake River Basin Local Working Group (USRBWG) for the Upper Snake River Basin Conservation Area (USRBCA).

The major task of the USRBWG is to develop and maintain, through updates and revisions, a local conservation management plan for sage-grouse within the USRBCA. This plan will provide recommendations and guidelines for cooperative management for all stakeholders in the area. The results of the conservation planning effort serve as the basis for this report. While this group does not have statutory management authority, the working group members represent their particular interests and liaison to the groups they represent to bring a cohesive, cooperative approach to sage-grouse management. The working group is committed to working with land management agencies, the Wyoming Game and Fish Department, local community organizations and individuals to implement the plan.

Purpose

The purpose of the USRBWG is to develop and facilitate implementation of a local working group plan for the benefit of sage-grouse and, whenever feasible, other species that use sagebrush habitats. This conservation plan identifies management practices and the financial and personnel resources to accomplish these practices, within an explicit time frame, for the purposes of

improving sage-grouse numbers and maintaining a viable population in the USRBCA, which includes Grand Teton National Park, the National Elk Refuge, and the Bridger-Teton National Forest. The plan also addresses the small interstate population associated with Star Valley and the migratory population that frequents the Hoback Basin during the late spring and summer for breeding and nesting and uses winter habitat in the Green River drainage in the Meadow Canyon area northwest of Big Piney (Upper Green River Local Working Group Area; Figures 1 and 2). The intent of the plan is to provide recommendations to land management agencies, landowners, and state and local government to protect and enhance sage-grouse populations and the habitat that supports those populations in the USRBCA.

The plan has been revised to reflect the Wyoming Game and Fish Department current policy for sage-grouse conservation under Wyoming Executive Order 2011-5. Executive Order 2011-5 identifies core areas for sage-grouse conservation associated with major lek complexes and seeks to protect habitat of about 80% of breeding males on 25% of the occupied habitat (Figures 2 and 3). Further, the order provides direction for management of core areas or priority habitat and non-core or general habitat areas in a working landscape. Criticism of the policy has centered on perceptions of: failure to protect small populations associated with general habitat; inconsistent approaches to protect migratory populations or to assure connectivity between populations or core areas; core area failure to include critical winter habitat of some populations; and weakness as it relates to managing livestock grazing in occupied sage-grouse habitat. In spite of those concerns, the U.S. Fish and Wildlife Service has indicated the executive order would adequately conserve sage-grouse populations in Wyoming and has urged other states to adopt similar policies (U.S. Fish and Wildlife Service, 2013).

Additionally, the Bridger-Teton National Forest is part of the Wyoming Nine Plan Amendment Process. The draft Wyoming Sage-Grouse Management Land Use Plan Amendment/Draft Environmental Impact Statement was released December 26, 2013, and public comment is open until March 24, 2014 (http://www.blm.gov/wy/st/en/info/news_room/2013/december/27sgrouse-9plan-deis.html). The Amendment includes an alternative that is largely consistent with the Executive Order. The Forest will select one or portions of several amendments to become the Sage-grouse Forest Plan Amendment. This plan will be updated as the process is finalized.

Future management challenges in the USRBCA will certainly involve maintaining the viability of this isolated population through habitat management, maintaining or increasing population numbers, and maintaining or improving connectivity to surrounding populations. A significant portion of the USRBCA is public land (Table 1), with the majority of the remaining sage-grouse habitat in Jackson Hole under the jurisdiction of Grand Teton National Park and the National Elk Refuge. The Bridger-Teton National Forest contains habitat and provides movement corridors, as do private lands. With cooperative management decisions, the communities and management agencies in the USRBCA are in position to insure that sage- grouse remain an integral component of the area's environment.

Figure 2. Occupied habitat in the Upper Snaker River Basin Conservation Area (USRBCA).

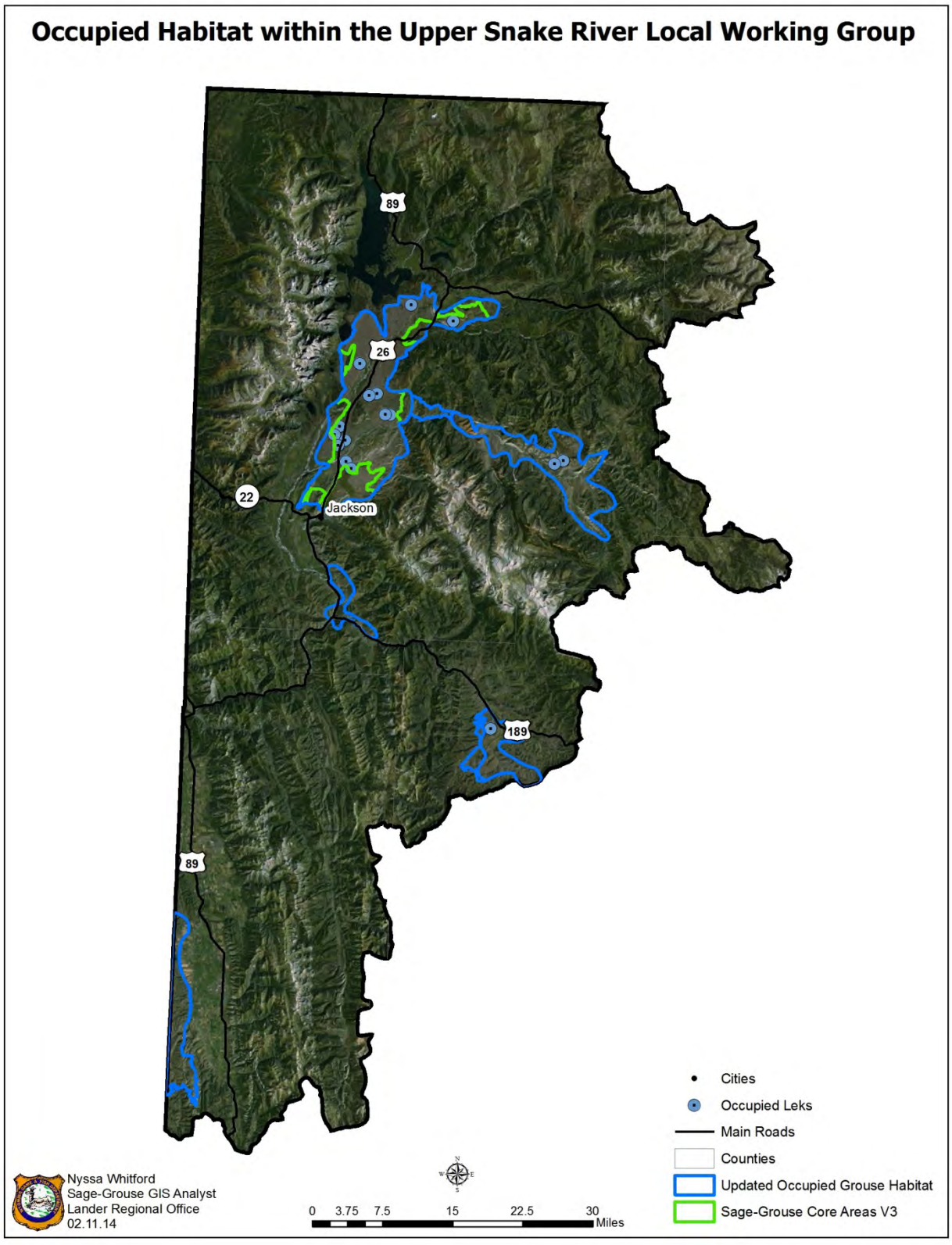
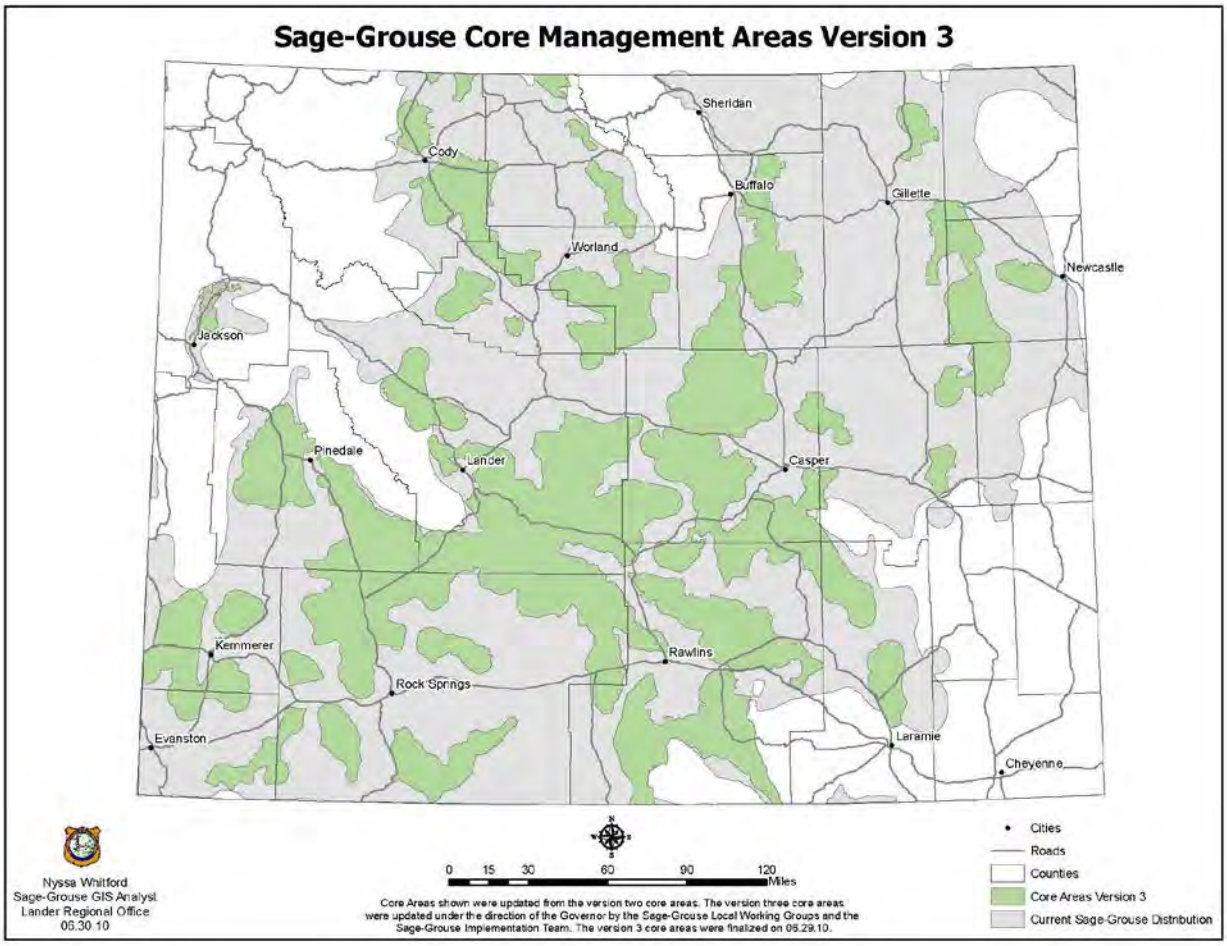


Table 1. Land ownership for the USRBCA

SURFACE OWNERSHIP	ACRES	MILES^2	HECTARES
National Park Service	263022.8	411	106441.5
Forest Service	2263478	3536.7	915997
WY Game and Fish	5556.2	8.7	2248.5
State	9241.4	14.4	3739.8
Bureau of Reclamation	610.7	1	247.1
Bureau of Land Management	7851.5	12.3	3177.4
National Elk Refuge	24950.8	39	10097.2
Private	277094	433	112135.9
Water	30305.2	47.4	12264.1
Total	2882110.6	4503.5	1166348.5

Figure 3. Wyoming Sage-grouse Core Areas.



Historical Account of Sage-grouse in Jackson Hole

The historic record of sage-grouse in Jackson Hole is relatively sparse. However, there should be little doubt that they are native to the valley given the amount of sagebrush habitat in the valley, the records of sage-grouse presence in suitable habitats in the Upper Green River Valley and Idaho, and their documented presence in the valley throughout the 20th century.

Patterson (1952: p. 38-40) provides a concise history of sage-grouse in the Upper Green River area of Sweetwater and Sublette counties and leaves little doubt that the area supported substantial populations of the species up through the publication date of his text. Patterson (1952, p.40) presents a provocative entry in the context of a larger Wyoming sage-grouse study: "[T]he primitive Jackson Hole district was utilized for experimental studies on dispersal and survival of sage-grouse following their removal to restoration areas, and also as a control area for determining population trends." This indicates that sage-grouse were present in Jackson Hole in the mid-1940s.

Regarding historical accounts, Russell's (1969, p. 18) diary entry for July 3, 1835, describes the northern portion of Jackson Hole as being "…wide smooth and comparatively even the whole being covered with wild sage and S[sic]urrounded by high and rugged mountains…" The 1872 Hayden expedition into the region (Hayden 1873, p. 265) describes Jackson Hole as such: "[T]his includes portions of the different terraces, all of which are more or less covered with sage-brush. Near the butte (Blacktail Butte), large areas of the sage had been burned off, and the grasses had grown up densely, forming fine pasturage and on these we again encountered antelope.…"

Although there is no specific mention made of sage-grouse in Jackson Hole by these or two other prominent journal keepers who visited the valley (Ferris 1983, and Reynolds 1868), this is probably more an omission common to diary entries where only unusual events or occurrences significant to survival are mentioned. Absence of mention of a less conspicuous species normally associated with a region or habitat should not be construed as absence of the species in the environment. Even today, a walk or horseback ride through areas known to be occupied, sage-grouse range in Jackson Hole seldom flushes birds.

The diaries of "Beaver" Dick Leigh (as referenced in: Whittlesey 1994, p. 37) make numerous reference to "prairie chickens," "sage chickens," and "grouse" in Pierre's Hole (Teton Valley immediately west of the Teton Range) in the mid-1870s. (It is generally assumed that the name "prairie chickens" referred to the somewhat similar sharp-tailed grouse that are still present in that valley.)

Patterson (1952, p. 165) states that the Jackson Hole sage-grouse population is isolated and "…has survived since primitive times on the sagebrush-covered outwash terraces bordering the Snake River in Jackson Hole, Wyoming."

Incidental observations of sage-grouse appear in the Jackson Hole Courier from the early to mid- 20th century. Two articles are referenced here: A July 28, 1932, article "Sage-grouse in Jackson's Hole Eat Web Worms" reports of a big, dead male apparently killed by traffic north of the Gros Ventre River. Examination of the crop and stomach revealed "…a quantity of sage and other vegetation, a number of ants and lesser number of other insects, and at least 522 web worms." It goes on to say that "…a number of farmers have mentioned seeing sage-grouse feeding on web worms." The article attributed this account to wildlife biologist, Olaus Murie.

An August 4, 1932, article headed "Chicken Season Open August 6, 7, and 8." It continues "…all of Teton County (are open) except for the lands south of the Gros Ventre River from its source to its confluence with the Snake River." In addition, it mentioned that the Teton State Game Preserve lands were also closed to hunting, and that "…chickens are quite abundant between the Ferry Bridge and Gros Ventre" (present day Moose and Mormon Row area, respectively).

Incidental to this is an August 11, 1932, account of four Jackson Hole hunters going to the Pinedale area, and on a farm somewhere within a 15-mile radius of the town, "…the hunters kicked up a flock of 5,000 chickens. The spring birds were so fat that they were mistaken for adults….and all viewing this rare spectacle were awe-struck…and their flight sounded like a storm." All hunters returned to Jackson Hole with their limit.

Patterson (1952, p. 184-85) reports observations made by Olaus Murie of sage-grouse migrating out of Jackson Hole into Idaho via the Snake River Canyon. Honess (1941), as cited in Patterson (1952, p. 184-85), reported seeing 43 sage-grouse "…in full flight down the Snake River, and when last observed, they were well into the canyon below the mouth of the Hoback River. More than two hundred additional birds were observed to be wintering on scattered areas of exposed sagebrush in Jackson Hole."

In an on-going effort to reduce sage-grouse damage to private alfalfa fields in the Eden Valley (Sweetwater County), 359 grouse were trapped and banded in 1948 and 1949 and released in the sage flats in Jackson Hole. Immediately prior to release, it was estimated that 500 grouse resided in Jackson Hole (Patterson 1952, p. 234). Numbers of males on the leks (indicated in parenthesis) appeared to change little for the years 1948 (205), 1949 (191), 1950 (223) and 1951 (214) (Patterson 1952, p.167).

A significant conclusion of the release was that "[O]n the basis of band recoveries in Eden Valley and sight records in Jackson Hole, there was considerable evidence that immature birds were more inclined to acclimate themselves to new habitat and to remain in the general vicinity of the transplant site than was the case with adult birds." (Patterson 1952, p. 237). And, "[E]xtensive releases of banded birds into Jackson Hole resulted in no marked increase in numbers of resident birds in succeeding years, although strutting ground observations revealed that from 10 to 20 percent of the transplanted birds actually remained in the vicinity of the release locality and established permanent residence" (Patterson 1952, p. 300).

Records of long-term population trends for Jackson Hole sage-grouse are sporadic at best with counts of males on leks providing the best relative measure of trends. Holloran and Anderson (2004, p. 1-2) provide a historical synopsis for sage-grouse in Wyoming and a table of lek counts (maximum number of males) for 21 of the years between 1948 and 2003 for the Jackson Hole population.

The Jackson Hole sage-grouse population probably experienced a population decline between the mid-1920s and 1940s similar to populations throughout the rest of their range in Wyoming. The Wyoming Game and Fish Commission closed all sage-grouse hunting from 1937 through 1948. A limited 10-day hunt was held in 1948 in Eden Valley. No hunting was allowed in Wyoming in 1949. The first major open season occurred in 1950 and 1951 in Wyoming's four southwestern counties (Patterson 1952, p. 16, 32-33).

With the 1950 expansion of Grand Teton National Park to include virtually all of the lands north of the Gros Ventre River, the legal harvesting of sage-grouse in Jackson Hole came to an end. Consequently, any population fluctuations of the Jackson Hole sage-grouse after the mid-1930s can eliminate hunting as a causative factor leaving environmental factors or indirect human impacts such as habitat destruction, alteration or disruptions as the likely influences.

By most accounts, including the recently completed range-wide Conservation Assessment of Greater Sage-Grouse and Sagebrush Habitats (Connelly et al. 2004), the numbers of sage-grouse have declined across their range during the past 50 years, as has the quality and distribution of the bird's requisite sagebrush-steppe habitat (see Knick and Connelly, eds. 2011b). Some increase has been documented during the last decade (1995-2005) in Wyoming and in the last several years in Jackson Hole (see Fedy and Aldridge 2011; Wyoming Game and Fish Department Annual Job Completion Reports).

Range-wide Conservation Efforts

In the mid-1950s, biologists in the western states again began to express concerns about populations of sage-grouse and sagebrush-steppe habitats, which led the Western Association of Fish and Wildlife Agencies (WAFWA) to establish the Western States Sage-grouse Technical Committee in 1956 to monitor distribution and abundance of sage-grouse. This science body provides technical support to WAFWA and has been instrumental in leading the conservation effort for sage-grouse over the last 50+ years.

Sage-grouse are currently found in California, Colorado, Idaho, Montana, Nevada, North Dakota, Oregon, South Dakota, Utah, Washington, and Wyoming in the United States and Alberta and Saskatchewan in Canada. The current range has been estimated to be a reduction of 44% from the historically occupied range. In addition, populations in most of the range declined between 1965 and 2003, the period when data were collected most intensively. Between May 1999 and December 2003, eight petitions were filed with the U.S. Fish and Wildlife Service (USFWS) to have sage-grouse protected under provisions of the Endangered Species Act (ESA). In 2001 the

USFWS determined that greater sage-grouse in the Columbia Basin of Washington state warranted protection under provisions of the ESA. In 2005 the USFWS determined that the greater sage-grouse did not warrant protection in the remainder of the range, but encouraged continued and enhanced conservation efforts. However, the Service was directed to review their 2005 finding in a court order. In March 2010, the USFWS published its petition decision for the Greater Sage-Grouse (hereafter sage-grouse) as "Warranted but Precluded" for listing under the Endangered Species Act (75 FR 13910 – 14014; 03/23/2010) as a threatened species (range-wide) but precluded by higher priority listing actions. The Service has committed to developing a proposed rule to list the greater sage-grouse by 2015.

The USFWS identified habitat loss and fragmentation from wildfire, invasive plants, energy and infrastructure development, urbanization, and agricultural conversion as the primary threats to the species throughout its range. Inadequacy of regulatory mechanisms and conservation measures in state and federal land management plans was also identified as one of the major factors in the USFWS's finding on sage-grouse.

Greater sage-grouse in Canada are listed as Endangered under provisions of the Species at Risk Act (SARA). WAFWA formalized a program of interstate coordination and cooperation in 1995 to address the issues of sage-grouse population losses and degradation of sagebrush ecosystems in order to: *maintain and increase where possible…present sage-grouse abundance…and present sage-grouse distribution*. The Bureau of Land Management (BLM), USFWS, and U.S. Forest Service (USFS) formally joined with WAFWA in range-wide conservation efforts in 2000. States began efforts to establish working groups to develop state and local plans to address sage-grouse conservation under the overall umbrella of the WAFWA conservation effort.

In 2000, the Gunnison sage-grouse (*Centrocercus minimus*) was officially recognized as a separate species, based on morphological, genetic, and behavioral differences from the greater sage-grouse. The strategy for Gunnison sage-grouse conservation is outlined in the Gunnison Sage-grouse Rangewide Conservation Plan which is available for download at the Colorado Division of Wildlife website (http://wildlife.state.co.us.). The USFWS proposed listing the Gunnison sage-grouse as endangered (78 FR 2486) on January 11, 2013, and a decision on the listing and designated critical habitat (78 FR 2540) is expected on or before March 31, 2014 (78 FR 65936).

WAFWA entered into a contract with the USFWS in 2002 to produce a complete range-wide conservation assessment and strategy for greater sage-grouse and its habitat. WAFWA chose to produce the document in two phases. Phase I (*Conservation Assessment of Greater Sage-grouse and Sagebrush Habitats*) was completed in 2004 and provides an assessment of greater sage-grouse populations and sagebrush habitats (Connelly et al. 2004) http://sagemap.wr.usgs.gov/conservation_assessment.htm).

The Assessment demonstrated that approximately 99% of the current population of greater sage-grouse is found in the United States, while the remaining 1% is located in Canada. Federal lands make up about 72% of the total range of the species making federal land management agencies

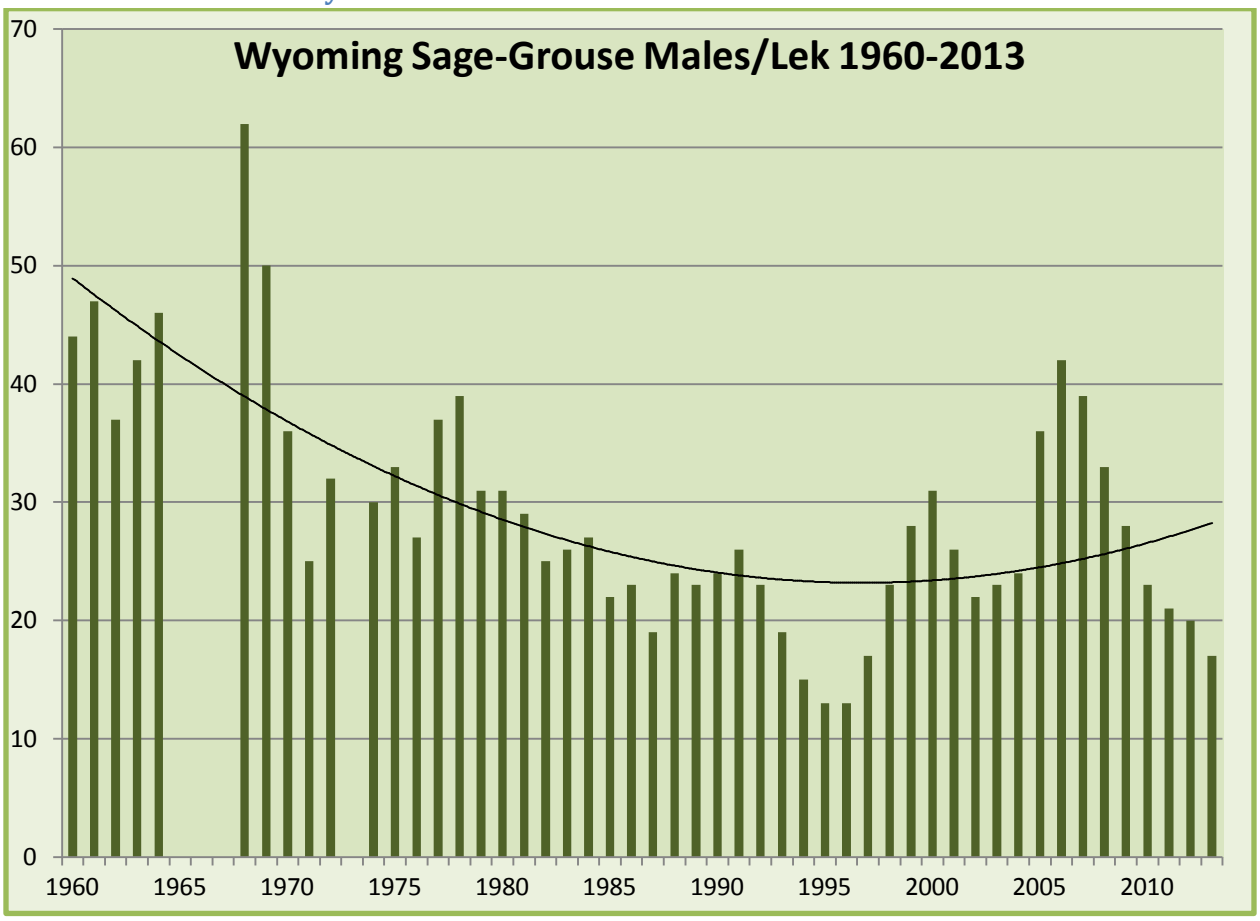
primarily responsible for habitat management. However, privately owned lands provide critical seasonal habitats for many populations and their importance to conservation may greatly exceed their ownership percentage. Throughout their range, sage-grouse populations are located on lands that overlap significant natural resources such as oil and gas resources, water resources, wind power sites, mineral deposits, as well as rangelands used for grazing, other agricultural uses and recreation. Sage-grouse are also found in habitats that are at significant risk of change due to exotic weeds, fire, and other climate-influenced changes.

Wyoming Population Status and Trends

Wyoming supports 35-40% of the range-wide population of sage-grouse. However, sage-grouse populations have declined in Wyoming and across the West over the last half-century. There has been a long-term decline, a mid-term increase and short-term decline in the statewide sage-grouse population based on average lek size. The mid- and short-term trends in statewide populations are believed to be largely weather related. In the late 1990s, and again in 2004-05, timely precipitation resulted in improved habitat conditions allowing greater numbers of sage-grouse to hatch and survive. Drought conditions from 2000-2003 and again later in that decade are believed to have caused lower grouse survival leading to population declines. These trends are valid at the statewide scale (Figure 4). Fedy and Doherty (2010) and Fedy and Aldridge (2011) provide analyses of cyclical trends in statewide population and implications for correlating management actions with population measurements at different scales. Trends are more varied at the local scale (Table 2, Figure 5). Sub-populations more heavily influenced by human impacts (sub-divisions, intensive energy development, large-scale conversion of habitat from sagebrush to grassland or row crop agriculture, Interstate highways, etc.) have experienced declining populations or extirpation.

The Assessment found that sage-grouse numbers had declined by an overall rate of 2.0% per year from 1965 to 2003 over the entire range of the species. In Wyoming the overall annual rate of decline was 5.2% for the time period from 1968-2003, but the average annual rate of decline from 1968-1986 was 9.66% compared to an average decline 0.33% per year from 1987-2003. The number of males per lek declined 49% from 1968-2003 in Wyoming (Connelly et al. 2004). From 1996 to 2005 the average size of leks increased reflecting a generally increasing population. However, the average size of leks declined from 2006-2010. Even so, the average lek size in 2010 remained higher than that recorded during the mid-1990s when sage-grouse populations were at their lowest level (Christiansen 2011).

Figure 4. Average number of Sage-grouse males/lek in Wyoming, 1960-2013. At least 100 leks were checked each year.



Greater Sage-grouse Comprehensive Strategy

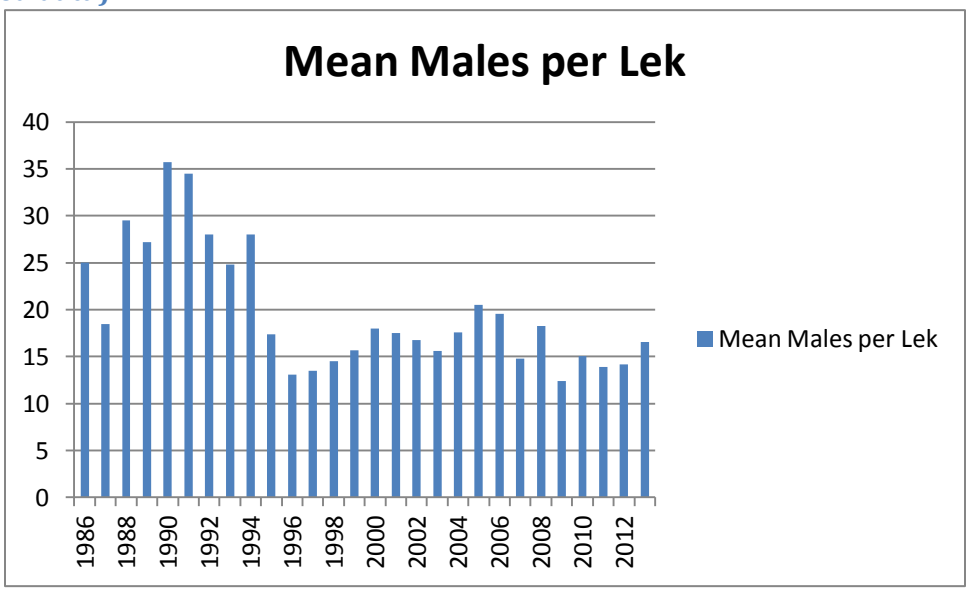
WAFWA's Phase II (*Greater Sage-grouse Comprehensive Conservation Strategy*) is a conservation strategy for greater sage-grouse and sagebrush habitats (Stiver et al. 2006). The Strategy was completed in 2006 and has been an important contribution to a number of state and federal planning efforts and status assessments leading up to the 2010 ESA finding, the 2011 National Technical Team (NTT) Report and the 2013 Conservation Team (COT) report discussed in subsequent sections of this plan. The overall goal of the Strategy is to maintain and enhance sage-grouse populations and distribution of sage-grouse by protecting and improving sagebrush habitats and ecosystems that sustain these populations. The Strategy outlines the critical need to develop the associations among local, state, provincial, tribal, and federal agencies, non-governmental organizations, and individual citizens to design and implement cooperative actions to support robust populations of sage-grouse and the landscapes and habitats upon which they depend. The driving force for this effort is the widespread concern for declining populations and reduced distribution of sage-grouse and the concurrent changes in the habitat that have occurred in the recent past (Stiver et al. 2006).

Table 2. Sage grouse lek counts (maximum males) by lek for the Jackson Hole and Gros Ventre, Wyoming population, 1985-2013 (Grand Teton National Park and Wyoming Game and Fish Dept. Unpublished data).
[1]

Year	Airport	Beacon	Airport Pit	CircleEW/ 3BarH	McBride	Antelope Flats	Moulton	Spread Creek	Bark Corral	Timbered Island	North Gap	Simpson	Breakneck Flats	Dry Cottonwood	RKO Road	Clark Draw	Total	Average # males/ active lek
1985				NC	27	NC	51*		NC		22						NA	NA
1986	25			NC	27	11	51		NC		14	22					150	25
1987	25			NC	18	1	30		NC		NC	NC					74	18.5
1988	26			NC	23	13	85		7		23	NC					177	29.5
1989	30			NC	21	7	91		6		8	NC					163	27.2
1990	52			NC	10	10	63		8		22	NC					214	35.7
1991	63			NC	15	10	48		16		29	NC					207	34.5
1992	51			NC	12	8	37		16		21	NC					168	28
1993	37	21		NC	16	5	24		8		9	54					198	24.8
1994	NC	NC		NC	27	NC	50		NC		7	NC					84	28
1995	18	15		NC	6	4	63		10		6	NC					122	17.4
1996	18	8		NC	4	2	33		8		19	NC					92	13.1
1997	15	1		NC	6	0	48		1		10	NC					81	13.5
1998	14	0		NC	4	0	33		0		7	NC					58	14.5
1999	17	0		NC	0	0	21		0		9	NC					47	15.7
2000	18	NC		NC	0	NC	28		NC		5	NC	21				72	18
2001	15	NC		NC	NC	NC	30		NC		6	NC	19				70	17.5
2002	19	24		NC	NC	NC	28		NC		4	NC	9				84	16.8
2003	25	NC		NC	NC	NC	35		NC	8	3	NC	7				78	15.6
2004	17	NC		NC	NC	NC	54		2	15	4	NC	14				106	17.6
2005	17	NC		NC	NC	NC	49		NC	17	18	0	16	6			123	20.5
2006	26	4	6	0	0	NC	44		0	20	30	0	21	9			157	19.6
2007	23	NC	0	0	1	0	41	4	1	20	9	0	30	4			133	14.8
2008	16	0	0	0	0	0	38	5	10***	26	23	NC	22	13	12**		165	18.3
2009	10	0	2	NC	0	NC	33	4	5	22	11	0	21	1	15		124	12.4
2010	10	0	0	NC	0	NC	40	5	24	18	13	0	24	4	13	13	151	15.1
2011	11	0	0	0	0	0	27	15	10	0	21	0	5	0	10	12	111	13.9
2012	17	0	0	0	0	0	44	0	3	7	18	3	14	0	8	14	128	14.2
2013	17	NC	0	NC	NC	0	46	24	0	16	8	0	14	5	6	13	149	16.6

*includes males and females; **new lek in 2008 with multiple obs.; ***Bark Corral has 2 activity centers, which may be separate leks. In the past birds have been observed at both sites but observations have been combined here.

Figure 5. Mean number of males/lek (1986-2013) for the Jackson Hole and Gros Ventre, Wyoming population (Grand Teton National Park and Wyoming Game and Fish Dept. Unpublished data).



Sage-grouse Management Zones

The Conservation Assessment of Greater Sage-grouse and Sagebrush Habitats (Connelly et al. 2004) developed sage-grouse management zones (Figure 6) determined by sage-grouse populations and sub-populations identified within seven floristic provinces. Floristic provinces were used to delineate Management Zones because they reflect ecological and biological issues and similarities, not political boundaries. The vegetation communities found in the floristic provinces as well as the challenges within Management Zones are similar, and sage-grouse and their habitats are likely responding similarly to environmental factors and management actions. Much of central and western Wyoming, including the USRBCA, is located in Management Zone II.

Plan Area

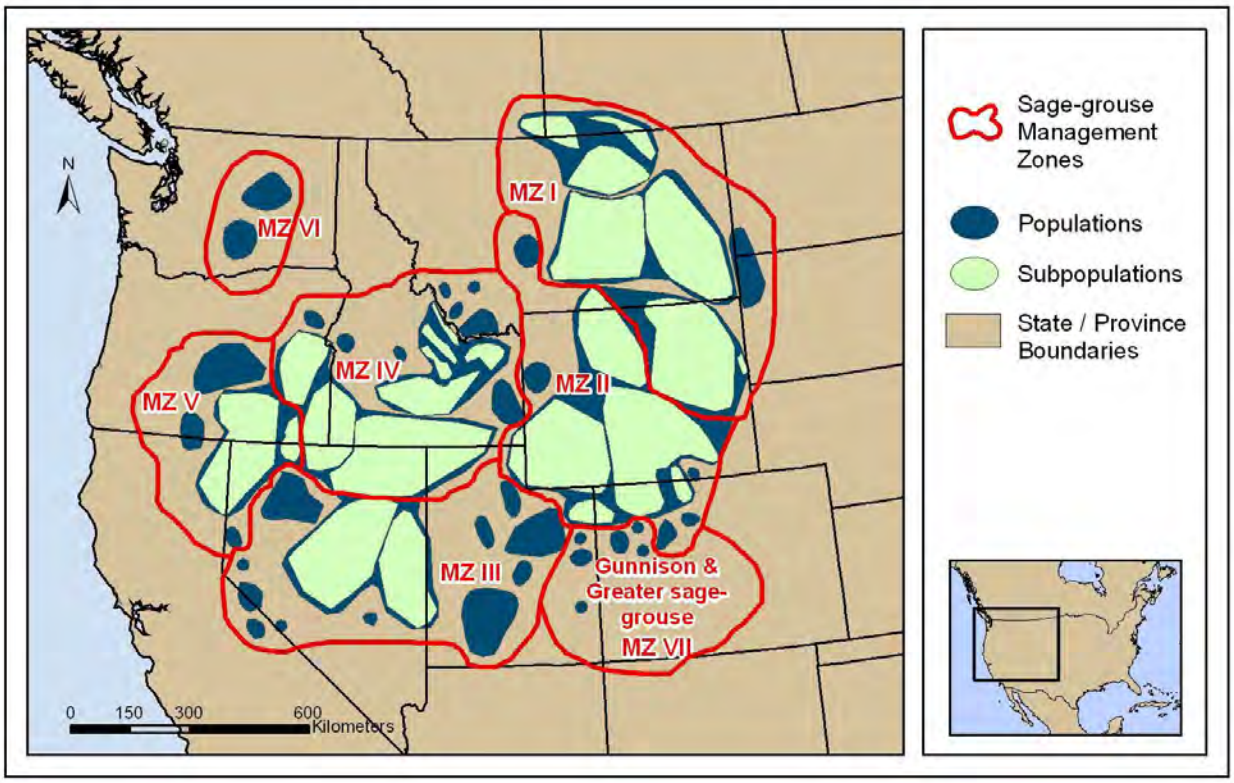
The USRBCA includes the entire Snake River drainage basin in Wyoming including the major tributaries of the Gros Ventre, Hoback and Salt River drainages. The area boundary encompasses about 4,464 square miles, including most of Teton County and small portions of Sublette and Lincoln Counties (Figure 1).

The occupied sage-grouse habitat in the plan area is primarily sagebrush grassland in the valley floor and foothills of Jackson Hole, the Hoback Basin, the Gros Ventre River Valley, and Star Valley (Figure 2). Much of the remainder of the area is forested habitats that are not occupied by sage-grouse. The core population is found primarily in Jackson Hole in Grand Teton National Park and the National Elk Refuge. Sage-grouse use some of the foothill areas around Jackson

Hole on the Bridger-Teton National Forest. There are two leks in the Gros Ventre drainage on national forest land and sage-grouse use much of the sagebrush habitat in the Gros Ventre Valley upstream from Lower Slide Lake. Sage-grouse also use public and private lands in the Hoback Basin in the summer and one lek was documented in the Clark Draw area in 2010. Based on limited GPS telemetry data from one marked hen, these birds move into the area to breed, nest, and raise their broods but spend the winter on the Piney Front near Big Piney in the Upper Green River drainage. There is a small population of sage-grouse in Star Valley that uses habitat associated with the Gannet Hills in Wyoming and Idaho. There are three known leks located in Idaho in the Crow Creek and Stump Creek drainages near the Wyoming-Idaho state line. Star Valley appears to have provided historic habitat, but most of the valley is no longer considered occupied habitat because of sagebrush conversion to farmland.

There is a need to survey the small population and occupied habitat in the Salt River drainage along the WY/ID state line to better determine seasonal habitats and the location of any leks. Personnel for the Greys River Ranger District believe there is the potential for a lek on the Big Ridge area on the Bridger-Teton National Forest in Wyoming. Idaho Fish and Game (IDFG) has indicated some concern over the expanding phosphate mining in sage-grouse habitat in the area in Idaho west of Grover adjacent to the existing Smokey Canyon Mine. There is one lek in the area and mining activity likely affects breeding habitat and winter habitat, but lek surveys have been very infrequent and incomplete. Continued coordination with the IDFG should be a priority to better manage this small population and both agencies should work with local landowners to conserve important sage-grouse habitat.

Figure 6. Sage-Grouse Management Zones with Populations and Sub-populations.



Regional Climate

This summary is excerpted from the *Final Elk and Bison Management Plan and Environmental Impact Statement* (USFWS and NPS 2007). While the habitat requirements for elk during the winter differ substantially from sage-grouse the information provides a picture of shrub and grassland habitat available to elk that might also be available to sage-grouse.

> *"Jackson Hole is characterized by long, cold winters with deep snow accumulations, and short, cool summers. January is the coldest month with an average daily maximum temperature of 24°F and a minimum temperature of 1°F at low elevations. Temperature extremes vary from summer highs of 92°F to 98°F to winter lows of -40°F to -63°F.*
>
> *Precipitation levels are relatively steady throughout the year, with a total average annual accumulation of 15.2 inches in Jackson Hole. Average monthly precipitation levels range between 1 and 2 inches, with May and December being wettest, and July and February driest. Jackson Hole averages 90 inches of snowfall per year, accounting for 60% of annual precipitation.*
>
> *Snowfall varies considerably throughout the area of the Jackson elk herd unit. On the National Elk Refuge, average snowfall ranges from 6 to 18 inches at the southern end, up to 48 inches at the northern end. In Grand Teton National Park, maximum snow depths range from 41-63 inches at low elevations (6,800 feet), to 82-98 inches at intermediate*

elevations (7,300-8,500 feet), and progressively deeper at higher elevations. Maximum snow depth is reached between March 15 and April 1 (Martner 1977). Elk tend to favor slopes with a southerly aspect during winter months because they can be snow-free due to sunshine and southwest winds (Skovlin, Zager, and Johnson 2002).

One factor affecting forage availability for elk and bison is the amount of water contained within the snowpack, referred to as snow-water equivalents or how much water in inches is contained in the snowpack. Deep, light snow allows elk easier access to underlying vegetation than does a shallower, heavy snow. For modeling purposes, a snow-water equivalent of 6 inches was the threshold at which no forage would be available and elk would be unable to acquire sufficient food resources to survive on their own (Hobbs et al. 2003). Areas receiving 6+ inches of snow-water equivalents in one season would be unsuitable for elk winter range during that year. Temperature conditions that cause snow crusting would make forage less available at lower snow-water equivalent levels.

During an average winter, an estimated 51,000 acres in the Jackson elk herd unit area would likely be suitable as elk winter habitat (Wockner, pers. comm. 2002). Most of this acreage would be in the Gros Ventre River basin, with about 8,500 acres on the refuge, as well as in the Buffalo Valley area. Suitable habitat in years when snows were above average would decline to an estimated 20,000 acres, most of which would be in the Gros Ventre River basin and an estimated 2,600 acres on the refuge. In a severe winter suitable habitat would decline to an estimated 12,000 acres, with less than 799 acres on the refuge.

A number of scientific studies indicate that in the past century, the climate is becoming warmer and drier in northern Yellowstone National Park (Balling, Meyer and Well 1992a, 1992b). If this warming trend continues, it could have far-reaching effects on the flora and fauna of the Greater Yellowstone Ecosystem (Romme and Turner 1991).

Analysis of precipitation records from 1921 to 2002 gathered by a National Oceanic and Atmospheric Administration weather station in Jackson, Wyoming, showed no significant trends, either increasing or decreasing (Smith, Cole and Dobkin 2004). Although temperature readings from 1931 to 2002 increased, calculations using the 1949-2001 Keetch-Bryam Drought Index (KBDI) values, which evaluate upper-level soil moisture content, revealed a "minor" decline in drought conditions" (Smith, Cole and Dobkin 2004, p. 98)."

The analysis of the Keetch-Bryam Drought Index (KBDI) ended with the 2001 data. Significant drought from 1999-2006 was not included in the dataset, and possibly changed the long-term trend. The current drought has likely had significant negative impacts on forb production, although 2004 and 2005 had average growing season precipitation and production. Herbaceous forage production on the NER is significantly lower in drought years (Cole and Farnes 2007), and

reduced forb production may reduce sage-grouse food availability during the brood rearing periods.

Historically (1950-2006), average temperatures in Wyoming have been increasing with the greatest changes seen at the higher elevations (Figures 7 and 8), and temperatures are expected to increase into mid-century (2050; Figure 9). Interactions between changes in temperature and precipitation influence water availability and thus primary productivity – the amount and timing of forage production - in sagebrush ecosystems, which in turn may affect habitat quality for sage-grouse. Schlaepfer et al. (2012) are working on projections of suitable big sagebrush habitat under future climate scenarios, where, overall, Wyoming is expected to maintain significant sagebrush suitability (germination and survival), but interactions with unknown climate variation and land use change could override ecohydrological suitability.

Sage-Grouse Biology and Habitats

Sagebrush habitat is essential for sage-grouse survival. Suitable habitat consists of plant communities dominated by sagebrush and a diverse native grass and forb (flowering herbaceous plants) understory. The composition of shrubs, grasses, and forbs varies with the subspecies of sagebrush, the condition of the habitat at any given location, and range site potential. Seasonal habitats must occur in a patchwork or mosaic across the landscape. Their spatial arrangement, the amount of each seasonal habitat, and the vegetative condition determine the landscape's potential for sage-grouse. This arrangement is an important factor in determining if a population is migratory or non-migratory in nature. Appendix 1 contains seasonal habitat requirement descriptions.

Figure 7. Wyoming warming trend from 1950 to 2006. Map produced by ClimateWizard©, University of Washington and The Nature Conservancy, 2009. Base climate data from the PRISM Group, Oregon State University, http://www.prismclimate.org.

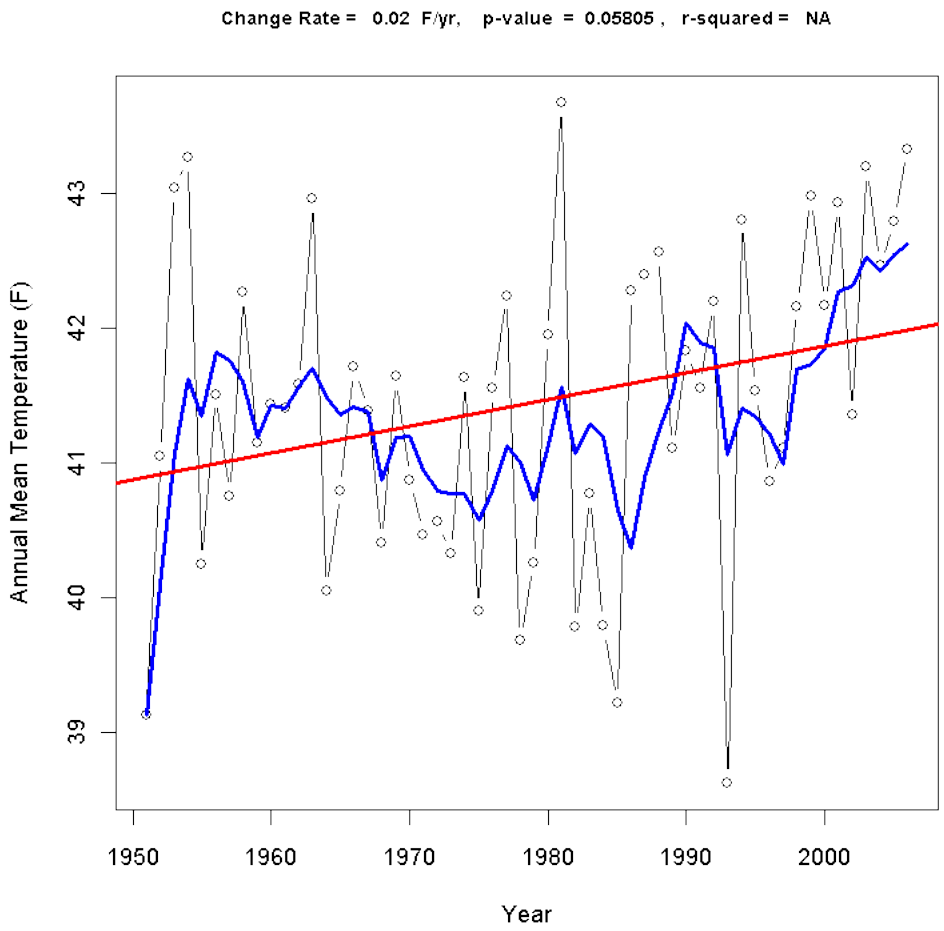


Figure 8. The 1950-2006 warming trend has been most significant at the higher elevations in the Greater Yellowstone Area (GYA) of Wyoming. Map produced by ClimateWizard©, University of Washington and The Nature Conservancy, 2009. Base climate data from the PRISM Group, Oregon State University, http://www.prismclimate.org.

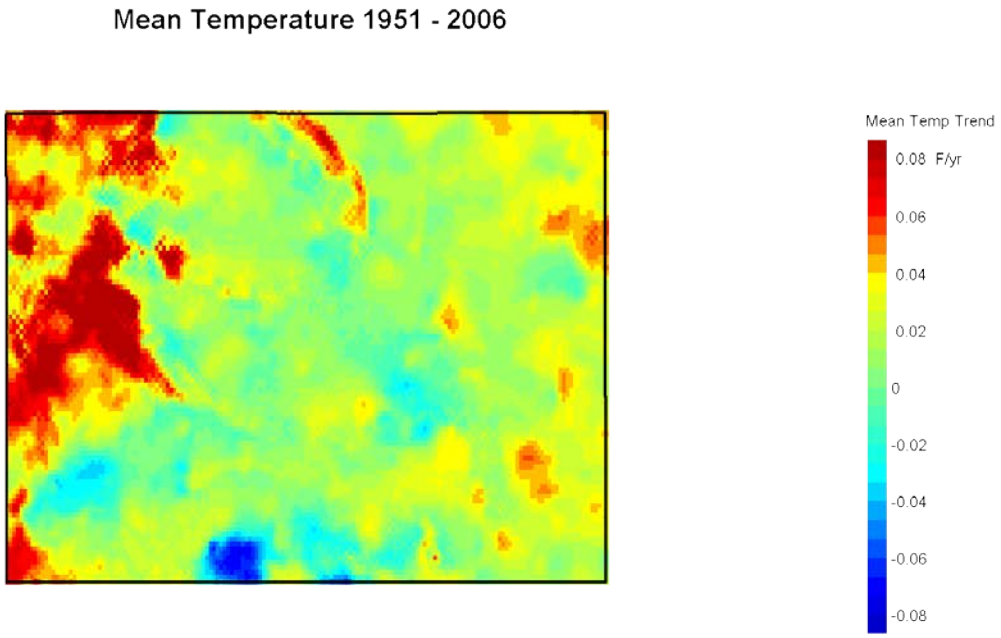
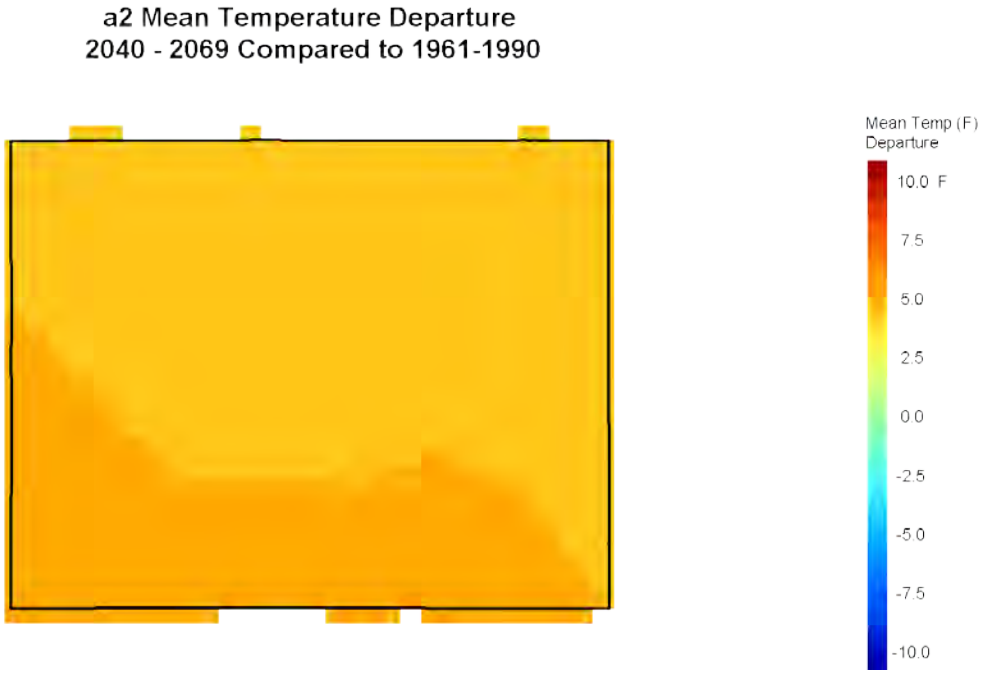


Figure 9. Temperature increases are projected to continue. Map produced by ClimateWizard©, University of Washington and The Nature Conservancy, 2009. Base climate projections downscaled by Maurer, et al. (2007). We acknowledge the modeling groups, the Program for Climate Model Diagnosis and Intercomparison (PCMDI) and the WCRP's Working Gropu on Coupled Modelling (WGCM) for their roles in making available the WCRP CMIP3 multi-modal dataset. Support of this dataset is provided by the Office of Science, U.S. Department of Energy.



CONSERVATION ASSESSMENT

In the USRBCA sagebrush occurs primarily in the valley floors and foothills. Mountain big sagebrush (*Artemisia tridentata var. vaseyana*) is the primary sagebrush species in the area (Bureau of Reclamation 2005). In addition, three-tip sagebrush (*A. tripartitata var. tripartita*) and scattered stands of basin big sagebrush (*A. tridentata var. tridentata*) are found on the National Elk Refuge. Areas south and west of Blacktail Butte (except recently burned areas), around the airport and south of Ditch Creek are dominated by a mix of mountain big sagebrush and antelope bitterbrush (*Purshia tridentata*). Previously cultivated lands east and north of Blacktail Butte have sparse mountain big sagebrush stands or grasslands dominated by the non-native smooth brome (*Bromus inermis*). South of Lost Creek mixed mountain big sagebrush and antelope bitterbrush stands are interspersed with aspen (*Populus tremuloides*) along the eastern edge of the valley. Burned areas (prescribed and wild fires) are dominated by grasslands with scattered sagebrush. The Potholes area, west of the Snake River in Grand Teton National Park (GTNP), has moderately dense stands of mountain big sagebrush mixed with low sagebrush (*A. arbuscula*) and three-tip sagebrush on lower elevation benches. The area around the Elk Ranch Reservoir is dominated by mixed stands of Wyoming (*A. tridentata var. wyomingensis*) and mountain big sagebrush, which mixes with aspen, conifer and cottonwood stands on northern aspects and along waterways. Antelope bitterbrush and other Rosaceae species occur throughout these areas. The Breakneck Flats area of the Bridger-Teton National Forest (BTNF) is dominated by mountain big sagebrush with basin big sagebrush and antelope bitterbrush interspersed throughout. Sagebrush mixes with aspen, conifer and cottonwood stands on steeper, south- or north-facing slopes, and along waterways. Sagebrush shrublands occur on approximately 8,010 acres of the NER, 56,843 acres of GTNP, and they are the most common non-forest habitat on the BTNF with the Breakneck Flats area covering approximately 25,679 acres. Significant sagebrush also exists in the Hoback Basin near Hoback Junction, in the Clark's Draw area south of Bondurant, and in Star Valley along the Idaho-Wyoming state line. Sage-grouse are known to occupy areas in the Hoback Basin and Clark Draw, but no documentation exists for sage-grouse occupancy in the Star Valley area.

Quantity, quality, and arrangement of sagebrush vegetation types determine the suitability of an area for sage-grouse survival and productivity. In each of the following topics of this section, the general needs of sage-grouse are described based on multiple sources over multiple areas – in essence these are the average needs recorded for sage-grouse. However, current research in the USRBCA is providing detailed information on how the local sage-grouse population uses the habitat available to them. Research conducted by Holloran and Anderson (2004) and Bedrosian et al. (2010) are cited in this plan to provide more detailed information on the USRBCA population which sometimes differs from "average" research findings.

Appendix 1 provides an overview of sage-grouse habitat requirements by season, excerpted from Stiver et al. (2010). These suitability categories are based on generalized habitat use criteria or attributes based on a range of average values derived from numerous studies in diverse sagebrush habitats across the range of occupied sage-grouse habitat.

Winter Habitat

During winter, sage-grouse feed almost exclusively on sagebrush leaves and buds. Suitable winter habitat requires sagebrush above snow. Sage-grouse tend to select wintering sites where sagebrush is 10-14 inches above the snow. Sagebrush utilized by sage-grouse above the snow may range from 10 to 30 percent canopy cover. Sage-grouse generally return to traditional wintering areas before heavy snowfall. Movements to wintering areas vary widely ranging from a few miles to over 50 miles, depending on the area. Foraging areas tend to be gentle southwest facing slopes and windswept ridges. Sage-grouse roost in open, low sagebrush sites on clear, calm nights. During windy periods or during snowstorms sage-grouse seek taller shrubs with greater canopy cover. Sage-grouse will fly considerable distances (>5 miles) and elevations (>1,000 feet) between winter feeding sites and suitable snow roosting sites. Sage-grouse will burrow in deep powdery snow to conserve energy. During severe winters, the amount of suitable available habitat is greatly reduced. Severe winter habitat may, or may not be, considered crucial habitat. Some severe winter habitat may be essential and used to a great extent during severe winters, while others may only be used occasionally.

Holloran and Anderson (2004) indicated winter habitat was likely a limiting factor for this population based on the research conducted on this population from 1999-2003. Expanding on the work by Holloran and Anderson (2004), a cooperative project between USGS, NPS, NER and WGFD mapped the potential winter habitat by using the winter distribution of sage-grouse to validate estimates of the available sagebrush habitats from Landsat imagery based on mapping exercises and habitat modeling (Appendix 3). Unexpected habitat use is further described in Chong et al. (2010): Jackson Hole sage-grouse used tall deciduous shrublands, cottonwood and aspen stands, and exposed hillsides in winter. Bedrosian et al. (2010) indicate important winter habitat in Jackson Hole includes: the area south of the airport around Gros Ventre Junction both north and south of the river; the area around Kelly in GTNP; the Gros Ventre Hills in the National Elk Refuge; the area between Kelly Warm Springs and Ditch Creek; Elk Ranch/Spread Creek in GTNP; south of the Lost Creek Ranch access road on Antelope Flats; and the bench along the Snake River in the Potholes portion of GTNP. The area south of Blacktail Butte was identified by Holloran and Anderson (2004) as important winter habitat but no longer provides adequate habitat as a result of a wildfire that removed most of the sagebrush in the area in 2003.

Breeding Habitat (Leks and lek associated habitat) - Early Spring

Breeding occurs on strutting grounds (leks) during late March through early May. Leks are generally situated on sites with minimal sagebrush, broad ridge tops, grassy openings, and disturbed sites such as burns, abandoned well locations, airstrips or roads. Sage-grouse select spots with lower herbaceous height and less shrub cover than surrounding areas as lek sites. Leks are generally proximal to nesting habitat.

There are migratory and non-migratory populations of sage-grouse. In some areas both migratory and non-migratory birds may use the same lek. If all of the components of their habitat are

available within one area, some sage-grouse may not migrate. For these non-migratory populations the lek may be an approximate center of their annual range. Migratory sage-grouse populations may move seasonally through hundreds of square miles of widely distributed habitats. Based on the work by Holloran and Anderson (2004) and Bedrosian et al. (2010) the sage-grouse in Jackson Hole appear to be non-migratory. However, other subpopulations in the USRBCA may be migratory. One hen with a radio collar moved out of the Breakneck Flats area in the upper Gros Ventre drainage to spend a portion of the winter near Wolff Ridge in GTNP but returned to the area around the Breakneck Fats lek prior to the breeding season and bred there and nested and raised a brood nearby. The Wyoming Game and Fish Department believed the sage-grouse using the Hoback Basin were birds that migrated from the Upper Green River Basin to nest and raise their broods in the Hoback Basin before returning to the winter range in the Upper Green River Basin. This migration was documented after a small lek was located in the Clark Draw area and GPS collars were placed on a male and female grouse near the lek. Both birds spent the summer in the vicinity of the lek and the hay meadows along the Hoback River. The male also used the ridge top above Muddy Creek before it was killed by a raptor in that location. The female migrated to the Meadow Canyon area near Big Piney and returned to nest a second year near the Clark Draw lek. The hen returned to the Meadow Canyon area for a second winter before she was killed by an unknown predator. The Idaho Fish and Game Department indicates the sage-grouse along the Wyoming-Idaho state line in Star Valley are a small, non-migratory population.

A number of studies indicate sage-grouse hens exhibit fidelity to lek and nesting areas, and males return to leks where they have achieved stature in the breeding hierarchy (Holloran et al. 2007). As populations decrease, leks may be abandoned; however as populations increase and expand, leks may become active again. Research conducted by Craighead Beringia South (CBS) suggests some female sage-grouse in Jackson Hole may visit multiple leks during the breeding season (Bedrosian et al. 2010).

Stands of sagebrush surrounding leks are used extensively by sage-grouse. During breeding, sage-grouse use the habitat surrounding a lek for foraging, loafing, and protection from weather and predators. Pre-nesting habitats contain patches of early-to-mid seral stage vegetative communities at fine scales with relatively open sagebrush canopies and a robust, leafy forb understory. These areas should be interspersed throughout potential nesting habitats provided by relatively tall, dense sagebrush stands (Appendix 1).

Plant composition in early spring habitat contributes to nesting success. At green-up, forbs are more nutritious than sagebrush. Sage-grouse hens need protein, calcium, and phosphorus rich foods to support nest initiation, increase clutch size, and improve hatch success as well as early chick survival. Low growing leafy forbs, especially milky-stemmed composites (e.g., dandelion), represent potential food forbs. Many of these food forbs are non-native species found in disturbed sites modified by livestock grazing or other agricultural practices that are interspersed in sagebrush habitats. Commonly identified important food forb species include common dandelion (*Taraxacum officinale*), curlycup gumweed (*Grindelia squarrosa*), western salsify

(*Tragopogon dubius*), western yarrow (*Achillea lanulosa*), prickly lettuce (*Lactuca serriola*), cudweed (*Gnaphalium palustre*), fleabane (*Erigeron spp.*), sweetclover (*Melilotus officinalis*), milkvetch (*Astragalus bisulcatus*), alfalfa (*Medicago sativa*), winterfat (*Eurotia lanata*) and fringed sagewort (*Artemisia frigida*) although most native forb species are eaten by sage-grouse when the plants are young and succulent.

In Jackson Hole area, sage-grouse appear to stage in late March near North Gap and the Old Kelly dump locations. These birds appear to be actively seeking and ingesting calcium rich soils at these sites where mineral deposition zones in the soil profile have been exposed by man-made disturbances and natural erosion (Bedrosian et al. 2010).

Nesting Habitat - Late Spring

Approximately two-thirds of hens in non-migratory populations nest within three miles of the lek where they were bred and about 80% nest within four miles of the lek where they were bred. The remainder of the birds usually nests within 15 miles of the lek, but one radio collared bird in the Pinedale study moved 60 miles from the lek of capture on the Mesa to her nest site in the valley below Green River Lakes (Holloran and Anderson 2005). These hens likely represent a migratory segment of the population being studied.

Sage-grouse typically nest under sagebrush but may use other large shrubs. Sage-grouse select mid-height, denser sagebrush stands for nesting. Studies conducted in southern and southwestern Wyoming indicate that the nest shrub heights for Wyoming sagebrush (*Artemisia tridentata* ssp. *wyomingenisis*) ranged between 8 to 18 inches, but individual plants (all subspecies of *Artemisia tridentata*) utilized range-wide by sage-grouse may reach 32 inches in height. Sagebrush canopy cover at nesting sites ranged between 6% and 40%, but most birds nested in sagebrush with 15% - 25% canopy cover (Holloran et al. 2005). Holloran and Anderson (2004) found sage-grouse in Grand Teton National Park used stands that averaged 21.4 inches in height with 27.9% total shrub canopy cover, 16.3% live sagebrush canopy cover and 2.7% dead sagebrush canopy cover. Random sites had slightly higher total shrub cover but similar values for live and dead sagebrush canopy cover.

Wyoming studies indicate greater total shrub, dead sagebrush canopy cover, and residual grass cover are vegetative attributes sage-grouse choose in the nest selection process, when compared to surrounding vegetation. These sagebrush stands should have sagebrush of varying heights with good residual grass under the sagebrush canopy, and the areas between the sagebrush should have good forb cover while maintaining some grass and litter cover (Holloran et al. 2005). Average live grass heights measured immediately after hatch ranged between 7.5 and 9.7 inches with residual grass heights of 4.7 to 6.7 inches in the Jackson Hole Study (Holloran and Anderson 2004). Herbaceous cover was quite variable and ranged between 1% and 85%.

Although dead sagebrush canopy cover has been shown to be statistically significant in nest selection, it represented only 12% to 21% of the overall canopy cover in the stand with the nest.

Dead sagebrush may provide screening cover while allowing for increased amounts of herbaceous understory (Holloran et al. 2005). In the Jackson Hole Study sage-grouse selected dense, tall sagebrush patches that provided overhead concealment cover for nest sites. Within those patches of sagebrush, nests with taller, thicker lateral concealing cover provided by herbaceous vegetation were more successful (Holloran and Anderson 2004).

In general, at nest sites, dense residual grasses at least as tall as the bottom of the canopy on mid-height sagebrush plants appear to positively influence hatching success. Areas that support a diverse forb understory should be in close proximity to these nesting sites for feeding during incubation and brood-rearing. Hatching success appears to improve with increased forb cover. The vegetative composition of an area depends upon site potential, seral stage and past management.

Early Brood-Rearing Habitat - June to Mid-July

Early brood-rearing habitats are used during the brood's first month of life. Hens move their brood immediately upon hatching from the nest site to brood-rearing areas. Sites used during the first 10-14 days after hatching are typically within 1.5 miles of the nest. The vast majority of chick mortality (87% of total brood loss in four studies in Wyoming) occurs during this period. After the first 10 days, broods may have dispersed five or more miles from the nest. In the Jackson Hole study, Holloran and Anderson (2004) found that hens raised their broods within 0.6 miles of their nests. However some hens moved their chicks as far as 7.5 miles from the nest site 10 days post-hatch in 2007 (Bedrosian et al. 2010).

A highly diverse vegetation mosaic is essential to early brood-rearing. Early brood-rearing habitat is more open (10-15% sagebrush canopy cover and similar sagebrush height) with higher herbaceous cover than nesting habitat. Brood survival is tied to an abundance of insects and green vegetation, primarily forbs, in close proximity to sagebrush cover that provides adequate protection from weather and predators. Food forb species important to chick survival are very similar to those listed as important for pre-laying hens. Vegetation diversity increases insect diversity. Insects are crucial during the first ten days post-hatch. Studies suggest insects can make up to 75% of chick diets. Insects remain an important source of protein throughout the summer.

In Jackson Hole and the Gros Ventre, Holloran and Anderson (2004) found sage-grouse broods selected mature sagebrush stands with diverse, dense forb understories during the first 2-3 weeks post hatch. It is thought that areas with good forb understories also provide good insect populations, which are critical to chick survival during this post hatch period. During the study Holloran found greater insect populations in the brood rearing areas in Grand Teton National Park than in the Gros Ventre drainage.

Late Brood-Rearing Habitat - Mid-July through Mid-September

As summer progresses and food plants mature and dry, sage-grouse move to areas still supporting succulent herbaceous vegetation. They continue to rely on adjacent sagebrush for protection from weather and predators, and for roosting and loafing. These areas may be lower elevation native or irrigated meadows where uplands lack green vegetation.

Sage-grouse will also migrate to higher elevations, seeking habitats where succulent forbs are still available in sagebrush habitats or select sites such as moist grassy areas, or upland meadows. A delay in maturing of forbs has a noticeable effect on bird movements. In years with above-average summer precipitation, sage-grouse may find succulent forbs on upland sites all summer. In more arid areas or in dry summers, riparian meadows become more important to survival of broods in the late summer. In the Jackson Hole Study, Holloran and Anderson (2004) found sage-grouse moved 1-2 miles between early brood rearing and late brood rearing areas.

From mid to late summer, wet meadows, springs and riparian areas along streams are the primary sites that produce the forbs and insects necessary for juvenile birds. The drier the summer, the more sage-grouse are attracted to the remaining green areas. In Jackson Hole, sage-grouse seem to be drawn to open areas with good forb production, including the area in and around the airport, potholes area in GTNP, and some of the old hayfields in GTNP between Antelope Flats and Kelly (Bryan Bedrosian pers. com.).

Fall Habitat - Mid-September to First Major Snow

Time spent in fall habitat is highly dependent upon weather conditions. Sage-grouse normally move off late brood-rearing habitat onto transitional fall habitat before moving onto winter range. As fall precipitation increases and temperatures decrease, sage-grouse move into mixed sagebrush-grassland habitats in moist upland and mid-slope draws where fall green-up of cool-season grasses and some forbs occur. As the meadows dry and frost kills forbs, sagebrush consumption increases. Fall movements to winter ranges are slow and meandering from late August to December. With major snowfall accumulation, sage-grouse move onto winter range. Holloran and Anderson (2004) found sage-grouse moved an average of 7.5 miles from summer to winter habitat. Holloran and Anderson (2004) and Bedrosian et al. (2010) indicated winter habitat is likely the limiting factor for the populations in the USRBCA (and see Appendix 3). Food and cover requirements are provided by sagebrush exposed above the snow. Sage-grouse will snow roost in winter to achieve thermal relief from cold temperatures at night.

Providing for all habitat needs on the scale required by sage-grouse may be the most challenging element of managing the landscape. The value of the various successional stages of sagebrush communities to sage-grouse is not well understood. Therefore there is debate about how they should be managed to maximize benefits to sage-grouse. There is also a need to identify structure and cover components. These challenges are greatest in breeding (pre-nesting, nesting and early

brood-rearing) habitats. These habitats have to be in proximity to one another and constitute a fine-grained mosaic of seral stages and vegetation structure (height and cover).

All habitat types are important, and an overabundance of one type will not make up for a lack of another. For example, managing for a late-seral stage on a landscape scale will not necessarily provide for early brood-rearing habitat, and conversely, managing for early seral sagebrush habitats on a large scale usually fails to meet the nesting, security cover, or winter habitat requirements for sage-grouse.

Because leks have been shown to be reliable indicators of nesting habitat, it is suggested that habitat assessments focus on nesting and early brood-rearing habitat associated with leks. Landscape scale assessments can be highly variable because the analysis area may contain migratory or resident populations, or both.

It is important to remember that sage-grouse are dependent on mature sagebrush stands for much of their annual habitat requirements. It is assumed that, if upland vegetation is managed at a variety of early, mid, and late seral stages and climax sagebrush plant communities at the landscape scale, the area will provide sage-grouse with the variety of habitats required annually. Optimal sage-grouse habitat should include a maximum of 20% of the sagebrush habitats in the early seral stage in a mosaic configuration with the remainder of the vegetation in more advanced ecological conditions. Issues relating to the landscape scale habitat needs of sage-grouse must consider seasonal habitat (pre-nesting, nesting, early brood-rearing, late brood-rearing, fall, and winter), juxtaposition, seral stages of vegetation, site potential, vegetative structure, and past and future management. The ideal or required percentages of each seasonal habitat, size of blocks of sagebrush and open areas, and the juxtaposition of these habitats on the landscape are not well understood.

Status of Sage-grouse in the Plan Area

Population Monitoring and Management Activities

Traditionally, sage-grouse data collection within the Pinedale/Jackson Region has focused on lek surveys, with some effort made to collect information from harvested birds. Prior to 1994, relatively few leks were monitored and prior to 2000, standardized efforts were not used to collect sage-grouse lek information. Since 2000, efforts have been made to increase data collection on sage-grouse leks and standardize data collection methods. Efforts to collect data on more leks along with increasing the number of site visits per lek have been made. Current lek monitoring has shifted from “lek surveys” to “lek counts” as described below.

A lek count consists of at least three site visits during the strutting season, with each visit conducted at least seven days apart. Lek counts are used to determine annual status (active or inactive) along with determining population trends. A lek count can also be a census technique

that documents the actual number of male sage-grouse observed on a lek complex. Counts are only practical where a few leks comprise a complex. Sage-grouse lek complexes include one or more leks that are located relatively close together, usually less than one to two miles apart, where males and females will frequently move between the leks during the course of the breeding season. From a population perspective, sage-grouse lek complexes represent the basic unit for estimating and monitoring sage-grouse population trends. In order to be classified as an accurate lek count (or census), a lek observation must include all leks within a complex on the same morning. These simultaneous observations must be performed at least three times during the strutting season, with at least seven days separating each lek observation. Lek complex counts have not routinely been conducted due to manpower and logistical restraints but counts on leks in Grand Teton National Park, and to some extent on the National Elk Refuge, were coordinated to occur on the same days in 2005, 2006 and ongoing as much as possible. We presume all the leks in Jackson Hole proper constitute a lek complex and the lek or leks in the Gros Ventre drainage constitute a second lek complex.

A lek survey consists of only one or two site visits during the strutting season. Lek surveys are important primarily to identify annual status (active or inactive) of a particular lek or lek complex and not for estimating population trends. Overall, lek counts are preferred over surveys and recent emphasis has been placed on collecting lek counts. Based on the findings at each lek, the lek will be assigned an annual status of "Active" (attended by more than one male sage-grouse), "Inactive" (it was known that there was no strutting activity during the breeding season), and "Unknown" (either active or inactive status has not been determined). Based on past and current status, leks are assigned one of the three categories for management purposes. The category "Occupied" is a lek that has been active during at least one strutting season within the last ten years. Management protection will be afforded to occupied leks. An "Unoccupied" lek has not been active during the past ten years, although there must be sufficient data to justify placing a lek into this category. A lek survey or count must have been conducted four out of ten years during non-consecutive years (i.e. every other year) without activity to be placed in the "Unoccupied" category. Unoccupied leks are also broken down into two subcategories: "Destroyed" – habitat no longer exists or "Abandoned" – habitat still exists. Management protection is not provided for unoccupied leks. The third category is "Undetermined" which is a lek that has not been documented as being active in the past ten years, but does not have sufficient data documentation to be considered unoccupied.

Prior to 2000, no standardized guidelines or criteria were identified to define what constitutes a lek, lek status, and lek category as identified above. Further modifications were made in 2003 to standardize lek monitoring and definitions. This lack of consistency in the past has led to erroneous lek classification when compared to the "new" lek definitions. Leks that did not meet the new lek definitions were deleted from the state-wide database and the lek databases for the local working groups.

The majority of the sage-grouse habitat in Jackson Hole is under the jurisdiction of Grand Teton National Park and the National Elk Refuge, with the Bridger-Teton National Forest containing

several small leks and potential movement corridors (Figures 2). The occupied sage-grouse habitat in the USRBCA is primarily sagebrush grassland habitat in the valley floor and foothills of Jackson Hole, Hoback Basin, Gros Ventre River Valley, and Star Valley (Figure 2). Much of the remainder of the area is forested habitats that are not occupied by sage-grouse. The core population (Jackson Hole lek complex) is found primarily in Jackson Hole in Grand Teton National Park and the National Elk Refuge. Sage-grouse use some of the foothill areas on the Bridger-Teton National Forest.

There are 16 known or historic sage-grouse leks in the USRBCA (Table 3). Thirteen leks are considered to be occupied and two appear to be unoccupied historic leks within the plan area (3 BAR H and Antelope Flats in GTNP). All but three of the active leks are in the Jackson Hole complex. In recent years the Simpson lek, formerly called Poverty Flats lek in the NER was considered to be unoccupied but three males were sighted there in 2012 by Eric Cole, Refuge biologist. Since we had no precise location of the lek it is uncertain if the lek was missed in previous surveys or if the lek is intermittently active and possibly a satellite lek of the North Gap lek. The McBride lek is classified as occupied but has only been active on a sporadic basis in recent years (one male in 2007) and warrants additional scrutiny. It is unclear if the Airport Pit lek is really a lek, a satellite lek or a sporadic activity center for birds displaced off the airport lek by airport operations. The Bark Corral lek may have two activity centers (East and West) or the West lek may be a satellite of the Bark Corral East lek.

There are two leks in the Gros Ventre drainage (Gros Ventre lek complex) on national forest land. This small population appears to be a potential link between the small, apparently isolated Jackson Hole population and the large Upper Green Basin population. Genetic work is underway to determine gene flow and possible population connectivity between these two populations.

Sage-grouse also use public and private lands in the Hoback Basin in the summer, and one lek was documented in the Clark Draw area on national forest land in 2011. Based on movements of one hen with a GPS transmitter, the birds using the Hoback Basin in the summer apparently breed and nest there and move to winter habitat in the Meadow Canyon area near Big Piney, WY. This group of birds is unique in that it is a migratory segment of the Green River winter population that moves into the Hoback Basin in early April to breed and spends the summer and early fall there before leaving as snow accumulates in early November.

Table 3. Sage-grouse lek locations by status and land ownership within the Upper Snake River Basin Conservation Area (2012).

General Category	Lek Count	Percent of Category
Area Total	16	100.0%
Classification		
Occupied	13	81.25%
Unoccupied	2	12.5%
(Destroyed)	1	6.25%
Land Ownership		
USF&WS	2	12.5%
NPS	11	68.75%
USFS	3	18.75%
State	0	0%
Private	0	0%
County		
Sublette	1	6.25%
Teton	15	93.75%
Lincoln	0	0%

There is a small population of sage-grouse in Star Valley that uses habitat associated with the Gannet Hills in Wyoming and Idaho. There are three known leks located in Idaho in the Crow Creek and Stump Creek drainages near the Wyoming-Idaho state line. These are small leks with less than 20 males per lek (IDFG data). Star Valley appears to have provided historic habitat, but most of the valley is no longer considered occupied habitat because of sagebrush conversion to farmland.

Only the Moulton Lek (now considered one lek with two activity centers) is a large lek, averaging over 40 birds. The other leks in the USRBCA are small leks (ranging from 2-30 birds). The discovery of a number of relatively small leks over the past five years (Timbered Island, Airport Pit, Dry Cottonwood, Spread Creek, RKO Road, and Clark Draw) has had the effect of reducing the average number of males per lek, while the total number of males counted in the USRBCA increased from 1999 to 2008. However, the total number of males and average number of males per active lek has fluctuated since 2008. In 2010 the total number of males and the number of males per active lek increased. The winter of 2010-2011 was severe, and deep snow persisted in the valley. Lek attendance in 2011was affected and birds either arrived late at some small leks or did not attend some leks in deep snow areas (Timbered Island and Dry Cottonwood leks). The

ability to conduct lek counts was also affected and some survey dates were missed due to weather or limited access to the leks due to snow or road conditions. It is likely the counts on the Gros Ventre leks were particularly affected by survey conditions and the counts missed the peak breeding activity period for this complex. Poor production in 2011 due to the cold, late spring is suspected to have contributed to the apparently suppressed population status in 2012, based on similar average male counts on active leks in 2011 and 2012 (Table 2).

Population Trends and Estimates

No reliable method for estimating the sage-grouse population for the USRBCA exists at this time, but Bedrosian et al. (2010) and Patterson (1952) have estimated minimum population size. Both the number of leks and the number of males attending these leks must be accurately quantified in order to accurately estimate the number of males in the population, population size and population trend. However, the number of males/lek provides a reasonable index of abundance of sage-grouse populations over time in response to environmental conditions. The average number of males per active lek takes into account the number of leks counted each year and perhaps is a more reliable measure of population trends over time.

Table 2 and Figure 3 provide a long term perspective of the population starting with the research conducted by Patterson (1952) in 1948. The long term trend in the lek count data suggests a declining sage-grouse population reaching a low point in 1996 and again in 2009 with some recovery in the intervening years. The decline to low levels in 1996 suggests that this population could have been at risk of extirpation if the causes of the decline (which are unknown) were to persist for several more years. Since 1985, the maximum total count of males in the Jackson Hole Complex ranged from a high of 214 in 1990 to a low of 47 in 1999.

The average number of males per active lek was relatively stable from 2000 to 2008 with the exception of a dip in the average in 2007. However, the average number of male sage-grouse per lek has fluctuated in the last five years (Table 2). Both the long term (1986-2013) and the short term (2002-2013) analysis indicate the population is on a decreasing trend with some annual fluctuations in total males counted. With small populations erratic fluctuations from year to year can be expected, as the recruitment of juveniles fluctuates from year to year, and there is little to buffer populations. However the overall declining trend is a concern.

In an attempt to develop another index of sage-grouse population trends, researchers for Craighead Beringia South conducted a winter census of sage-grouse on known winter areas outside the National Elk Refuge (which is closed to human entry during the winter). On February 2, 2008, 14 volunteers counted 443 grouse in Jackson Hole. Snow conditions were above normal and counting conditions for the ground survey were excellent. Since the National Elk Refuge was not surveyed but provides winter habitat for sage-grouse, this count is a minimum count for this population. The Gros Ventre was not surveyed due to logistical constraints and the big game winter range closures, which make a ground survey impractical. The winter census in Jackson Hole in 2009 resulted in a count of 385 birds. The census was cancelled in February 2010 due to

lack of adequate snow in the valley floor. In February 2011 the winter census resulted in a total count of 287 grouse in the south part of the valley but no birds were observed in the north portion of the valley in the Spread Creek/Uhl Hill area. In February 2012, a similar survey was conducted and 198 sage-grouse were observed in the south portion of the valley (Bryan Bedrosian, pers. com.). Snow conditions were nominally average for the 2012 survey. Lack of snow in Jackson Hole precluded a winter survey in 2013.

From 1986 to 2011 the average number of males counted per lek ranged from 13.1 in 1996, to a high of 20.5 in 2005, to 13.9 males/ lek in 2011 (Table 2). From 2002 to 2011 we saw similar trends in grouse numbers on a per lek basis when surveys were more complete. In either case the average number of males per lek parameter is sensitive to lek size. If small leks are not counted the average is skewed upward. Larger leks are more likely to be found and counted but more intensive surveys in recent years have found a number of small leks. Sage-grouse lek complexes include one or more leks that are located relatively close together, usually less than one mile apart, and males and females will frequently move between the leks during the course of the breeding season. From a population perspective, sage-grouse lek complexes represent the basic unit for estimating and monitoring sage-grouse population trends. We presume the leks in Jackson Hole comprise one complex and the leks in the Gros Ventre are a separate lek complex.

It appears the most recent peak in total sage-grouse numbers occurred in 2008 based on total males counted. Improved coordination of lek counts in Grand Teton National Park and the National Elk Refuge and increased monitoring efforts may have contributed to the increase in observed grouse numbers but trends in the population indices appear to be real. Please see Table 2 and Wyoming Game and Fish job completion reports for lek count data.

Population Viability

Prior to 1950, it is estimated that 500 sage-grouse were resident in the Jackson area (Patterson 1950). Garton et al. (2011) analyzed lek data from 1985-2007 and estimated the annual rate of change for this population averaged -2.2%. Their analysis from multi-model forecasts suggests the probability of the Jackson population declining below 50 effective breeders as 11% and 27% in 30 and 100 years, respectively. Based on their analysis, the probability of long term persistence for populations with less than 500 effective breeding adults is 0%. Their threshold for an effective breeding population is 500 adults indexed to a minimum count of 200 males on leks (Garton et al. 2011). The Jackson population has been below 200 males counted on leks since 1992. Garton et al. (2011) found the rate of change from 1995-1999 was less than 1 suggesting a declining population for the analysis period, but the rate of change was greater than 1 from 2000-2007 suggesting an increasing population in the more recent analysis period. Clearly the long term persistence of this population is of paramount concern to the local working group and resource managers.

Genetics and connectivity

Habitat loss is well recognized as an immediate threat to biodiversity. Depending on the dispersal capabilities of the species, increased habitat fragmentation often results in reduced functional connectivity and gene flow followed by population decline and a higher likelihood of eventual extinction. Knowledge of the degree of connectivity between populations is therefore crucial for better management of small populations in a changing landscape.

Schulwitz et al. (in press) compared genetic material from the Jackson Hole population with surrounding populations, and their results suggest the Jackson and Gros Ventre populations are isolated with some one way gene flow from the Jackson population to the Gros Ventre population. Schulwitz et al. used 16 microsatellite loci and 300 greater sage-grouse samples collected throughout Wyoming and southeast Montana, and significant population differentiation was found to exist among populations. Both Jackson and Gros Ventre populations exhibited significantly reduced levels of neutral genetic diversity relative to other sampled populations. More work is warranted to determine the timing at which Jackson and Gros Ventre populations had become isolated and whether it was primarily due to recent habitat fragmentation or more historic processes. Due to its small population size, continual monitoring of the population is recommended with the goal of at least maintaining current population size and, if possible, increasing suitable habitat and population size to levels recorded in the past.

Habitat Assessment, Monitoring and Evaluation

Connelly et al. (2000) developed guidelines to manage sage-grouse habitats based on a synthesis of existing sage-grouse research. The 2010 12-Month Findings for Petitions to List the Greater Sage-Grouse (*Centrocercus urophasianus*) as Threatened or Endangered by the U.S. Fish and Wildlife Service provides a more updated analysis of sage-grouse habitat requirements and the impacts from development on sage-grouse populations. The Wyoming Executive Order 2011-5 provides guidelines for managing sage-grouse habitat in Wyoming in a working landscape. The Executive Order is based on recent science but reflects political decisions to meet sage-grouse habitat requirements at a level adequate to sustain populations in core areas while allowing some level of energy development and other commodity outputs from sagebrush habitats occupied by sage-grouse. An analysis of these guidelines for core areas by the National Technical Team (2011) found the Core Area policy to be insufficient to sustain current numbers and distribution of sage-grouse. The Greater Sage-grouse Conservation Objectives Report (COT) provides the most recent review of threats to sage-grouse conservation and recommendations to address those threats (USFWS 2013). All of these documents should be reviewed when developing habitat projects in occupied sage-grouse habitat.

The Bridger-Teton National Forest is in the midst of an effort to determine population viability and adequate habitat protection measures to maintain viable populations. The USRBWG is uncertain how to proceed and there is no consensus to adopt the Wyoming core area policy or an alternative that might be satisfactory to the Bridger-Teton National Forest and the state of Wyoming. Meeting any of these sets of guidelines is contingent upon knowledge of existing habitat conditions for the Jackson Hole sage-grouse population. Known sage-grouse habitat

related field work and datasets are available to help guide research and management in the USRBCA (Table 4).

Table 4. Sage-grouse habitat related field work and datasets in the USRBCA.

AGENCY	TYPE	FORMAT	DESCRIPTION
Teton Conservation District	Plant community data	Digital, hardcopy	Data collected from 2010-2013. Parker 3-Step data, Site Analysis data, Line Point Intercept data, Rooted Nested Frequency
Teton Conservation District	Photo points	Digital photos, hardcopies	Data collected from 2010-2013. Photo points were repeated from past 3'x3' photo frames documenting range condition.
Teton Conservation District	LiDAR, Aerial photos	Digital	LiDAR and aerial imagery were flown in 2008 of a ~140 square mile area, roughly from Granite Canyon south to Red Top Meadows, and from the Snake River to the BTNF/CTNF divide.
US Army Corps of Engineers	LiDAR	Digital	Data collected 2007. Snake River Corridor (1/4-1/2 mile buffer from center), from Moose to South Park Bridge.
US Army Corps of Engineers	LiDAR	Digital	Data collected 2012. Snake River Corridor (1/4-1/2 mile buffer from center), from Moose to South Park Bridge.
NER	Plant Community Map	Digital, shapefile	Plant community map of National Elk Refuge, Original air photo interpretation 1986, updated 2000. 35 plant community types, including 3 sage brush types
NER	Aerial photos	Photo hardcopies	Color infrared aerial photos of National Elk Refuge, flight lines designed for stereo interpretation , July 2001,
NER	Image	Digital, MrSid	GTNP, NER and vicinity. 2001 true color orthophoto basemap, 1-m pixel
NER	Habitat Data	Digital and Hardcopy	Forage production data 1986-2005. Includes data for 3-4 sage brush sites located on NER over this time period.
NER	Invasive Plant Species Map	Digital, Shapefile, ArcMap	2005, Location, patch size data for invasive plant species on NER
BTNF	Photo Points	Photo hardcopies, digital photos	EcoData plot data collected 1994-1999. 1,053 plots. Color ground-based photo set at randomized plots established to track vegetation changes
BTNF	Forest Vegetative Layer	Digital, shapefile, ArcGIS	Completed in 2007. Provides information on plant communities, dominance.

BTNF	Satellite Image	Digital, shapefile	Utah State University satellite classification. Based on 88 plots over 4,409,500 acres. Delineates broad vegetation types. 63.6% accurate.
BTNF	Noxious Weed Database	ArcGIS, shapefiles, digital photos	Annual location, patch size data for invasive plant species on the Jackson RD.
GTNP	Veg Map	Digital, coverage	From 2002 aerial photos and ground surveys in 2003 and 2004. 52 classifications with 4 sage brush types, GTNP, NER, and vicinity. Final report produced in 2005.
GTNP	Detailed Veg Plots	Locations digital, plot data currently hardcopy	Land Birds project habitat survey plots
GTNP/WGFD	Habitat Use	Digital	Hollaran and Anderson (2004) radio telemetry data and seasonal habitat selection data
TCWP	Noxious Weed Database	Digital, Map Info Coverage	Noxious weed location and patch size info for Teton County.
CBS/WGFD	Habitat Use		Craighead Beringia South (Bedrosian et al. 2010) radio telemetry data and seasonal habitat selection data.

FACTORS AFFECTING SAGE-GROUSE POPULATIONS AND HABITATS

In their March 2010 listing decision, the U. S. Fish and Wildlife Service (USFWS) concluded that the key threats to the continued survival of sage-grouse are: (1) habitat loss, fragmentation, and modification and (2) inadequacy of existing regulatory mechanisms, particularly in relation to energy and other development. The USFWS also evaluated the "utilization" (e.g. hunting) of sage-grouse and concluded that “the greater sage-grouse is not threatened by overutilization for commercial, recreational, scientific, or educational purposes now or in the foreseeable future" (USFWS 2010 p. 77). The USFWS also examined the effects of hunting on greater sage-grouse in an earlier status review of the species. In its 2005 finding the USFWS determined that hunting as regulated by state wildlife agencies was not a significant threat to the conservation of sage-grouse (USFWS 2005). The expert panel used by the USFWS to make this determination ranked hunting 17th out of 19 potential threats considered (Figure 10).

In December 2011, Wyoming Governor Matt Mead and Secretary of the Interior Ken Salazar co-hosted a meeting to address coordinated conservation of the Greater sage-grouse (sage-grouse) across its range. Ten states within the range of the sage-grouse were represented, as were the U.S. Forest Service (USFS), the Natural Resources Conservation Service (NRCS), and the Department of the Interior (DOI) and its Bureau of Land Management (BLM) and U.S. Fish and Wildlife Service (USFWS). The primary outcome of the meeting was the creation of a Sage-Grouse Task Force (Task Force) chaired by Governors Mead (WY) and Hickenlooper (CO) and the Director of the BLM. The Task Force was directed to develop recommendations on how to best move forward with a coordinated, multi-state, range-wide effort to conserve the sage-grouse,

including the identification of conservation objectives to ensure the long-term viability of the species.

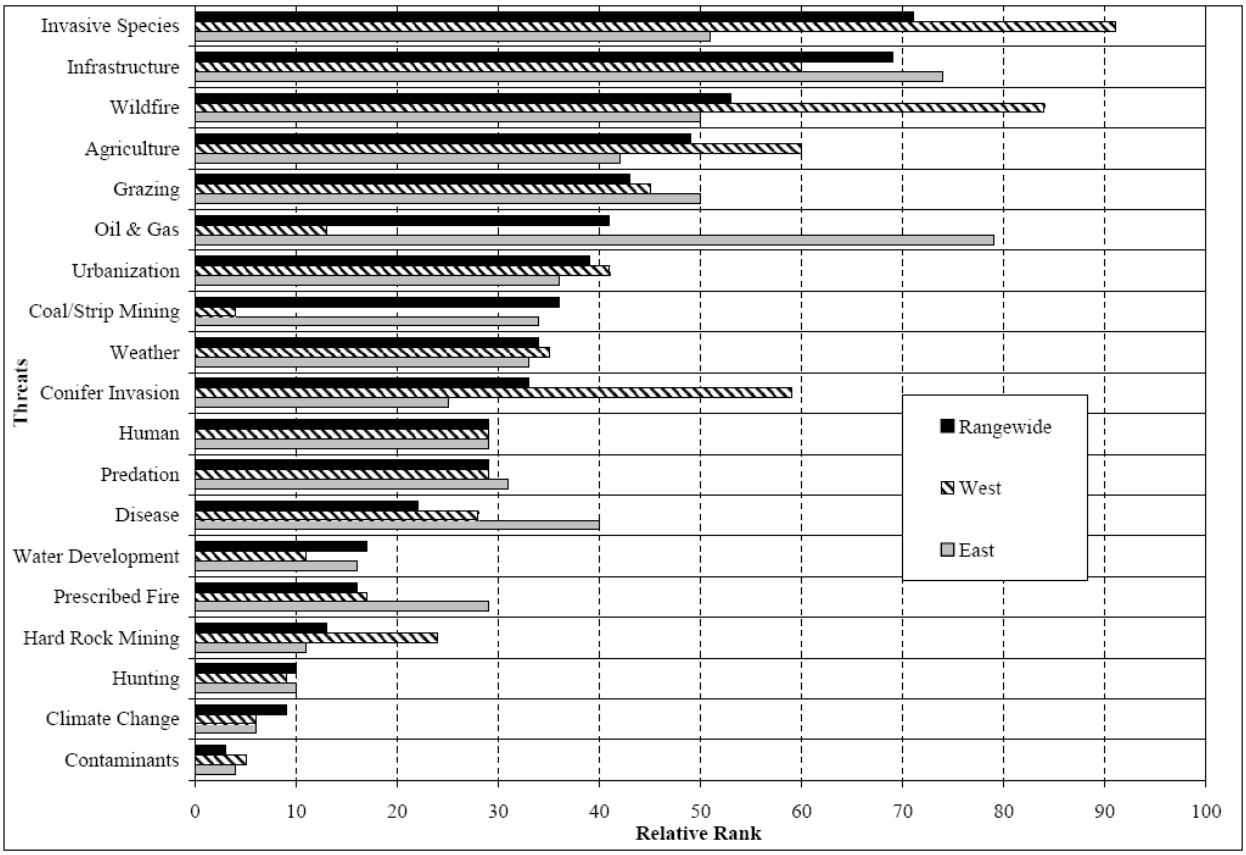
The USFWS was tasked by its Director with the development of conservation objectives for the sage-grouse. Recognizing that state wildlife agencies have management expertise and retain management authority for this species, the USFWS created a Conservation Objectives Team (COT) of state and USFWS representatives to accomplish this task. Each member was selected by his or her state or agency. Bob Budd was the Wyoming representative to the COT. The purpose of the COT was to develop conservation objectives by defining the degree to which the threats need to be reduced or ameliorated to conserve the sage-grouse so that it is no longer in danger of extinction or likely to become in danger of extinction.

In summary, the report prepared by the COT (U.S. Fish and Wildlife Service 2013) listed energy development, infrastructure, improper livestock and/or wildlife grazing practices and recreation as broad scale threats to sage-grouse in the Wyoming portions of the Wyoming Basin Management Zone with localized threats being sagebrush elimination, fire, conifer encroachment, weeds/annual grasses, mining, feral/wild horses, and urbanization. The report estimated a 10.7% probability of the subpopulation of breeding birds declining below 500 by 2017. This figure is the second lowest probability of a decline to this level for any population/sub-population across the range of greater sage-grouse.

The USRBCA lies within this unit and the probability of the Jackson subpopulation persisting is unlikely based on the analysis which suggest a 27.3% probability there will be less than 50 birds and 20 breeding males in 2017 and 100% chance there will not be 500 birds and 200 males in 2017. Clearly this is a population at risk and those risks are addressed in this Conservation Plan as updated in 2013. The plan addresses the Wyoming Core Area Strategy, and the working group and its partners have implemented (Table 5) and suggested (Table 8) management actions and projects designed to address the issues.

The final, peer-reviewed COT report delineates objectives to conserve the sage-grouse so that it would no longer be in danger of extinction or likely to become in danger of extinction in the foreseeable future. The COT report identifies General Conservation Measures, and Specific Conservation Objectives by Threat or Risk Category.

Figure 10. Threats to sage-grouse as ranked by an expert panel convened by the U.S. Fish & Wildlife Service in 2004. The rationale for these rankings can be found in the final listing decision document.



Notes:

- Wyoming is in the "East" portion of the range.
- Infrastructure includes fences, roads, power lines, communication towers, and pipelines, developed for any purpose.
- Agriculture includes activities primarily associated with farming.
- Grazing includes all activities primarily associated with grazing.
- Weather refers to short time events, including but not limited to late season snowstorms, drought, etc. Climate change refers to long-term, permanent weather changes, usually occurring over a period of 100 years of more.
- Conifer invasion primarily refers to pinyon/juniper.
- Human refers to an increased human presence in sagebrush ecosystems from recreational, residential, and resource development activities.
- Similarly, Wyoming's sage-grouse LWGs have not identified hunting as a high priority issue in their plans but do provide concrete recommendations for how hunting should be managed. In addition, Governor Freudenthal's Sage-Grouse Implementation Team did not mention hunting in either their 2007 or 2010 recommendations they believed would contribute to the stabilization of sage-grouse populations and long-term conservation of sagebrush habitat in Wyoming (Wyoming Governor's Office 2007, 2010.)

The General Conservation Objectives identified by the COT are:

- Stop population declines and habitat loss.
- Implement targeted habitat management and restoration.
- Develop and implement state and federal sage-grouse conservation strategies and associated incentive-based conservation actions and regulatory mechanisms.
- Develop and implement proactive, voluntary conservation actions.
- Develop and implement monitoring plans to track the success of state and federal conservation strategies and voluntary conservation actions.
- Prioritize, fund and implement research to address existing uncertainties.
- The COT identified specific threats or risks to sage-grouse persistence across the range. Some threats apply to the populations found in the USRBCA. These include:

    - Fire
    - Non-native Invasive plants
    - Energy development
    - Sage-brush removal
    - Grazing
    - Range Management Structures
    - Mining
    - Recreation.
    - Ex-Urban Development

- Identified threats in the COT that do not apply to the USRBCA include:

    - Free-roaming equid management
    - Pinyon-juniper expansion
    - Agricultural conversion

Additionally, the report identified specific threat reduction objectives for each category of threats and conservation measures to accomplish those reductions. The report also identified specific Conservation Objectives relative to "Priority Areas for Conservation" (synonymous with Wyoming "Core Areas").

Table 5. Projects supported by the USRBWG (2005-2014) with General Fund Budgets.

Project Name	Budget Biennium	Total Cost	SG $	Project Description	Partners	Status
6 - Jackson Hole Plant Species Composition & Structure	2005-06	$65,450	$26,250 requested/approved/ spent	GIS sage-grouse winter habitat inventory and monitoring.	USGS, USFWS, WGFD	Complete
30 - Jackson Hole Sage-Grouse Demographic Study (also see #75, 105 & 140)	2007-08	$504,269 (multiyear)	$62,000 requested/approved/ spent	Research to define population demographics and habitat use via VHF and GPS telemetry.	Craighead Beringia South, JH Conservation Alliance, Grand Teton NP	Complete
75 - Jackson Hole Sage-Grouse Population Demographics (see #30, 105 & 140)	2009-10	$461,731 (multiyear)	$100,000 requested/approved/ spent	Telemetry study to determine habitat use, movement and population demographics in Jackson Hole	Jackson Hole Airport, Grand Teton National Park, Charles Engelhard Foundation	Complete
95 - Kelly Hayfields restoration (see also #114 and 141)	2009-10	$120,945	$65,045 requested, $50,000 approved/spent	Restore native vegetation to abondoned smooth brome hayfields.	Grand Teton National Park	Complete
105 - Jackson Hole SG Habitat and Movement Modeling (see also #30, 75 & 140)	2011-12	$24,000	$16,000 requested, $8,000 approved/spent	Develop sage-grouse habitat selection and home-range models using data from prior work.	Craighead Beringia South	On-going
108 - Grand Teton NP lek monitoring	2011-12	$11,369	$4,032 requested/approved/ spent	Hire technicians to conduct lek monitoring in Grand Teton National Park	Grand Teton National Park, WGFD	Complete
112 - Noxious weed control in Spring Crk/Big Ridge BTNF	2011-12	$22,000	$7,500 requested, $3,883 approved; $3,869.39 spent	Noxious weed control on Bridger-Teton NF lands	Lincoln Co. Weed & Pest, Wildlife and Nat. Res. Trust, RMEF, USFS	Complete
114 - Kelly Hayfields restoration Phase II (see also #95 & 141)	2011-12	$140,181	$52,647 requested; $31,585 approved/spent	Restore native vegetation to abondoned smooth brome hayfields.	Grand Teton National Park, NRCS	Complete
133 - Invasive Species Mapping and Control in BTNF & GTNP (see also #142)	2011-12	$53,000	$12,000 requested, $6,500 approved/spent	Invasive/noxious weed mapping and control.	Teton Co. Weed & Pest, Grand Teton National Park, Nat'l Elk Refuge, Bridger-Teton NF, Jackson Hole Airport	Complete
140 - Jackson Hole SG Habitat and Movement Modeling (see also #30, 75	2013-14	$24,000	$8,800 requested/approved	Finish sage-grouse habitat selection and home-range models using data from prior work.	Craighead Beringia South, Community Foundation Jackson Hole, private donors	On-going
141 - Kelly Hayfields restoration Phase 3 (see also #95 & 114)	2013-14	$87,534	$30,000 requested; $33,200 approved	Restore native vegetation to abondoned smooth brome hayfields.	Grand Teton National Park, NRCS	On-going
142 - Invasive species control in Teton Co. (see also #133)	2013-14	$46,728	$3,000 requested/approved	Invasive weed control in Teton County	Jackson Hole Weed Mgt Assoc.	Approved

Ranking of potential issues affecting sage-grouse in the USRBCA

In 2013 the USRBWG categorized issues into high, medium and low based on our expectations of potential impact to sage-grouse in the USRBCA. Note that each issue requires some form of monitoring to gage impacts of the issue on sage-grouse and sage-grouse habitat and to assess the effectiveness of any management actions taken in attempt to mitigate an issue. Without sufficient monitoring, management effectiveness cannot be evaluated and subsequent management activities will not be improved based on previous successes or failures. The process of applying a management action, assessing the action's effectiveness and then fine-tuning management based on previous actions' effectiveness is referred to as adaptive management.

High: This category contains issues with immediate impact on sage-grouse.

- Habitat (vegetation composition and management)
- Fire Management
- Infrastructure Development
- Weather

Medium: These issues might easily move into the high category in specific locations or with changes within the specific issues (e.g., introduction or expansion of high impact invasive plants).

- Predation
- Invasive Plants
- Conflicting Wildlife Management
- Recreation
- Livestock Grazing
- Energy/Mineral Development

Low: These issues have a low probability of significance in the USRBCA because of our high proportion of Federal lands and geographic location.

- Residential Development
- Management of State Lands
- Farming and Pesticides
- Parasites and Disease

Not Applicable:

- Hunting

HIGH RISK CATEGORY

Habitat (Vegetation Composition and Management)

The extent of sagebrush communities in the USRBCA is relatively limited compared to other areas in Wyoming. The largest areas of contiguous sagebrush exist in GTNP and the northern

NER, but these are spatially separated from sagebrush areas in the Gros Ventre and areas around Hoback Junction and Clark Draw. In addition, the USRBCA is isolated from neighboring sage-grouse populations and their habitats by large mountain ranges. Therefore, the availability of sagebrush is likely a limiting factor for USRBCA sage-grouse populations, especially in the winter when most sagebrush is covered with snow (Holloran and Anderson 2004; Appendix 3). It should be a top priority to protect and maintain existing sagebrush habitat and implement projects to restore degraded habitat.

The majority of the USRBCA is public land (90%; Table 1), so most sage-grouse habitat is protected from future large-scale habitat alteration. However, it should be noted that many sagebrush areas were lost in the early 20th century due to land conversion for agriculture. Many of these lands are still privately owned and support livestock grazing, farming, or hayfield operations, most of which are located south or west of Jackson or in Star Valley (see Farming and Pesticides section). However, former agricultural areas are also present on public lands, including 9,000 acres of abandoned hayfields within GTNP. In 2008, GTNP began a project to restore 4,500 acres around the Kelly Hayfields to their historic condition as sagebrush shrublands. The USRBWG has contributed to this project, and restoration efforts such as this are important ways to increase the availability of sage-grouse habitat in the USRBCA and enhance the resiliency of the population.

In addition to restoration, maintaining existing sagebrush is also important. Teton County Weed and Pest District has a comprehensive program to reduce the spread of noxious weeds on private and public lands (see Weed Management section). Efforts are continuous to protect sage-grouse habitats on private lands using conservation easements. The Jackson Hole Land Trust, The Nature Conservancy, and Teton County Scenic Preserve Trust all manage conservation easements that overlap sagebrush in the USRBCA. Efforts to manage sage-grouse habitat in and around the Jackson Hole Airport are described in the Infrastructure section.

Perhaps the greatest threat to sage-grouse habitat in the USRBCA is the uncertainty of the impact of future climate change. Long-term weather patterns and climate can greatly influence sage-grouse habitat by affecting sagebrush vigor and reproduction, herbaceous growth and cover, snow cover and depth, and wildfire occurrence and intensity. Therefore, a top priority should be managing sagebrush communities for diversity and resilience. A mosaic of sagebrush patches of different ages and structures can benefit sage-grouse as long as large patches of mature sagebrush remain well distributed throughout the area. Heterogeneity within sagebrush communities will help buffer them against future climate change and disturbances such as wildfire or disease. Vegetation treatments, including prescribed burning, mechanical and chemical methods can be used in certain instances to increase the age and structural diversity of sagebrush communities and enhance herbaceous cover (see Fire Management section). Appropriate pre-treatment and post-treatment monitoring should be used to determine the treatment objectives, desired outcomes, appropriate method, and whether the objectives were achieved.

There are several resources available to help managers plan, implement, and monitor vegetation treatments in sage-grouse habitat.

1. The Western Association of Fish and Wildlife Agencies has developed a set of guidelines for managing sage-grouse populations and habitat (Connelly et al. 2000).
2. The WGFD has interpreted and updated these guidelines to apply to many situations in Wyoming, and this information can be found in its technical bulletin, "Sage-grouse habitat management guidelines for Wyoming" (Bohne et al. 2007), which is available at http://wgfd.wyo.gov/web2011/Departments/Wildlife/pdfs/SG_HABITATMNGGUIDELINES0000691.pdf and
3. The WGFD has developed a document titled "Protocols for Treating Sagebrush to be Consistent with Wyoming Executive Order 2011-5; Greater Sage-grouse Core Area Protection" available at http://wgfd.wyo.gov/web2011/Departments/Wildlife/pdfs/SG_TREATINGSAGEBRUSHPROTOCOL0000668.pdf

Fire Management

Mountain big sagebrush communities were historically a mosaic of successional shrub age classes created and maintained by fire cycles ranging in frequency from 10 to greater than 200 years depending on the vegetation composition and site (Houston 1973, Miller & Rose 1999, Baker, 2006). Patchy fires appear to have been the norm in most sagebrush communities; while larger fires at lower frequencies occurred in other areas, depending on the time of year, climate, topography, plant composition, and aridity of the site.

Prescribed fire can be an effective habitat treatment if done correctly because it promotes forb growth and can be managed to produce a patchy treatment pattern (Bohne et al. 2007). Models developed by Pedersen et al. (2003) predicted that patchy, low intensity fires would benefit sage grouse. However, removal of large tracts of sagebrush is detrimental to sage-grouse populations (Connelly et al. 2000, Pedersen et al. 2003). While some birds may be able to adjust by using adjacent sagebrush habitats, areas of extensive treatment or sagebrush conversion no longer support sage-grouse. Sage-grouse hens show fidelity for nesting in the same general area in successive years and female chicks have a strong fidelity to nest in natal areas upon reaching sexual maturity as yearlings. Fire removes the best nesting habitat by burning the dense sagebrush patches used for nesting. In other areas winter habitat is limited and loss of key winter habitat can have an adverse impact on the population. Holloran and Anderson (2004) suggested winter habitat was a limiting factor for this population and cautioned against vegetation treatments which further reduced tall sagebrush cover in areas used by sage-grouse in the winter. Approximately 13.5% of the available sagebrush habitat in the USRBCA has burned within the past 30 years, either as a result of wildfires or prescribed burns (Table 6). For the purposes of this plan occupied sage-grouse habitat in the USRBCA was mapped by the USRBWG using the sage-grouse winter map (Figure 2, Appendix 3), lek locations, sagebrush distribution determined from the vegetation databases from the USFS and NPS, radio relocation data from Bedrosian et al.

(2010) and Holloran and Anderson (2004), WGFD WOS database and general knowledge of sage-grouse distribution. The nominal map of occupied sage-grouse habitat was overlaid with vegetation layers depicting sagebrush from the National Elk Refuge, Bridger-Teton National Forest, and Grand Teton National Park. The Interagency Fire Database was used to identify (Table 7) and plot (Figure 11) wildfires and prescribed fires from 1983 – 2012 within occupied sage-grouse habitat. A few small fires are missing from the database. However, fire severity has been only recently documented and actual acreages burned are less than the total acres within the fire perimeter noted in Table 7. Some fires burned spotty and a mosaic of unburned vegetation remains within the fire perimeter while other fires, primarily wildfires that ignited in August, burned very hot and consumed most of the vegetation within the fire perimeter. Actual burned areas have not been mapped.

Based on the map of occupied sage-grouse habitat provided by Figure 2, about 207,126 acres of habitat is found in the USRBCA. Of that acreage, about 104,903 acres is mapped as sagebrush. About 14,110 acres of sagebrush are found within prescribed and wild fires polygons. Variations in fuel continuity and burning conditions (i.e., temperature, relative humidity, wind speed, topography) determine the level of fuel consumption and removal of vegetation. Prescribed fires are generally conducted during conditions that result in more of a mosaic of unburned and burned patches approximating 50% removal of sagebrush. Wildfires generally occur during conditions that result in increased fuel consumption or approximately 70% sagebrush removal. Given the above levels of sagebrush removal, it is estimated that 5,575 acres (5.3% of the sagebrush component) have been affected as a result of prescribed fires and 2,072 acres (2.0% of the sagebrush component) have been affected by wild fires (Table 6). This analysis was provided by Diane Abendroth, GTNP Fire Ecologist, and John Stephenson, GTNP Wildlife Biologist.

Sagebrush has regenerated to near pre-burn levels on some small prescribed fires in the Gros Ventre that were burned in the late 1970s. Sagebrush regeneration has been documented on most burns: even the severe Row fire (1994) and the Blacktail Fire (2003) have sagebrush canopy cover in the 5-10% range over most of the burns. It is likely sagebrush canopy cover will reach 15-20% in these old burns within 15-25 years. The small fires that burned in a fine grain mosaic of burned and unburned patches likely enhanced sage-grouse brood rearing habitat (Bohne et al. 2007). However the larger, intense wildfires, like the Row and Blacktail fires that removed most of the shrub cover within the fire perimeters, resulted in the loss of some key nesting and winter habitat. These wildfires burned in a pattern and extent that is normal and typical of the area.

The cumulative effects of human caused impacts, in conjunction with such natural events, could have a significant adverse impact on this sage-grouse population. The total acres of sage-grouse habitat temporarily converted from shrub cover to grass/forb patches is at most 13.5% of total acres of available sagebrush if affected acres equals actual acres where sagebrush canopy is reduced to less than the 5% criteria for unsuitable habitat (WY EO 2011-5). The maximum acreage of sagebrush treated falls under the ballpark of the 20% threshold suggested by Connelly et al. (2000) as a maximum size for sagebrush treatments in sage-grouse breeding and winter habitat and approximates the 20% threshold for sagebrush treatments in the WY EO 2011-5. Not

all the sagebrush has been removed within treatment polygons nor do all the affected acres equate to actual sagebrush acres burned within the polygons. However, the small area occupied by this population and limited habitat available for nesting and winter habitat suggests any further vegetation treatments should carefully consider sage-grouse habitat requirements which may constrain additional sagebrush treatments until the existing burns recover. Full suppression of wildfires during the fire season in sage-grouse habitat is a priority given the potential of these fires to consume large blocks of sagebrush habitat under favorable conditions.

Table 6. Analysis of potential sagebrush acres impacted by prescribed and wild fires from 1983-2012 within occupied habitat of the USRBCA. Fires are listed in Table 7.

	Acres	% available sagebrush
Occupied habitat (all habitat types)	207,126	
Sagebrush within occupied habitat	104,903	100
Sagebrush in fire polygons	14,110	13.5
-Sagebrush in prescribed burn polygons	11,150	10.6
-Sagebrush in wildfire polygons	2,960	2.8
Sagebrush affected by presribed burns (~50% consumption)	5,575	5.3
Sagebrush affected by wildfires (~70% consumption)	2,072	2.0

Figure 11. Prescribed and wildfires within occupied sage-grouse habitat of the USRBCA, 1983-2012.

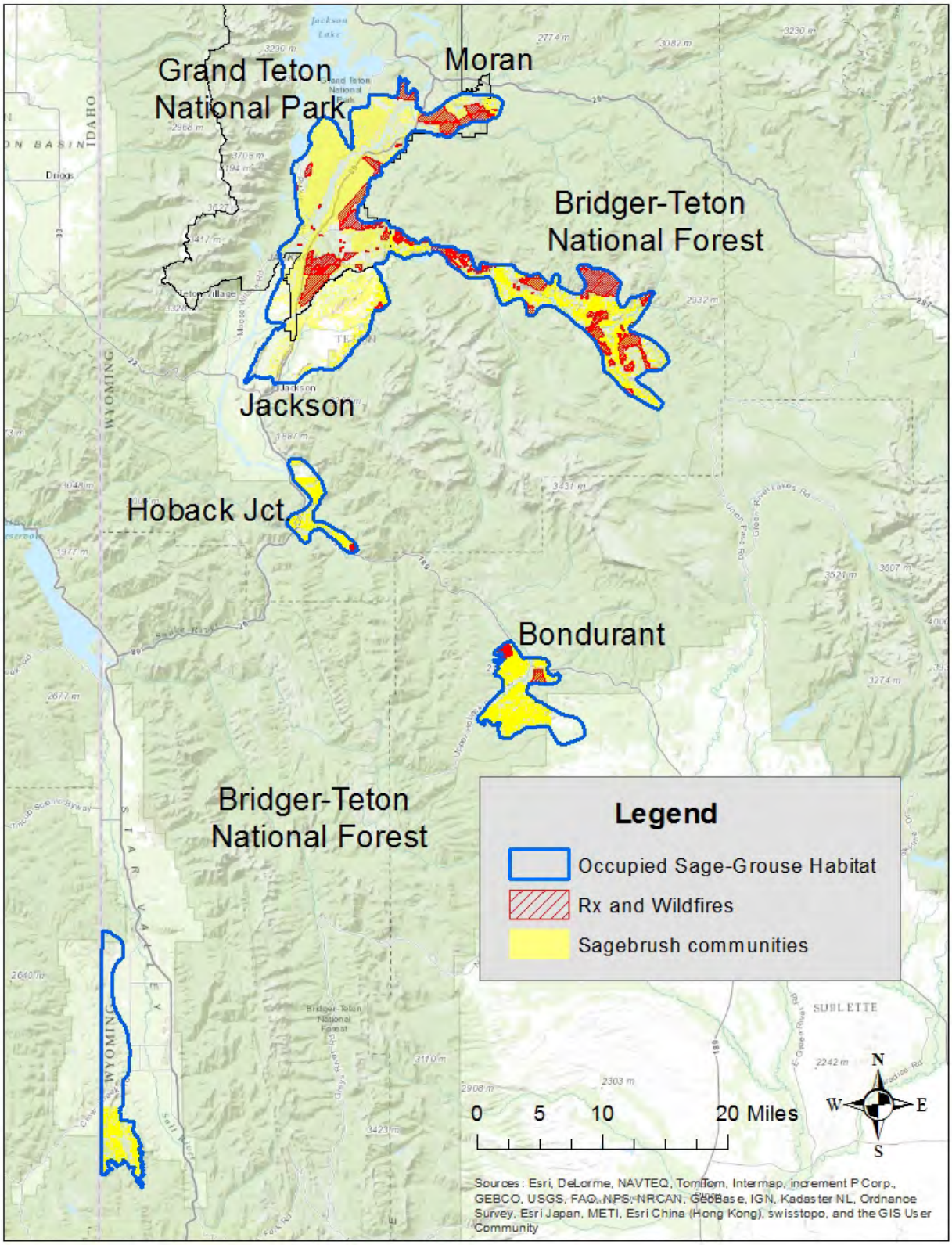


Table 7. Prescribed fires and wildfires within occupied habitat of the Upper Snake River sage-grouse population, 1983-2012.

Name	Year	Severity	Acres	Type*
Gros Ventre Sagebrush treatments	1983	NA	745	Rx
Beaver Creek	1985	NA	37	W
Dry Dallas	1985	NA	49	Rx
Gros Ventre Big Game treatments	1989	NA	555	Rx
Dry Hollow	1990	NA	90	Rx
Gros Ventre Big Game	1990	NA	1,864	Rx
Poison Creek	1990	NA	78	Rx
Russold Hill	1990	NA	211	Rx
Breakneck	1991	NA	293	Rx
Cottonwood	1991	NA	394	Rx
Dry Cottonwood	1991	NA	3,745	W
Row	1994	NA	1,556	W
Lower Spread Creek	1995	NA	35	Rx
Lost Creek	1996	NA	465	Rx
Lower Spread Creek	1996	NA	983	Rx
Uhl Draw B	1996	Moderate	705	Rx
Lower Spread Creek	1997	Moderate patchy	983	Rx
Uhl Draw	1997	Moderate	555	Rx
Antelope South	1998	Low	1,203	Rx
Blacktail C	1998	Moderate-HIgh	278	Rx
Blacktail South	1998	Moderate-High	1,103	Rx
Fisherman Creek	1998	NA	484	Rx
Gray Hills/Lightning Ck	1998	Moderate	72	Rx
Gros Ventre Big Game	1998	NA	24	Rx
Hayfields	1998	Severe burned	259	W
Lower Spread Creek	1998	Moderate	545	Rx
Cow Lake	1999	NA	1,054	Rx
S. Gros Ventre	1999	Moderateh-high	920	Rx
Upper Slide	2000	NA	2	W
Kelly	2002	Moderate	81	Rx
Timbered Island	2002	NA	234	Rx
Wolff Ridge	2002	Severe in sage	1,510	Rx
Blacktail Fire	2003	Severe	2,653	W
Lloyd	2003	NA	169	W
Murie	2003	NA	23	Rx
Bar C Pile	2005	NA	20	Rx
Blacktail N	2005	NA	6	Rx
Fabian	2005	NA	9	Rx
Lost Creek	2005	Moderate	112	Rx
Triangle X	2005	NA	30	Rx

Eynon Ranch	2006	NA	426	Rx
Warm Ditch	2006	NA	26	Rx
Bar BC	2007	NA	20	Rx
Lower Gros Ventre	2007	Moderate	384	Rx
Ditch Creek	2008	NA	4	Rx
Hunter Ranch	2008	NA	211	Rx
Lower Gros Ventre	2008	Moderate	767	Rx
Shane Cabin	2008	NA	9	Rx
Ditch Creek	2009	NA	8	Rx
FI-210	2009	NA	5	Rx
Gunsight	2009	NA	154	W
Hunter Ranch	2009	NA	73	Rx
Lower Gros Ventre	2009	Moderate	508	Rx
4 Lazy F	2010	NA	10	Rx
Dry Island	2010	NA	21	W
Elbo East	2010	NA	216	Rx
TVR North	2010	NA	15	Rx
Grey Hills	2011	NA	1,040	W
Red Rock	2011	NA	288	W
Total			27,574	

*Note: Rx=prescribed fire; W=wildfire

Infrastructure Development

While infrastructure development within the USRBCA area is limited due to the protected nature of Grand Teton National Park, The National Elk Refuge and the Bridger-Teton National Forest, significant sources of habitat loss, disruption, and secondary effects still exist. Expanding residential development in the USRBCA is resulting in expanded infrastructure development such as roads, power lines, fences, other tall structures, and ornamental landscaping which results in habitat loss, fragmentation, and degradation by expanding the human footprint into occupied habitat (Leu and Hanser 2011). Bedrosian et al. (2010) estimated that 42% of historically available habitat within the southern half of Jackson Hole has already been lost due to development, habitat conversion and fires. Existing and new infrastructure features and new anthropogenic food sources can increase habitat use by potential predators such as foxes, coyotes, ravens, and raptors.

One potential issue with infrastructure is the provision of perch sites for raptors. The Bridger-Teton National Forest installed perch guards on winter travel signs in the Gros Ventre to prevent perching by raptors. The Spread Creek Lek is in close proximity to overhead power lines and the Airport Lek is surrounded by tall fencing. While the grouse do not seem to avoid these sites, the power and fence poles may provide perching sites for raptors which may disrupt leking behavior and/or increase the mortality of strutting grouse. It is not likely that the power lines will be relocated, but future plans for power lines or other structures in occupied sage-grouse habitat should consider this issue and retrofitting should be considered.

Research suggests that road-related disturbances during the breeding season may cause sage-grouse leks to become inactive over time, cause fewer hens bred on disturbed leks to initiate nests, and increases the distance from the lek hens will move to selected nesting habitat. GPS tracking data from the USRBCA also indicate marked birds avoid roadsides year-round (Bedrosian et al. 2010). Dust from roads and other surface disturbances can adversely affect plants and animals. Transmission and power line construction does not cause direct habitat loss, but sage-grouse tend to avoid areas associated with these lines (as they provide potential raptor perch sites), thus resulting in an indirect loss of habitat in the vicinity of overhead lines. The potential effects of noise on sage-grouse include masking sounds that influence courtship, mate selection, grouping, and escape behavior. Road noise may be one cause for the McBride lek becoming inactive in recent years, which is located south of the airport near the Jackson Hole Golf & Tennis Club.

Infrastructure development within and from residential areas continues to be a concern both within private and public lands. Residences along the Snake River corridor have a significant potential to increase anthropogenic species that predate on sage-grouse and/or their nests. Mammalian predation is the leading cause of both adult mortality and nest failures within the USRBCA (Bedrosian et al. 2010) and increases in urbanization and habituation have increased local fox and other mammal populations. It is recommended that campaigns in neighborhoods surrounding sage-grouse habitats be started to educate homeowners not to feed wildlife, restrict outdoor cats, and leash dogs within sage-grouse habitat. Minimizing ornamental trees that house potential avian predators (e.g., spruce spp.) should be limited.

Other types of infrastructure that have been constructed or considered in sage-grouse habitat are the bike pathways in the southern half of GTNP and the NER. Such pathways have potential to cause disturbance, nest failure or habitat abandonment due to increased human presence. Further, these structures also continue to fragment habitat and cause direct habitat loss. There have been proposals from homeowners, the airport, and GTNP to create waste disposal lines into the town of Jackson. Cables have been buried across the USRBCA, including key sagebrush habitats, which has led to the direct loss of a sage-grouse nest in at least one recorded instance. Any such activity should consider timing of sage-grouse nesting and cumulative habitat loss, particularly when a reduction in winter habitat may be involved.

The single most important infrastructure feature in core sage-grouse habitat in the USRBCA is the existence and potential for further expansion of the Jackson Hole Airport. The airport operates under a lease from the National Park Service and has two leks within its perimeter: one active since at least the late 1940s (Airport) and the other not active since 2002 (Beacon) when the control tower was erected near the lek. Hens with broods frequent the area inside the airport perimeter fence in late summer and early fall. These grouse appear to be feeding on forbs in the formerly disturbed areas and along the runways and access roads. There is some speculation that runoff from the runways prolongs green-up and there is some documentation of sage-grouse feeding extensively on *Berteroa incana* (Hoary alyssum), a non-native forb growing on areas that have been disturbed in the past within and outside the airport perimeter.

In summer 2011, the Jackson Hole Airport constructed a deicing pad at the north end of the main taxiway located 300-350 m away from the Airport Lek center. During the peak sage-grouse breeding season from mid-March through mid-May, the airport agreed to use only the south end of the deicing pad before 8am to increase the separation distance to 400-450 meters and to decrease the likelihood of disturbing sage-grouse on the lek. Any expansion of infrastructure at the airport should consider the potential impacts on sage-grouse.

Concern has been expressed by the Federal Aviation Administration (FAA) and the Jackson Hole Airport Board over the presence of sage-grouse around the airport and the potential for collisions between aircraft and sage-grouse, which has implications for human safety and economic losses resulting from damaged aircraft. Thirty-two plane strikes with sage-grouse are reported in the FAA's national database at Jackson Hole Airport between 1994 and 2012. Five of these reported strikes occurred in March, 24 occurred from June through September during the brood rearing period, and three occurred from October through December.

Safety issues related to the potential for sage-grouse strikes with airplanes arriving or leaving the airport has prompted the FAA to require the Jackson Hole Airport to create a Wildlife Hazard Management Plan. This plan creates an action plan and mitigation measures for the Jackson Hole Airport to reduce airplane strike risk with all wildlife, but emphasis is placed on the sage-grouse given the lek proximity and historical strikes. The FAA is tasked with managing all wildlife risks within 10 miles of the airport perimeter, but GTNP also has jurisdiction over wildlife within that region. This led to a highly collaborative project between all stakeholders, including the USRBWG, to create a management plan for the Jackson Hole Airport. The USRBWG should consider the implications of recommendations in the pending report from the FAA for the sage-grouse population in Jackson Hole.

In anticipation that the report will suggest some management options directed at sage-grouse using the airport, the working group offers possible management options for the appropriate agencies to consider when addressing this issue. The group is not aware of any solution that will likely resolve this apparent conflict quickly or easily. Chapter 12 of the Conservation Assessment of Greater Sage-grouse and Sagebrush Habitats by Connelly et al. (2004) provides a good discussion of the impacts of the human footprint on the landscape and sage-grouse habitats. More specifically the working group recommends a number of measures to address this issue, and these could also serve as potential mitigation actions for the continued use of GTNP by the airport:

1. The working group recommends the Airport Board or FAA fund a monitoring program to evaluate how sage-grouse use the airport by expanding the ongoing research on sage-grouse being conducted in Jackson Hole by Craighead Beringia South (CBS) to establish a credible plan to manage this situation based on the best available science and to provide the ability to monitor the effects of any effort to reduce the risk associated with sage-grouse presence in the area and airport operations. The most logical way to implement

this recommendation would be to provide additional funding to allow CBS to conduct the intensive monitoring program in conjunction with the ongoing research project.

2. The working group strongly recommends that lethal removal of the birds should not be attempted. The grouse using this lek are critical to maintaining this small population which may already be at some risk of extirpation due to low genetic diversity and high inbreeding (Shulwitz et al. *in Press*) and small size (Garton et al. 2011).
3. As an interim measure, avoid conflicts with breeding sage-grouse by enforcing timing stipulations provide in this document to protect leks.
4. Reconsider current efforts by the airport staff to haze the grouse off the end of the runway prior to aircraft landing during the breeding season because it disrupts breeding and increases energy output by grouse during a time in which physiology is already stressed due to leking and food shortages during winter.
5. Evaluate the possibility of slowly altering the lek center either to the terminus of the over-run, which is not normally used by aircraft except in an emergency, or outside the airport perimeter.
6. Evaluate the option of enhancing habitat outside the airport perimeter to create potential lek sites and improve brood-rearing habitat. Improving both early and late brood rearing habitat can serve to attract sage-grouse away from the immediate airport area, especially during the periods of increased airplane strikes after the young hatch and during the fall. Manipulating habitat outside the perimeter could be done as mitigation for habitat loss within and around the perimeter of the airport or as part of on-going habitat restoration projects.
7. Evaluate the option of manipulating the habitat within the airport perimeter to reduce year-long sage-grouse use within the perimeter.

Weather

Although sage-grouse have evolved with weather fluctuations for thousands of years, it remains a significant factor in determining the status and well-being of their populations. Weather can have either a positive or negative effect upon sage-grouse habitat and populations, and wildlife managers must understand these effects in order to correctly assess the extent to which they are limiting a population or contributing to its decline. The short-term role that weather plays in the annual life cycle on sage-grouse populations and long-term climate change effects on sagebrush habitats must be considered when management practices for sage-grouse are selected.

Even within the relatively small area of the USRBCA there is much geographical variation in climatic conditions. The USRBCA is characterized by high mountain valleys with cool and fairly mesic conditions compared to the rest of Wyoming. Most precipitation comes in the form of snow from November through mid-April or in monsoonal thunderstorms in July and August. In Jackson Hole mean annual precipitation averages about 15.2 inches. Significant snowfall events are common with the mean annual snowfall over the area of about 90 inches. The annual range of temperatures over the USRBCA ranges from a low of –63 degrees Fahrenheit in winter to a

high of 98 degrees Fahrenheit in summer. January is the coldest month with an average daily temperature of 24 degrees Fahrenheit.

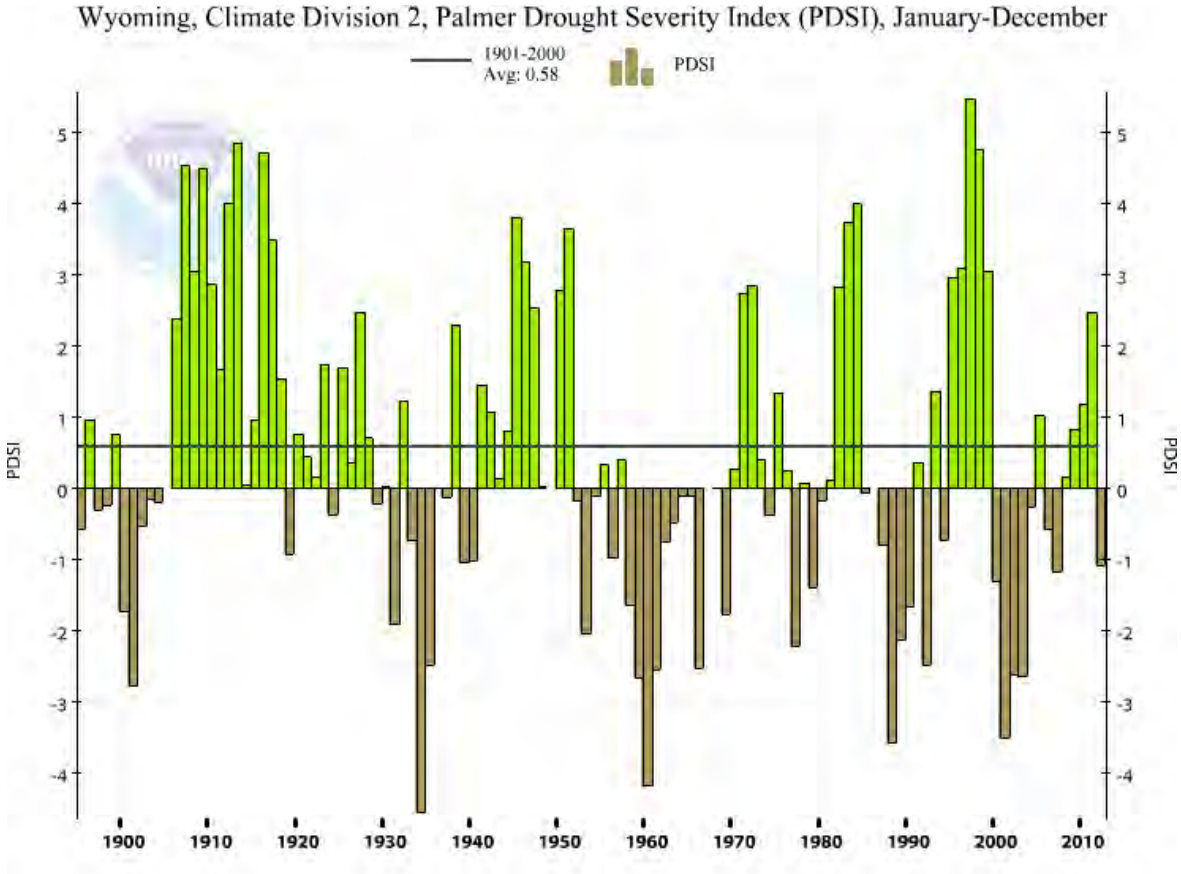
Wyoming is an arid state and drought a frequent occurrence. The Palmer Drought Severity Index (PDSI) quantifies the duration and intensity of long-term drought patterns. Long-term drought is cumulative, therefore current month drought intensity depends on previous months' intensities. The Palmer Drought Severity Index for the Jackson Hole area from 1895-2012 indicates oscillating periods of drought and recovery since 1895 (Figure 12). The first half of the 20th century was relatively wet with only 15 years of drought, whereas the second half was drier with 25 years of drought. Since 2000, the region has experienced a prolonged drought, with 8 of the last 13 years classified as dry.

Long term drought can cause changes in vegetative communities that decrease the effectiveness of sage-grouse habitat, such as reduced forb and grass cover, reduced sagebrush vigor, and increased probability of wildfire. These declines in effectiveness of sage-grouse habitat can result in reductions in population productivity and eventually population declines. On the other hand, a long term trend of above average precipitation can enhance sage-grouse habitat due to the positive influence of moisture on vegetative communities. These long-term weather patterns typically influence sage-grouse populations at the regional level. In general wet years positively influence sage-grouse and dry years negatively influence sage-grouse.

Annual variations in local weather patterns can also impact sage-grouse populations. For example, cold, wet weather during early brood-rearing can physically stress and kill young chicks and have adverse effects on insect populations. However, cool, wet springs can also be advantageous to sage-grouse by promoting herbaceous growth, especially forbs. Extremely hot and dry conditions during the summer concentrate sage-grouse on riparian areas, and thereby increase the potential for predation and the risk of disease. Annual weather patterns influence the abundance and duration of herbaceous cover for nesting and forb availability for brood-rearing.

Severe winters can increase snow depths to levels that cover most of the sagebrush and limit areas available for foraging and cover. Holloran and Anderson (2004) indicated winter habitat might be the limiting factor for the populations in USRBCA, which is supported by a winter sagebrush availability analysis (Appendix 3) and a habitat use analysis (Chong et al. 2010). Given the limited amount of sagebrush available during the winter, snowstorms may play a major role in winter movements, habitat use, and mortality.

Figure 12. Annual averages of the Palmer Drought Severity Index for the Jackson Hole Area, 1895-2012.



Sage-grouse populations in the USRBCA may be especially vulnerable to future climate change due to their isolation from surrounding populations and their reliance on limited, high elevation sagebrush habitat. The most current climate predictions for the next 50 years in the Intermountain West are accompanied by a high degree of uncertainty (Brekke et al. 2013) compared to other regions. It is unclear what to expect regarding precipitation and temperature changes although average temperatures have been rising and are predicted to continue to do so (Figures 7 and 9). Regardless, managing for resiliency of sagebrush habitats and of sage-grouse populations in the USRBCA should be a top priority.

MEDIUM RISK CATEGORY

Predation

As should be expected, predation is and has always been the major cause of sage-grouse mortality. Predation during nesting and early brood-rearing has the greatest influence on sage-grouse populations. Nest predators identified in Wyoming studies include badgers, red foxes, ravens and ground squirrels. In the Jackson Hole Study area, Holloran and Anderson (2004)

documented 24 unsuccessful nests; 23 were destroyed by predators and one was abandoned as a result of disturbance by cattle. Nest predators in the Jackson Hole study included badgers, ravens, and coyotes. In the study, nest success was within the low range of normal and brood survival was high but overall chick production was low (Holloran and Anderson 2004).

In addition, golden eagles, red foxes, ravens, coyotes, various hawks, bobcats, and weasels prey on sage-grouse throughout the year. Humans have altered the landscape and influenced predator-prey relationships that evolved between sage-grouse and native predators. These activities have led to a change in the number, distribution and type of predators that prey on sage-grouse.

As habitats are altered and fragmented, and/or where predators dramatically increase in number or in type, impacts of predation may be magnified. "Newcomer" predators such as red fox and raccoons have expanded their range into sage-grouse habitats where they were not previously a factor. These newcomers and traditional sage-grouse predators have increased in numbers largely as a result of readily available food associated with human activities.

Lethal predator control to increase production and recruitment in bird populations has only been shown to be effective on small, intensively managed areas where efforts are continual. Management of predators may be necessary in localized situations to maintain a sage-grouse population.

Predator management may mean lethal control, but may also include removing key elements that attract predators (e.g. perches, food sources) and/or increasing the quality of habitat for sage-grouse. As with many issues surrounding sage-grouse management, predator-prey relationships are complex and difficult to quantify. It is important to identify potential unintended consequences of predator control as it relates to sage-grouse. Large-scale predator removal is not indicated as a statewide objective. Where predation is demonstrated to be of significant concern, USRBWG should consider localized predator management as a possible tool to maintain or enhance sage-grouse populations. Before any predator control is implemented, the consequences of this management action should carefully evaluate impacts to all wildlife in the proposed project area.

Crow and raven populations are increasing, and "newcomer" predators such as red fox and raccoons are well established in the USRBCA. Raven populations are extremely high in Jackson Hole. Human activity increase foods sources for magpies, ravens, and crows (corvids) which are effective nest predators on ground nesting birds. Landfills, dumpsters, litter along roadways and in campgrounds, carcass pits in ranching operations, road killed wildlife, gut piles from big game hunting, and carrion from large ungulate populations provide additional sources of foods for corvids and other scavenging predators in the USRBCA. Expanding rural subdivisions bring garbage, horse and pet feed, and bird feeders which attract scavenging and predatory animals. These developments also are a source of domestic pets such as cats which roam freely in areas in or adjacent to sage-grouse habitat. Likewise, expanding development fragments sagebrush

habitat into smaller patches and brings powers lines, fences, and other ancillary facilities that may serve as raptor perches.

Invasive Plants

The extent to which invasive plants, primarily non-natives, have historically affected sage-grouse in northwest Wyoming is unknown. However, there is potential for these undesirable plants to have a significant effect in the future if left uncontrolled. Invasive plants along roadways and right-of-ways can spread to surrounding rangelands and riparian areas and replace native vegetation critical for sage-grouse nesting and brood-rearing. Changes in fuel bed content and structure, such as those caused by the invasive annual cheatgrass (*Bromus tectorum*) can result in long-term conversion of sagebrush shrublands to areas with frequent fires that inhibit shrub re-establishment.

Primary species of concern in sage-grouse habitats in the USRBWGA include species considered noxious in the state of Wyoming (http://www.tcweed.org/weedlist.htm). Although cheatgrass does not appear on some western states' lists of noxious species, it should be considered a species of concern because of its ability to change ecosystem processes by increasing fire frequency and reducing water availability thus destroying sage-grouse habitat. In riparian areas species such as Canada thistle, spotted knapweed, leafy spurge, perennial pepperweed and cheatgrass compete with native plant communities that provide brood rearing habitat.

Spatially explicit information on noxious and otherwise undesirable plants is not currently well coordinated, although the Greater Yellowstone Coordinating Committee (GYCC) is working to compile and update existing information. The GYCC is also funding additional work in the USRBWGA to assess the current status of cheatgrass. The Jackson Hole Weed Management Association (Teton County Weed and Pest, GTNP, WGFD, BTNF, NER and others) are involved in those efforts, and they maintain records of where noxious species have been found and treated. Additionally, the JHWMA is currently implementing a three year cheatgrass monitoring and treatment program thanks to a grant from the Wyoming Wildlife and Natural Resource Trust. Treatment options include cultural, chemical, biological and mechanical.

All invasive plant treatments may have undesirable effects on native species within the treatment area. These effects should be assessed prior to choosing any treatment method and an integrated approach should always be evaluated. Prevention though grazing practices, weed-free certification of hay and seeds, and reduction of seed transfer (e.g. on equipment, clothing and vehicles); early detection and control; and reclamation practices that favor native plants are necessary to control the proliferation of weeds. In situations where reclamation is required (e.g. following fire, energy development, or restoration of abandoned agricultural lands), efforts should be made to source local, native seed with particular attention paid to maintaining seed purity (i.e., absence of weed seeds). Vegetation monitoring is equally critical in non-native and native plant species management in relation to habitat management. Monitoring methods must be sufficient to detect changes in nonnative and native plant species composition and structure.

Conflicting Wildlife Management

Management goals for other wildlife species utilizing sagebrush ecosystems can conflict with sage-grouse population and habitat management goals. Managing a single sagebrush site for all wildlife species that may inhabit sagebrush communities is impractical or impossible because practices that benefit some species can be detrimental to others. In Wyoming, approximately 100 bird species, 70 mammal species, and several reptiles are found in sagebrush habitats including many sagebrush obligate or near-obligates such as the sage-grouse, sage sparrow, Brewer's sparrow, sage thrasher, sagebrush vole, sagebrush lizard and pronghorn. A number of other wildlife species are dependent upon or inhabit the sagebrush ecosystem including the white-tailed jack rabbit and mule deer. Each species has specific habitat requirements that may differ from the seasonal habitat requirements of sage-grouse. On a landscape scale, a mosaic of seral stages and vegetation types can accommodate the specific seasonal habitat requirements of the various wildlife species that inhabit sagebrush ecosystems. Sage-grouse may function as an umbrella species and management for sage-grouse habitat may meet the needs of other sagebrush obligates. However, sage-grouse require extensive areas of mature sagebrush to meet their seasonal habitat requirements and this may not provide optimal habitat for some species.

Elk, bison, mule deer, bighorn sheep, moose, and pronghorn are the primary wild ungulates that occur within occupied sage-grouse habitat. While sage-grouse require sufficient canopy cover and sagebrush structure during at least some life stages, big game species depend on young and middle-aged shrubs with higher nutritional quality to meet their energetic needs, particularly during winter. Thus, habitat management for younger shrub communities versus older ones may conflict in certain areas for these species. Furthermore, grazing and browsing by wild ungulates can contribute to long-term changes in plant communities and can alter various habitat components that contribute to the health of sagebrush ecosystems and the sage-grouse habitat it supports. As with livestock, these grazing/browsing effects may be positive, negative or neutral depending on site specific conditions.

Federal and state laws, rules, regulations, and management plans have been enacted that guide management of various wildlife and plants. In addition, some threatened, endangered or candidate species have habitat requirements that directly conflict with sage-grouse habitat requirements or preferences. For example, the U.S. Forest Service's Northern Rockies Lynx Management Direction (2007) will limit conifer removal projects in sage-grouse habitat in some circumstances. In the past, most vegetation treatments in the planning area have been targeted at improving habitat for big game, but more recently some prescribed fires have been conducted to restore natural functions and ecological conditions in sagebrush, mountain shrub, and aspen plant communities. At times these treatments (primarily prescribed burns) have removed sagebrush in areas of important sage-grouse habitat and promoted grass and forb production. Generally these burns were patchy and created a mosaic of burned and unburned areas. In the short term this may

have resulted in the loss of sage-grouse nesting or winter habitat if the burn patches were large. However, if the fires produced a fine-grained mosaic of burned and unburned areas, the vegetation treatments may have enhanced brood rearing habitat. Proposed habitat treatments should consider seasonal habitat use by sage-grouse in the area.

Recreation

Effects of motorized and non-motorized recreation on sage-grouse populations include disturbance of breeding and nesting activities, and habitat fragmentation. Impacts of recreation are likely similar to road-related disturbances resulting from energy and residential development. Research suggests that disturbance during the breeding season may cause sage-grouse leks to become inactive over time, reduce nesting attempts by hens, and increase the distances hens locate nests from leks. Recreational viewing disrupts breeding activities, especially when it occurs close to leks (< 400 m). Off-road vehicles such as 4-wheelers and snowmobiles may flush sage-grouse from secure cover, increasing energy costs and exposing the birds to predation by raptors and predatory mammals. The chassis and tires of vehicles may damage sagebrush and other shrubs through their mechanical action.

Recreational effects often occur on public lands because they are usually freely accessible to the public. Travel management of public lands should aim to dramatically reduce disturbance to sage-grouse leks, especially those near open roads; reduce disturbance of nesting habitat and early brood rearing habitat; and reduce effects on crucial winter habitat for the birds. This can be achieved through road and/or area (off-road motorized) closures, facilitated by locked gates or other physical barriers.

The Jackson Hole portion of the USRBCA is almost entirely public land. The National Elk Refuge (NER) represents 14% of occupied sage-grouse habitat in the USRBCA. Other than motorized use of several roads on its east side, public access to the National Elk Refuge is severely restricted, except for a fall-early winter elk and bison hunt, and fishing on Flat Creek from August to October. Access to the fishable area is restricted primarily to a mesic meadow where sage-grouse are rare.

Sagebrush and other habitats in GRTE provide 41% of occupied sage-grouse habitat in the USRBCA. Here, public viewing of sage-grouse leks is popular, particularly the Moulton lek (Antelope Flats) during the spring. This lek is visible from the vicinity of the Antelope Flats Road. Tours to observe the lek from near the road are led by park naturalists and several tour operators. The Airport lek is close to Highway 89/191 (< 1.5 km), but it is not visible from the road.

Within GTNP some hiking (spring–fall), cross country skiing (winter–early spring) and elk reduction on the east side (fall) occurs in the sagebrush steppe communities, often along roads. However, most sagebrush communities receive little visitation because of their long average distance (> 1 km) from roads, deep snow and tall sagebrush that renders them largely impassable

to skiers and hikers, and the availability of other skiing and hiking locations with better ski terrain and recreation sites closer to the Teton Range.

Human activity in occupied sage-grouse habitat in GTNP is seasonally restricted through several road and area closures. Many of these closures are in place for reasons other than sage-grouse protection. The Antelope Flats Road is typically closed from mid-December to mid-April, primarily due to drifting snow and difficulties in keeping it open for travel. The Teton Park (inside) Road is similarly closed from November 1 to May 1. The Bar BC, River Road, and RKO Roads (west side of the Snake River and east of the inside road) are closed during the fall (beginning with the elk reduction) and open again typically in June. Area closures include the Snake River floodplain from December 15 to April 1 between Moose (R Lazy F Ranch) north to the mouth of the Buffalo Fork. Some closures also occur around gray wolf activity centers (approximately 1-mile radius) from May 1 through October 1, and around bald eagle nests (1/2-mile radius) from February 15 through August 15.

Forest Service (Bridger-Teton National Forest) lands represent 37% of occupied sage-grouse habitat in the USRBCA. The Gros Ventre watershed provides fishing, camping, hiking, horseback riding, and ATV use from early June to mid-September, and big game hunting in late September and October. During the winter, snowmobile use by commercial tour operators is heavy on designated routes, particularly along the main Gros Ventre Road, and two of the three routes that access the Mt. Leidy Highlands north of the main road.

From 2009 to present, the Jackson and Buffalo Ranger Districts have operated under a spring–summer travel plan that restricts use of motorized vehicles to designated routes. Closure of many user-created and several system roads has improved security for nesting hens and broods. Closed roads are gated or barricaded; open routes are posted as open. Although some gates and barricades were damaged and re-opened by uncooperative visitors, compliance improved after 2012, increasing closure effectiveness.

There is one set of designated ATV (Slate Creek) routes and one designated motorcycle (Horsetail Creek) route on the north side of the Gros Ventre watershed. Crucial big game winter habitat identified by the Forest Service is closed to all human entry from December 15 through April 30. This closure overlaps nearly all occupied sage-grouse habitat in the area, including Bacon Ridge (upper Gros Ventre River). However, portions of Dry Cottonwood Creek, Breakneck Flats, Lower Cottonwood, Lower Fish Creek, and Bacon Creek remain open to travel on designated routes or are open as (off-route) snowmobile play areas. Some of these areas are used by sage-grouse as wintering habitat; one main and two satellite leks are here as well. Requests by Forest Service for riders to avoid using snowmobiles off of designated routes are posted annually. This request generally receives good compliance from guides leading commercial snowmobile tours. Breakneck Flats (main and one satellite lek) typically receives some (1–2 occasions per winter) legal off-route use in the play area, and some illegal use in its nearby winter closure.

The Hoback Basin portion of the USRBCA is a mixture of public and private land. Much of the occupied sage-grouse habitat here is located on public lands. ATV travel, camping, horseback riding, and hiking in the sagebrush habitats occurs during the spring and summer, but heavy use occurs during the fall by hunters and by snowmobile riders. At Clark Draw (near Bondurant), kite skiing is very popular during the winter and spring, particularly along Highway 191. No winter closures for wildlife protection are in place in the Hoback Basin.

Private land dominates the floor and foothills of Star Valley. Little public activity occurs on private land during the spring sage-grouse breeding and nesting periods. Most human activity is ranch and farming operations. The limited public land in the Valley that supports sage-grouse habitat is relatively inaccessible to the public due to the patchwork of private lands below. Accessible public lands receive heavy recreational use, especially during hunting seasons. During the spring and summer, ATV riding, horseback riding, and sightseeing are common. Snowmobile riding is popular during the winter.

Livestock Grazing

Domestic livestock grazing is the most pervasive use of western rangelands and has been identified as a factor that may affect the suitability and extent of sage-grouse habitat across the western United States. Grazing and browsing can contribute to long-term changes in plant communities and can alter various habitat components that contribute to the health of sagebrush ecosystems and the sage-grouse habitat it supports. *"A Synthesis of Livestock Grazing Management Literature Addressing Grazing Management for Greater Sage-Grouse Habitat in the Wyoming Basin – Southern Rocky Mountains Ecoregions,"* is accessible at http://sagemap.wr.usgs.gov/docs/Literature%20Synthesis.doc and identifies more than 300 papers. Cagney et al. (2010) discuss grazing and sage-grouse habitat with most examples in the document based on a Sandy Ecological Site (as defined by the Natural Resources Conservation Service) in the Platte River Valley near Saratoga Wyoming with 10-14 inches of precipitation.

Generally, continuous heavy use by livestock and/or wild ungulates rarely leaves suitable residual cover for nesting nor does it maintain the site potential for riparian areas in sage-grouse habitat. However, there have been few research efforts made, and therefore little direct experimental evidence, linking specific livestock grazing practices to sage-grouse population levels. The sagebrush ecosystem evolved with grazing by a variety of wildlife species, but the timing, duration, location, and intensity of grazing that maintains ecosystem function, including sage-grouse habitat, is not well understood.

Active management aimed toward opening the canopy in extensive, dense, mature sagebrush stands and creating or maintaining a mosaic of micro-sites of open areas with grasses and forbs can be beneficial to sage-grouse. Forb diversity and forb-associated insects are important to pre-nesting condition of hens and early brood-rearing of chicks. There is some evidence that there has been a reduction of these important habitat components in the understory of sagebrush stands as a result of current and historic grazing and fire management policies that have altered plant succession in some areas (Bohne et al. 2007). Additionally, the interaction between fire and grazing may be important to habitat diversity, but is not well understood.

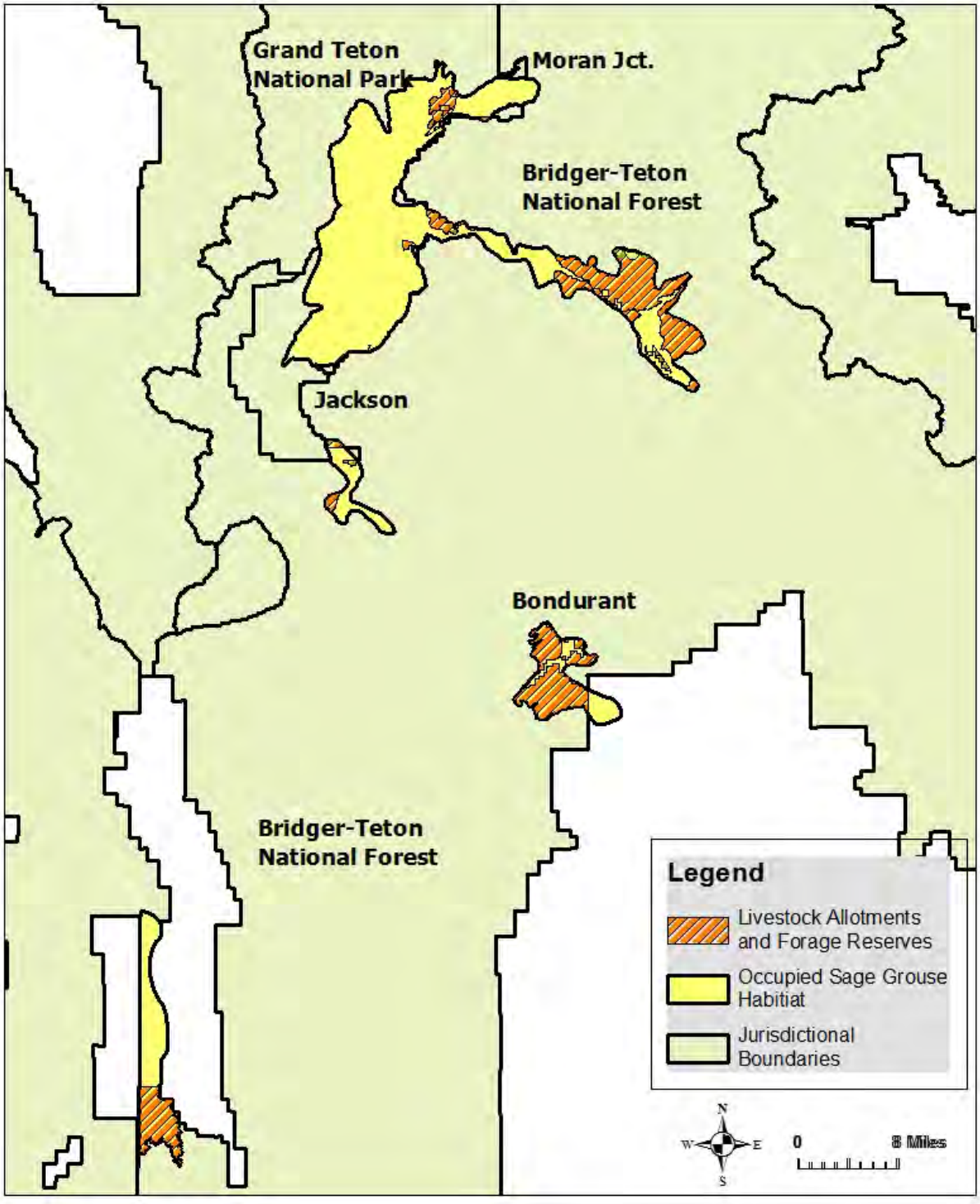
Livestock production in the USRBCA is primarily comprised of sheep, dairy and beef cattle, and horses. Beef cattle production is limited to a few working ranches in Teton County, but extensive cattle operations exist in the Hoback Basin and Star Valley. Large dairy operations are present in Star Valley but generally are limited to farmlands in the valley floor. Sheep graze national forest lands in the Salt Range and Wyoming Range and a few farm flocks are found in the valley. Horses for pleasure riding, pack strings and dude ranches graze much of the private lands in the USRBCA. Most ranching operations use national forest lands for summer pasture for their cattle and move the cattle to private lands during the winter. However, private lands provide much of the pasture in Star Valley and Jackson Hole.

There are 11 horse and cattle allotments in Grand Teton National Park ranging from 18 to 1,504 acres (mean = 317 acres; max = 1,504 acres; min = 18 acres) and totaling 3,491 acres. The general locations are Spread Creek-Moran and Kelly. There are 20 horse and cattle allotments on the Bridger-Teton National Forest (Figure 13) ranging from 3 to 9,402 acres (mean = 1,498 acres; max = 12,513 acres; min = 3 acres) and totaling 29,951 acres. The general locations are Game Creek, Gros Ventre watershed, Hoback Junction and Bondurant. There are two forage reserves/winter ranges size 189 and 20,508 acres located in Spread Creek and the Gros Ventre watershed. Two of the largest allotments in USRBCA, the Blackrock-Spread Creek allotment and the Fish Creek-Bacon Creek allotments, have been closed or placed in a forage reserve status to achieve wildlife objectives. Some periodic grazing could occur on the Fish Creek-Bacon Creek allotment under the forage reserve status after an allotment management plan has been completed. This allotment includes much of the sage-grouse habitat in the upper Gros Ventre drainage and maintenance and enhancement of sage-grouse habitat should be a component of the grazing plans for this allotment.

Ranching operations can affect sage-grouse habitat by removing much of the herbaceous vegetation and limiting the amount of residual grasses left after grazing (which affects the quality of nesting habitat), or through water developments, fencing, vegetation treatments, and disturbance from ranch operations associated with livestock grazing practices such as salting areas, bed grounds, and gathering corrals. Range fences can be a significant source of sage-grouse mortality that results from birds hitting the wires as they fly into nearby leks or feeding areas. There are no known problem fences in the USRBCA but no inventories have been conducted to identify potential problems. If problem fences are documented the fences should be removed or modified to eliminate sage-grouse mortalities. Placing reflectors on the top wire can improve the visibility of the fence to grouse and may reduce collisions and grouse mortalities if fence removal is not an option.

Appendix 2 summarizes the best available information regarding grazing and sage-grouse and should be consulted when making management decisions regarding grazing in sage-grouse habitat.

Figure 13. Livestock allotments and forage reserves in occupied sage-grouse areas in the USRBCA.



Energy and Mineral Development

The discovery and development of natural gas, oil, and coal bed methane throughout the western United States has impacted habitat and has been identified as a potential causative agent in declining sage-grouse populations. There is increasing demand for goods and services supported by the energy industry. Connelly et al. (2004) estimated there were 6 major fields covering 8,740 sq. km (5,431 sq. miles) in southwest Wyoming with 7,980 active and potential wells. The infrastructure associated with natural gas developments in the region is expected to continue to increase. The various types of energy operations are managed pursuant to a wide array of state and federal statutes and regulations, each with specific provisions that may or may not be flexible or effective in minimizing impacts to sage-grouse.

Sage-grouse populations are impacted at oil and gas well densities commonly permitted in Wyoming (Naugle et al. 2011, Hess and Beck 2012, Kirol 2012), and "valid and existing rights" will trump core area policy. Impacts have not been detected at well densities less than about 1 well/mile^2, but above this threshold, losses of leks have been 2-5 times greater inside than outside of development, and numbers of grouse at remaining leks decline by 32 to 77% (Doherty et al. 2010). The magnitude of loss has varied from one field to another, but impacts are always negative and typically severe (Harju et al. 2010). High site fidelity (loyalty) of adult males to leks and adult females to nesting habitat and lower survival of adult sage-grouse combine with lek avoidance by younger birds (Holloran et al. 2010) result in time lags of 2-10 years between when development began and the loss of local sage-grouse leks (Holloran 2005, Walker et al. 2007a, Harju et al. 2010).

Energy development also impacts sage-grouse habitats and vital rates outside the breeding season away from leks. Vital rates are measures such as nest success, hatching success and survival (Taylor et al. 2012). The risk of chick death has been shown to be 1.5 times higher for each additional well site visible within 0.6 mi of brood locations compared to random locations (Aldridge and Boyce 2007), and sage-grouse avoid otherwise suitable winter habitat disturbed by energy development (Doherty et al. 2008, Carpenter et al. 2010, Dzailak et al. 2012, 2013).

The specific mechanisms that lead to avoidance and decreased fitness have not been empirically tested but rather suggested from multiple correlative and observational studies. For example, abandonment may increase if leks are repeatedly disturbed by raptors perching on power lines near leks (Ellis 1984), by vehicle traffic on nearby roads (Lyon and Anderson 2003), or by noise and human activity associated with energy development during the breeding season (Remington and Braun 1991, Holloran 2005, Kaiser 2006, Blickley and Patricelli 2012). However, recently completed research in Wyoming (Blickley et al. 2012), experimentally demonstrated that noise from natural gas drilling and roads resulted in a decline of 29% and 73% respectively in male peak attendance at leks relative to paired controls; declines were immediate and sustained throughout the experiment. The WGFD recommends operational noise from energy production

facilities should not exceed 49 decibels (dB) measured at 30 feet from the source (Tessmann et al. 2004). As a guideline, grouse vocalizations are less than 20 dB and can be heard by humans over one mile away on a calm morning (Dantzker et al. 1999). However, Blickley and Pattricelli (2012) recommended that efforts should be made to minimize noise from development activities above 10 dBA above ambient background levels within 4.0 miles of a lek.

Collisions with nearby power lines and vehicles and increased predation by raptors may also increase mortality of birds at leks (Connelly et al. 2000a). Alternatively, roads and power lines may indirectly affect lek persistence by altering productivity of local populations or survival at other times of the year. For example, sage-grouse deaths associated with power lines and roads occurs year-round (Beck et al. 2006, Aldridge and Boyce 2007), and ponds created by coal bed natural gas development may increase the risk of West Nile virus mortality in late summer (Walker et al. 2004, Zou et al. 2006, Walker et al. 2007b). Anthropogenic developments (e.g. produced water features and distance to wells) appear to facilitate depredation (Dzialak et al. 2011, Webb et al. 2012). Loss and degradation of sagebrush habitat can also reduce carrying capacity of local breeding populations (Swenson et al. 1987, Connelly et al. 2000a, 2000b, Crawford et al. 2004). Birds may avoid otherwise suitable habitat as the density of roads, power lines, or energy development increases (Lyon and Anderson 2003, Holloran 2005, Kaiser 2006, Doherty et al. 2008, Carpenter et al. 2010, Hess and Beck 2012, Kirol 2012).

Long-term studies in the Pinedale Anticline Project Area in southwest Wyoming present the most complete picture of impacts over time. Early in development, nest sites were farther from disturbed than undisturbed leks, the rate of nest initiation from disturbed leks was 24 percent lower than for birds breeding on undisturbed leks, and 26 percent fewer females from disturbed leks initiated nests in consecutive years (Lyon and Anderson 2003). As development progressed, adult females remained in traditional nesting areas regardless of increasing levels of development, but yearlings that had not yet imprinted on habitats inside the gas field avoided development by nesting farther from roads (Holloran 2005). The most recent study confirmed that yearling females avoided gas field infrastructure when selecting nest sites, and yearling males avoided leks inside of development and were displaced to the periphery of the gas field (Holloran et al. 2010). Recruitment of males to leks also declined as distance within the external limit of development increased, indicating a high likelihood of lek loss near the center of developed oil and gas fields (Kaiser 2006). The Pinedale work also showed that population level sage-grouse declines are explained in part by lower annual survival of female sage-grouse. (Holloran 2005).

Some of these impacts can be minimized by mitigation, reclamation, and planning for sage-grouse needs. Some of these impacts are short-term and related to specific periods of activity that can be scheduled to avoid conflicts with sage-grouse. In some situations, positive effects may result habitat alteration, such as increased forb production, and additional water sources in areas that have been reclaimed successfully. However, impacts from full field development of oil and deep natural gas or coal bed methane gas result in long-term negative impacts (30 years or more), and rehabilitation of impacted habitats may take many more years to complete. Roads built to accommodate energy exploration and development activities often result in the establishment of

permanent travel routes, improved public access, increased long-term traffic related disturbance, indirect noise impacts, and direct mortality.

Energy development may not be a major impact on sage-grouse populations in the Jackson Hole and Gros Ventre Valley portions of the USRBCA in the near future. The potential for oil and gas occurrence in the USRBCA is high, based on US Geological Survey (USGS) and Bureau of Land Management (BLM) analyses of the Jackson Hole area due to the potential occurrence of source rocks, reservoir rocks, and traps. However, the development potential for oil and gas is low due to the limited amount of land available for leasing and the lack of information to precisely locate a north-south trending anticline known to be present that could produce a structural trap. About 75 wells have been drilled in the area as of December 2006 but there are currently no producing wells (Figure 14).

Existing Federal oil and gas leases are located in the southwestern portion of the Gros Ventre Mountains. The area north of the Gros Ventre River to the 11th Parallel and up to the Continental Divide is available for Federal oil and gas leasing. Federal lands around and south of Jackson are available for Federal oil and gas leasing. The Salt River and Wyoming ranges are closed to any new Federal oil and gas leasing except for the current analysis of Federal oil and gas leasing. Lands along major streams, such as the Blackrock, Gros Ventre, and Snake rivers are typically buffered by a ¼-mile No Surface Occupancy Lease Stipulation. Numerous areas are covered with a Technical No Surface Occupancy Lease Stipulation for lands susceptible to landslides, marginally unstable soils, or easily erodible soils. The Palisades Wilderness Study Area (WSA) is covered with a Conditional Surface Use Lease Stipulation. Lands available to Federal oil and gas leasing within the USRBCA (Figure 15) are covered by the Jackson Hole Area Oil and Gas Lease Stipulation, various wildlife timing stipulations – including winter closures – and other resource protections.

Coal deposits cover large areas of the USRBCA including occupied sage-grouse habitat in the Gros Ventre drainage and the Hoback Basin (Figure 16). All developed coal mines are historical and no longer in production. Coal leasing and development potential is low given the relatively small – but numerous – coal deposits and limited economic significance. Many abandoned mines exist throughout the USRBCA. Such sites are typically small with little to no chemical hazards, and a few physical hazards. Most sites are old enough without recent activity that the area vegetation has been reestablished.

Gold, limestone, bentonite, and gravel (Figure 17) mining may impact sage-grouse and sagebrush habitat in the USRBCA. Large areas of the USRBCA are covered with phosphate reserves. Phosphate leasing and development potential is low given the inconsistent quality, thin beds, steep dips, and inaccessibility.

Figure 14. Oil and gas wells in the USRBCA.

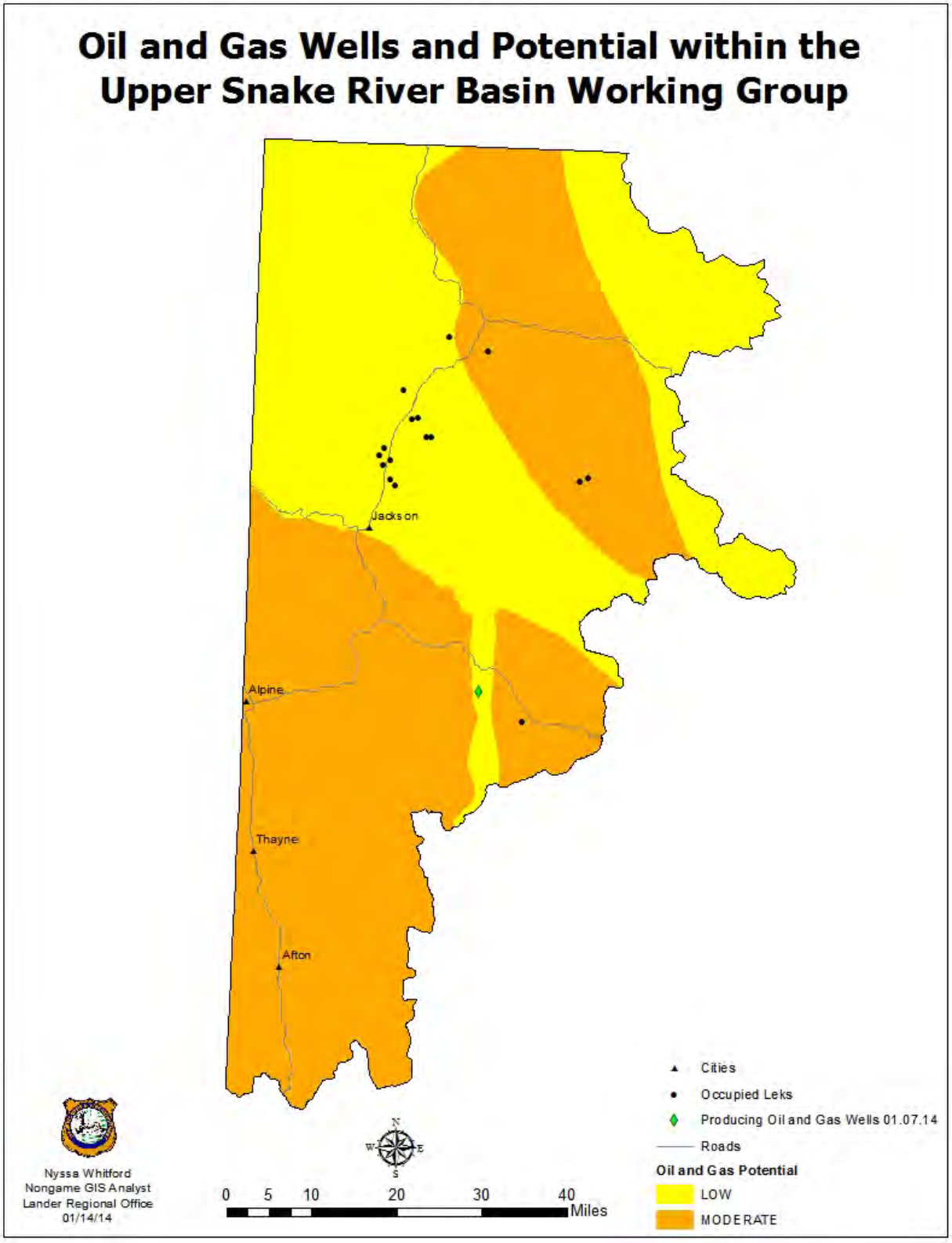


Figure 15. Bridger-Teton National Forest areas available for Federal leasing (energy and mineral) and abandoned/retired mines in occupied habitat.

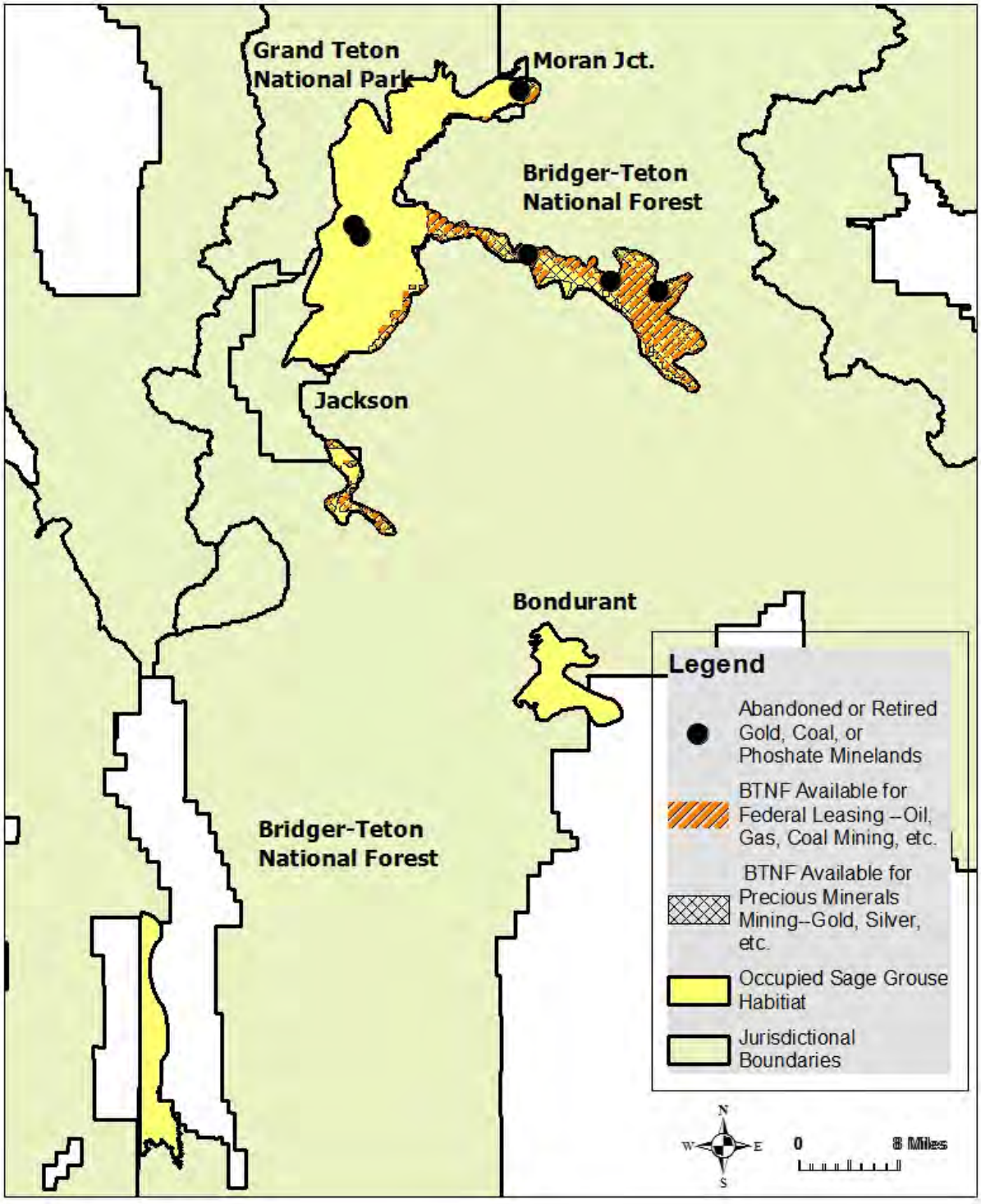


Figure 16. Coal deposits in the USRBCA.

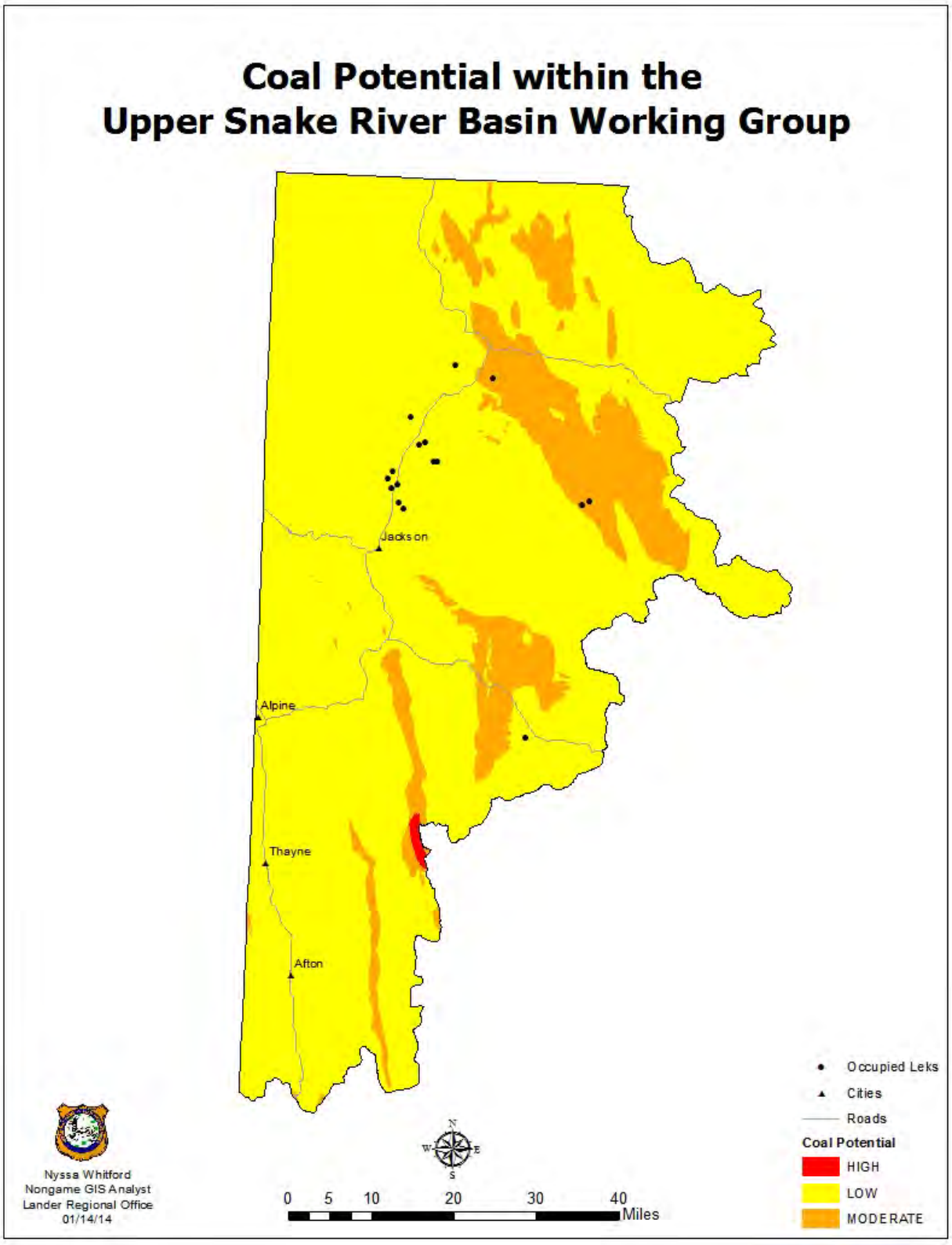
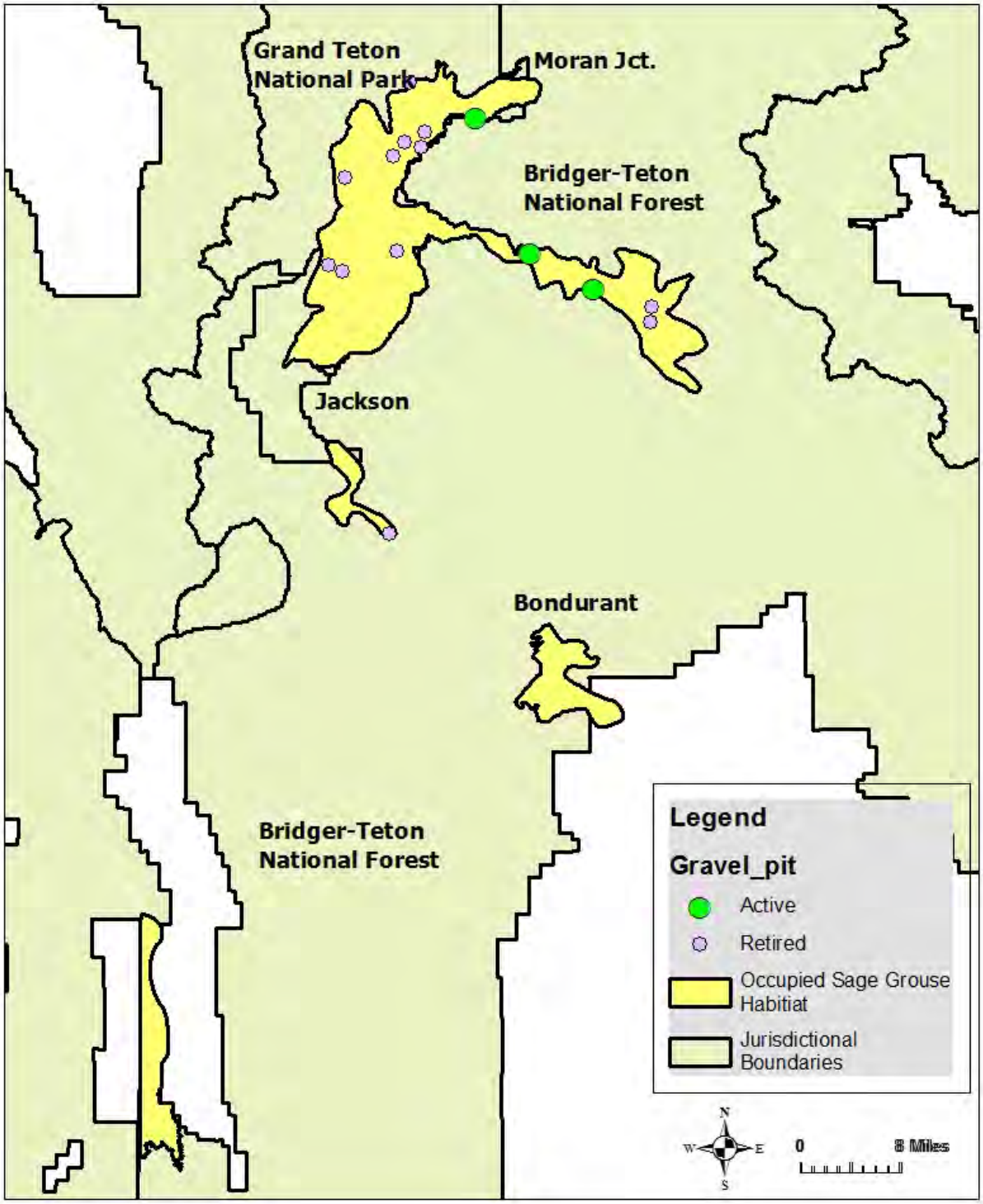


Figure 17. Active and retired gravel pits in occupied sage-grouse areas in the USRBCA.



LOW RISK CATEGORY

Residential Development

Private lands in the USRBCA present a unique wildlife management challenge because of the intense pressure to reap significant profits through development. When development does occur it seldom benefits wildlife unless by accident or through the benevolence of the landowner. Compounding this problem is the prevalent view held by many land owners that sagebrush habitat has little intrinsic value and is a logical location to place development such as roads and building envelopes.

Residential and infrastructure development (a "high risk category) are closely linked with one activity facilitating the other. Little or no research is available that directly addresses the effects of residential development on sage-grouse, but some of the effects are obvious. Residential development can cause direct loss of lek sites and seasonal habitats and also fragment those habitats. Other factors that may impact sage-grouse populations include increased roads, fencing, power lines, human activity, and density of cats and dogs. In addition, new landfills/trash facilities may increase predator populations. Impacts from residential development in sagebrush habitats are closely related to impacts from the resulting infrastructure development that occurs to support expanding human populations and industrial development.

Almost all of the USRBCA is experiencing significant residential development in rural areas. Much of this residential expansion occurs because of people's desire to live outside of town to distance themselves from neighbors and have enough property for animals. County governments in Lincoln, Sublette, and Teton Counties, which include the USRBCA, vary in their regulation of subdivisions depending on their planning and zoning regulations. Teton County has the most proactive regulations to protect wildlife habitat but current planning and zoning regulations do not recognize the importance of sagebrush habitats occupied by sage-grouse. Subdivisions with lot sizes greater than 35 acres are not regulated by Wyoming's subdivision law. Most of the large parcels in Teton County have been subdivided into 35-40 acre parcels.

The joint Jackson/Teton Comprehensive Plan was revised in 2012. It recognizes that historically 60% of development has occurred in rural areas of the county and sets a goal to change development patterns so that 60% of development occurs in Town or developed areas. At this point it is not clear how they will make this happen. It also recognizes that the citizens of Teton County place a high priority on protecting wildlife. Principle 1.1 of the 2012 Jackson/Teton County Comprehensive Plan is to "Maintain healthy populations of all native species." It recognizes that the community must manage our impacts to wildlife and wildlife habitat on private and public land. Some key Policies from the 2012 Comp Plan that might have impact on sage-grouse are:

Policy 1.1.a: Protect focal species habitat based on the relative critical value

The 1994 Comp Plan used critical habitat for elk, moose mule deer, bald eagles, trumpeter swans and cutthroat trout to define the Natural Resource Overlay (NRO). Development in the NRO receives additional scrutiny but is not prohibited. The 2012 Plan envisions shifting to "focal species" to protect various habitat types. The focal species will be used to indicate the health of all native species in specific types of habitat. Until these focal species are identified, the 2012 Comp Plan will continue to use the species and definitions from the 1994 Plan.

Policy 1.1.b: Protect wildlife from the impacts of development

The 2012 Comp Plan envisions establishing a tiered system of protection to provide the highest protection to the most critical habitat. While the Comp Plan was being revised it appeared that most of the focus for protection was on riparian areas and wildlife travel corridors.

Policy 1.1.e: Understand the impacts of development on wildlife and natural resources

The Natural Resource Technical Advisory Board (NRTAB) was established prior to adoption of the 2012 Comp Plan to help the Town and County understand the impacts of development on wildlife. NRTAB will gather baseline data and monitor the impacts of growth on "wildlife, wildlife habitat and wildlife mobility." This information will be used to shape regulations that result from policies 1.1.b, 1.1.f, and 1.1.g

Policy 1.1.f: Require mitigation of unavoidable impacts to habitat

Where impacts cannot be avoided the, 2012 Comp Plan envisions using mitigation. Since the impacts are largely unknown, there is no plan for mitigation at this time.

Policy 1.1.g: Encourage restoration of degraded areas

The Town and County will work with private and public land owners and managers to identify degraded areas with wildlife habitat or connectivity potential and direct off- site mitigation to these areas.

State Lands Management

State owned lands face problems similar to those identified for private lands where wildlife habitat management is not a priority. State lands administered by the Office of State Lands and Investments have not applied stipulations to leases to protect sage-grouse breeding and nesting habitat and other crucial wildlife habitat until just recently and only on new leases for energy development and other resource development activities. In the past the legislative mandate to manage these lands for the greatest return to the schools of Wyoming was strictly interpreted and protective measures for wildlife were not included in state lease agreements. In the USRBCA this mandate can rarely be met by traditional means, e.g. leasing grazing rights. Consequently, the State Land Board is under pressure to increase its financial return by selling their lands for development. As such, private and state lands in the USRBCA face similar pressures with the

same potential impacts to sage-grouse and wildlife in general—development with a loss of habitat.

There are currently two 640-acre parcels of land within GTNP that are owned by the State of Wyoming. One parcel is in core sage-grouse habitat and the other is in occupied sage-grouse habitat. The Department of Interior (DOI) is working with the State to acquire the land for inclusion in GTNP. The acquisition by the DOI would ensure the continued management of the land as undeveloped sage-grouse habitat.

Both private and state lands need to be viewed in terms of their proximity to existing sage-grouse habitat, particularly critical areas such as leks, nesting and early brood rearing areas and winter range. Even well planned development results in habitat loss, fragmentation and degradation. The impact of development extends well beyond the building envelope or the road corridor and these off-site impacts associated with development can have a significant adverse impact on the local sage-grouse population depending on the nature of that development.

It is therefore incumbent that the USRBCA sage-grouse conservation plan addresses the disposition and management of private and state owned lands, particularly those providing sage-grouse habitat values. The execution of this component of the conservation strategy will likely require more managerial awareness and involvement than biological action. It is important the land management agencies recognize the importance of sage-grouse habitat as a component of the whole issue of protecting crucial wildlife habitat in these land management decisions and work to avoid conflicts if possible and minimize and mitigate impacts that are unavoidable.

The importance and implementation of this strategy will vary within the USRBCA. The most critical locations are within Jackson Hole and the Gros Ventre River valley because they harbor resident populations of sage-grouse. The two other areas of concern, Bondurant Basin and Star Valley appear to provide seasonal habitat for sage-grouse but critical habitats have not been identified. Should it be found that either or both of these areas support resident populations of sage-grouse, or it is determined that they could benefit or be impacted by development, then they should receive more management attention.

Farming and Pesticides

In this portion of Wyoming, "farming" is primarily limited to cropland producing alfalfa and grass hay along some streams and rivers and in the valley floors of Jackson Hole and Star Valley where irrigation is possible. In Star Valley most of the sagebrush habitat in the valley floor and foothills was converted to farmland with the major crops being grass hay, alfalfa, oats and oat hay, and barley. Agricultural land (dry land and irrigated) currently comprise a minimal percentage of the landscape in Jackson Hole, the Gros Ventre valley, and the Hoback Basin. Irrigated pasture makes up the majority of the non-cropland sites on private lands. Almost all farmland in Star Valley and the Hoback Basin is privately owned. Farmlands that raise alfalfa or

mixed grass hay may be beneficial to sage-grouse since these hay crops provide a valuable food source to sage-grouse during the summer.

In Jackson Hole and the Gros Ventre Valley much of the private lands that were farmed have been acquired by the Park Service, the U.S Fish and Wildlife Service or the Forest Service in the last 50 years. Many of the impacts from farming occurred following homesteading of the area and old hayfields and farm lands still persist. These areas are thought to provide limited useable habitat for sage-grouse since the agronomic grasses which dominate these sites are not particularly valuable to sage-grouse unless there is a remnant forb component such as alfalfa or clover. Sagebrush habitats that had the best soils were converted to hay and grain crops. Cropland in Grand Teton National Park and the National Elk Refuge has been allowed to return to "native" rangeland and sagebrush has expanded into some of these areas from adjacent sagebrush habitats. This "go back" land holds potential for enhancement through seeding to increase native plant diversity and quality, which could benefit sage-grouse. The USRBWG has provided support to the Kelly Hayfields restoration, Grand Teton National Park.

Pesticides (herbicides, insecticides and rodenticides) are used to a limited extent in the USRBCA area for a variety of purposes and have been identified as a possible influence on sage-grouse. However, it is not believed that pesticides are currently a major issue for sage-grouse under existing application practices. No direct research on the effects of the field applications of currently used pesticides on sage-grouse has been conducted in Wyoming. Toxicity under laboratory conditions does not equate well to wildlife hazards under field conditions. Sage-grouse exposure and potential risk are dependent on numerous factors, such as application rate, pesticide formulation, and timing of treatment. Pesticide impacts on sage-grouse in the field are difficult to quantify. This is exacerbated by the fact that these effects are believed to be sub-lethal, they may predispose animals to predation or reduce reproductive success, but they do not result in direct mortality. Widespread use of pesticides to control grasshoppers and Mormon crickets has occurred over the years in Wyoming. Mosquito abatement programs are common and fairly widespread on agricultural lands near urban areas and in some rural areas. These programs include the use of biological and chemical control agents. It is unknown if these mosquito control programs can provide some measure of protection from West Nile Virus by reducing the populations of the disease carrier. Application of the pesticides in early summer can suppress insect populations that sage-grouse and other birds depend upon for brood production and any proposal should avoid important sage-grouse brood rearing habitat.

Some treatment techniques for invasive plants such as knapweed, Canada thistle, and leafy spurge involve spraying sagebrush habitats to remove the noxious weeds with herbicides. These treatments tend to be spot treatments which if done correctly should not eliminate sagebrush. However, some sagebrush and bitterbrush die-offs have been observed along the Gros Ventre Road north of the town of Kelly, which apparently is the result of repeated weed spraying (Geneva Chong, USGS pers.com.). Large-scale treatments using a broadcast application of herbicides in sagebrush habitats could have a negative local impact on sage-grouse. Other herbicides can result in a reduction of forbs and may be locally significant, but not widespread.

Sagebrush treatments to promote forage for livestock are less common today than in the past when large acreages were treated, but any sagebrush treatments in occupied sage-grouse habitats in the USRBCA should be carefully evaluated and planned to avoid the loss of important sage-grouse habitat.

Parasites and Diseases

Sage-grouse are known to harbor a number of parasites and diseases (Christiansen and Tate 2011). Most of these have evolved with sage-grouse over time. Many are not a serious concern unless the sage-grouse are stressed or concentrated, e.g. coccidiosis. Diseases and parasites that affect sage-grouse include various bacteria, protozoa, worms and ecto-parasites. In general, diseases and parasites are not believed to be a major contributor to sage-grouse declines with the possible exception of West Nile Virus (WNV).

West Nile Virus may pose a serious threat to the sage-grouse, particularly in northeast Wyoming where the disease has been documented as having a serious impact (Walker and Naugle 2011). Naugle et al. (2004) found that WNV contributed to a 25% decline in the survival of four populations of marked sage-grouse in 2003. In one northeast Wyoming population, Walker et al. (2007) determined survival of marked sage-grouse was only 25%. In 2004, Naugle et al. (2005) found that late summer female survival was 10% lower in four populations with confirmed WNV than in eight populations without WNV. No evidence of survival by sage-grouse exposed to the WNV was found until 2005. Some female sage-grouse captured in northeast Wyoming in the spring of 2005 and 2006 had antibodies indicating they survived exposure (10.3% and 1.8% respectively) (Walker et al. 2007).

Current evidence suggests summers are too cool to support West Nile viremia in the USRBCA and the threat appears to be low. No sage-grouse have been documented with WNV in the USRBCA. However, as recently as the summer of 2013, of 73 Teton County mosquito pools tested, one was positive for WNV (Wyoming Department of Health 2013). Therefore, the full impact of this disease has yet to be realized and more monitoring and research is needed to determine sage-grouse exposure and survival; identify species that serve as reservoir hosts; and identify options to mitigate the effects of the disease. The effects of climate change and global warming are also unknown but could alter environmental conditions allowing the spread of a disease such as WNV to areas and bird populations currently not vulnerable to the disease (Christiansen and Tate 2011).

NOT APPLICABLE

Hunting

The WGFD closed the USRBCA (Management Area 1 and 2) to sage-grouse hunting in 2000, although the core area in Grand Teton National Park and the National Elk Refuge has been closed to hunting since these lands were acquired by the National Park Service and U.S. Fish and Wildlife Service. Given that sage-grouse habitat and numbers are limited in the USRBCA and the area actually open to hunting and past harvest was minimal, it is not anticipated the closures will result in increasing populations. Prior to 2000, a few hunters were afield in the Gros Ventre drainage and the Hoback Basin but the annual harvest survey conducted by the Wyoming Game and Fish Department likely did not adequately sample the few hunters that hunted sage-grouse in the USRBCA and the harvest data are somewhat suspect. From 1990 to 1999 the Wyoming Game and Fish Department annual harvest surveys reported the harvest ranged from 176 to 1,135 birds and the number of hunters ranged from 120 to 315. The low end of the reported harvest and hunter numbers is probably more accurate.

CONSERVATION GOALS AND OBJECTIVES

The goal of this conservation planning effort is to maintain viable populations of sage-grouse in Jackson Hole, the Gros Ventre Valley, Hoback Basin and the Salt River drainage. This effort implies a land management philosophy based on no net loss of sagebrush habitats and it requires further work to determine factors which may be limiting these populations and a commitment to effectively ameliorate those limiting factors. It would be unacceptable from both a local, state, and national perspective to lose the population of sage-grouse in Jackson Hole that lives in Grand Teton National Park and the National Elk Refuge. It may be more problematic to retain the other three populations because they are so small. Little is known about the sage-grouse in the Hoback Basin and Star Valley. Landownership patterns and jurisdictional differences may constrain management options for the Star Valley population, in particular. If we are successful in implementing this conservation plan, we will have fulfilled a commitment made in the state plan and done our part to forestall the need to list sage-grouse under the Endangered Species Act.

The USRB Conservation Plan is presented with conservation goals, objectives, ongoing commitments and recommended actions (Table 8) and categorized by factors affecting sage-grouse in the conservation area. Some recommended actions are essentially best management practices. Agency and industry sector commitments that were already underway as of the writing of the conservation strategy are indicated in Table 8. Fulfilling all listed commitments by the responsible parties will be contingent on adequate funding and resources.

Proposed actions have organizations or sponsors identified who would be the logical leads to develop and implement the action based on legal jurisdictions, landownership, and organizational agendas. These actions will undoubtedly involve many partnerships as will the funding mechanisms required to accomplish these actions. However, these are suggested or

recommended actions and are not binding on any of the entities identified in this section of the plan.

The strategy for sage-grouse conservation in the USRBCA is to meet the goals set forth below through the development and implementation of action items for specified objectives. These actions items are based upon the general biology of the species, their seasonal habitat requirements specific to the area, and the potential and documented impacts and issues associated with long-term management of the species. Some objective and management actions may be valid for several conservation goals.

Actions taken to alter sagebrush and/or improve sage-grouse habitat should consider not only the changed/treated area, but also the position of that area within the matrix of habitats surrounding the area and the role of that area for sage-grouse within the entire USRBCA. The table covers five Conservation Goals: (1) Maintain, enhance, or restore sage grouse habitat to maintain or increase the abundance and distribution of sage-grouse, and improve population and habitat monitoring within the USRBCA; (2) Manage factors contributing to direct mortality of sage-grouse; (3) Identify private and state owned lands with existing or potential sage grouse habitat value and minimize future impacts to sage grouse resulting from either transfer of ownership and/or changes in land use practices; (4) Contribute to sage-grouse research; and (5) Inform and educate the public, landowners, government agencies and others within the USRBCA about issues related to sage-grouse conservation. The guidelines on seasonal habitat requirements for sage-grouse appear in Appendix 1. Current Conservation Documents are referenced in the grazing appendix (Appendix 2).

Land Management Agencies are: Bureau of Land Management (BLM), Land Trusts, National Park Service (NPS), State of Wyoming, US Fish and Wildlife Service (USFWS), and US Forest Service (USFS). Other entities include: local governments (for example the Natural Resource Technical Advisory Board (NRTAB) for the Jackson/Teton County Comprehensive Plan Revision); Craighead Beringia South (CBS); Idaho Fish & Game (IDFG); Natural Resource Conservation Service (NRCS); Teton Conservation District (TCD); universities; US Geological Survey (USGS); Wyoming Game & Fish Department (WGFD); and Wyoming Sage-grouse Conservation Fund.

Table 8. Commitments and recommended actions.

CONSERVATION GOAL 1: Maintain, enhance, or restore sage-grouse habitat to maintain or increase the abundance and distribution of sage-grouse, and improve population and habitat monitoring within the USRBCA.

Habitat Management	Action	Responsible Parties	Time Schedule	Funding Source
	Objective 1. Manage vegetative communities to provide for lek, nesting and early brood rearing habitats			
	Management Actions:			
Commitment	1) Inventory and map leks, nesting and early brood rearing habitats.	WGFD, Land Management Agencies, NRCS	Ongoing	WGFD, Land Management Agencies, NRCS;
Recommended Actions	1) Establish baseline conditions on all project areas prior to implementation.	WGFD, Land Management Agencies, NRCS	TBD	TBD
	2) Manage nesting and early brood rearing habitats to retain tall sagebrush stands providing 15-25% canopy cover within 4 miles of a lek or where identified as nesting and brood rearing habitats.			
	3) Identify those critical habitats that are at risk or are limiting sage-grouse population growth or stability. Protect critical habitats from actions which would fragment the largest, intact sagebrush stands.			
	4) When necessary to restore functioning sagebrush habitats, implement appropriate techniques (prescribed fire, range pitting, aerating, chaining, livestock grazing, etc.) It is essential to recognize that sage-grouse need extensive areas of mature sagebrush for nesting habitat, and that hens have a strong fidelity to nesting areas and yearling hens tend to nest in the same general area as their natal nest site. [BMP citation]			
	5) Where possible, manage winter/early spring domestic livestock and other ungulate grazing in nesting habitats to maintain residual grass cover.			
	Objective 2. Manage vegetative communities to provide for late brood rearing habitats.			
	Management Actions:			

Commitment	1) Inventory and map late brood rearing habitats.	WGFD, Land Management Agencies, NRCS; all actions	Ongoing	WGFD, Land Management Agencies, NRCS; all actions
Recommended Actions	1) Establish baseline conditions on all project areas prior to implementation.	WGFD, Land Management Agencies, NRCS; all actions	TBD	WGFD, Land Management Agencies, NRCS; all actions
	2) Manage late brood rearing habitat to maintain a diversity of forbs, insects and appropriate sagebrush cover.			
	3) Identify need for improvements to late brood rearing habitats.			
	4) Create a mosaic of open patches of grasses and forbs in large areas of dense sage not used as nesting habitat.			
	Objective.3. Manage vegetative communities to provide for winter habitat.			
	Management Actions:			
Commitment	1) Inventory and map winter habitat.	WGFD, Land Management Agencies, NRCS; all actions	Initial effort completed 3/31/07	WGFD
	2) Continue to monitor changes in winter habitat distribution.			
Recommended Actions	1) Recognize that winter sage grouse habitat for the USRB population is strongly limiting and warrants consideration in land use and vegetation treatment decisions. 2) Establish baseline conditions on all project areas prior to implementation.	WGFD, Land Management Agencies, NRCS; all actions	Ongoing	WGFD, Land Management Agencies, NRCS; all actions
	3) Emphasize the maintenance and protection of tall sagebrush (11-31 inch high) stands with >15% canopy cover and/or windswept topographic features with low sagebrush (i.e. black sagebrush) as potential winter habitat.			
	Objective 4: Habitat connectivity			
	Management Actions:			
Recommended Actions	1) Identify potential and existing movement corridors within and between the USRB population and surrounding populations.	WGFD, Land Management Agencies, IDFG, NRCS; all actions	TBD	TBD
	2) Conduct landscape-scale analyses, with sage grouse habitat in mind, when evaluating sagebrush for management needs and potential treatments.			
	3) Consider marking birds from appropriate leks in an attempt to identify movement corridors and to the extent possible maintain movement corridors between habitats in the Gros Ventre, Union Pass, Hoback Basin, Jackson Hole, Star Valley, and southeast Idaho as discovered and documented.			

	4) Maintain Bacon Ridge/Breakneck Flats and lower Fish Creek sage-grouse winter use areas.			
	5) Coordinate habitat work with the Idaho Fish and Game Dept. to maintain/improve connectivity between occupied habitat in Star Valley and Southeast Idaho.			
	6) Conduct genetic analysis on these apparently isolated sage-grouse populations to determine if there is adequate genetic diversity in the populations in the USRBCA and if there is gene flow between populations.	CBS, USGS, U. North Texas	Ongoing	Various
	Objective 5: Mineral extraction, infrastructure development, timber harvest			
	Management Actions:			
Recommended Actions	1) Avoid placing roads, bike paths, gravel pits, gold mines, equipment maintenance areas, and tall structures within 4 miles of leks or in identified important breeding and winter habitat. Minimize disturbances such as logging, hauling or mining near important habitats. In Core areas allow only 1 well pad or disturbance feature per 640 acres within 4 miles of a lek and limit disturbance to 5% of suitable habitat.2) On federal lands provide a no surface occupancy stipulation on lands within 0.6 miles of a lek to protect breeding birds from disturbance and to protect sage-grouse using the lek	USFS, WGFD, NPS, USF&WS, BLM	TBD	TBD
	Objective 6. Restoration of altered habitats			
	Management Actions:			
Recommended Actions	1) After fires consider using native seed plantings to promote establishment of grass and forbs to reclaim temporary roads, fire lines, and other disturbed sites if necessary.	USFS, WGFD, NPS, USF&WS, BLM; all actions	TBD	TBD
	2) Reclaim abandoned/closed roads, pipelines, well pads, gravel pits using native seed plantings to reestablish grasses and forbs. Establish sagebrush on these sites where possible using appropriate techniques.			
	3) Support Kelly hayfields restoration to native sagebrush grassland plant community in Grand Teton National Park.		Ongoing	WY Sage-grouse Conservation Fund
	4) Promote restoration of native sagebrush habitats that were converted to agricultural lands from past and current farming practices.			

	5) Treat noxious weeds and invasive plants as part of restoration and rehabilitation efforts.		Ongoing	
	6) Promote good irrigation practices on hay meadows and pastures to maintain forb composition.			
	7) Encourage grazing practices which promote and maintain forb composition on irrigated meadows and upland sites.			
	8) Address soils, grade, and native species composition in restoration projects. When rehabilitation (restoration?) is necessary, the first priority is protection of the soil resource. Use appropriate mixtures of sagebrush, native grasses, and forbs that permit disturbed areas to recover to a sagebrush-perennial grass habitat.			
	9) Consider management of vegetation related to irrigation ditches to restore to sagebrush grasslands.			
	Objective 7. Promote healthy sagebrush communities with native species diversity. Use recommendations in the Wyoming Executive Order (Appendix EO).			
	Management Actions:			
Recommended Actions	1) Encourage a diverse age structure of sagebrush, recognizing that sage-grouse require extensive stands of mature sagebrush for nesting and winter habitat.	USFS, WGFD, NPS, USF&WS, BLM; all actions	TBD	TBD
	2) Provide adequate amounts of mature sagebrush at the project and landscape scale in occupied sage-grouse habitats.			
	3) Identify the extent of conifer encroachment into sage grouse habitats and develop projects to remove conifers where feasible.			
	4) Treat sagebrush in patches rather than contiguous blocks. If treatments are necessary, encourage treatments which result in a mosaic of treated and untreated areas.			
	5) Additional treatments in adjacent areas should be deferred until the previously treated area again provides suitable sage-grouse habitat.			
	6) Avoid removing sagebrush adjacent to summer sage-grouse foraging areas along riparian zones, meadows, lakebeds and farmland.			
	7) In order to improve brood-rearing habitats, use appropriate treatments in areas with relatively high shrub cover (>30%) and a poor herbaceous understory component.			
	8 Monitor the effectiveness of vegetation treatments for sage grouse habitat improvement.			
	9) Develop and maintain cumulative records for all vegetation treatments to determine and evaluate site specific and cumulative impacts to sage-grouse habitats and identify best management practices for successful vegetation treatments.			

	<u>Objective 8</u>: Promote cooperation between agencies with different management objectives and practices through development of consistent goals and application sage grouse habitat management guidelines (see all other objectives)			
	<u>Management Actions:</u>			
Recommended Actions	1) Consider sage-grouse habitat needs in fuel reduction programs on federal lands.	USFS, WGFD, NPS, USF&WS, BLM, WGFD; all actions	ongoing	TBD
	2) Consider sage-grouse habitat requirements in the implementation of the Final Elk-Bison Management Plan and EIS on lands in GTNP and the NER.			
	3) Consider sage-grouse habitat requirements in the implementation of the state elk feed ground program.			
	4) Incorporate sage-grouse habitat protection and management guidelines in the USRB sage-grouse plan into federal agency land and resource management plans.			
	<u>Objective 9.</u> Promote sage grouse habitat management and protection on private lands			
	<u>Management Actions:</u>			
Recommended Actions	1) Work with willing private landowners to identify, manage and protect important sage-grouse habitats.	Teton Conservation District, NRCS, Teton, Lincoln and Sublette Counties, WGFD, NRTAB	TBD	TBD
	2) Work with the county planning departments to incorporate use of this document into land-use plans (e.g., development density, open space).			
	3) Insure that the revision of the Teton County Comprehensive Plan and the Natural Resource Overlay recognizes important sage-grouse habitat in Teton County by using sage grouse as one of the focal species for sagebrush habitat.			
	4) Encourage local land trusts to prioritize and acquire conservation easements in sage-grouse habitat which also allows proactive habitat management to achieve the goals of the easements.	JH Land Trust and others	Ongoing	
Population Monitoring	**Action**	**Responsible Parties**	**Time Schedule**	**Funding Source**
	<u>Objective 1.</u> Monitor sage-grouse populations to assess population trends and effectiveness of conservation efforts.			
	<u>Management Actions</u>			
Commitments	1) Monitor all of known leks each year to ensure an adequate sample to determine population trends. All known leks should be "counted" each year to provide a more intensive assessment of population trends. Results are published annually in the USRBCA Sage-grouse Completion Report.	WGFD, USFS, NPS, NER	Ongoing	WGFD, USFS, NPS, GTNP
	2) Continue to search for new leks in the USRBCA each spring.			

	3) Complete a risk assessment and sensitivity analysis to determine the viability of the population and the factors which drive the population.	Dr. David McDonald, University of Wyoming, WGFD	Completed	BLM, Wyoming Governor's Sage-grouse Fund, WGFD
Recommended Actions	1) Conduct a landowner survey to assess grouse distribution and status on private lands and on their grazing leases on public lands in the Salt River drainage and the Hoback Basin.	WGFD, Conservation Districts, NRCS	TBD	WGFD
	2) Educate public on importance of lek counts and why state agencies need to know where a lek is located (i.e. private lands).			
Habitat Monitoring	**Action**	**Responsible Parties**	**Time Schedule**	**Funding Source**
	Objective 1. Monitor sage-grouse habitat			
	Management Actions			
Commitments	1) Map lek perimeter boundaries to ensure adequate stipulation buffers are applied to protect breeding habitats.	WGFD, NPS	Ongoing	WGFD,NPS
	2) Identify and map winter habitats to enable development planning and mitigation actions in maintaining the integrity of these critical areas.	WGFD, USGS	Ongoing	WGFD
	3) Develop a winter habitat selection model based on sagebrush occurrence and topography supported by winter sage-grouse locations.		TBD	
Recommended Actions	1) Request the WGFD, NPS, BLM, NRCS, USFS, and USGS to create and maintain a GIS data layer that encompass all of the habitat treatments in potential sage-grouse habitat (sagebrush and mountain shrub communities) that have taken place basin-wide for use in assessing cumulative impacts and guidance on future habitat treatments.	WGFD, NPS, USF&WS, USFS,USGS	TBD	TBD
	2) Implement monitoring plans to determine the effectiveness of vegetation treatments.	WGFD, NPS, USF&WS, USFS,USGS, NRCS	TBD - all	TBD - all
	3) Maintain cumulative records for invasive plants treatment and prevention programs to evaluate site specific and cumulative impacts to sage-grouse habitats.			
	4) Request land managers earmark future funds for personnel to coordinate habitat data collection, maintain GIS databases, and deliver GIS based information to support management programs and project development.			
Fire Management	**Action**	**Responsible Parties**	**Time Schedule**	**Funding Source**
	Objective 1: Consider sage grouse habitat needs in the management of wildfire and prescribed fire			

	Management Actions:			
Commitments	1) Coordinate with wildlife biologists and fire managers to reduce adverse effects of prescribed fires and wildfires on sage grouse habitat.	USFS, WGFD, NPS, USF&WS, BLM; all actions	ongoing	TBD
	2) Monitor pre- and post-fire coverage of sagebrush in areas burned in wildfires and treated with prescribed fires.			
Recommended Actions	1) Develop and implement strategic fire management plans which identify preventative actions needed to prevent unacceptable wildfire impacts and address sage-grouse habitat needs in nesting, early brood rearing, and winter habitat for the characteristically small sage-grouse populations in the USRBCA.	USFS, WGFD, NPS, USF&WS, BLM; all actions	Ongoing	TBD
	2) Burn plans should safeguard occupied sage grouse habitats. Managers should develop fire management objectives which recognize sage-grouse nesting and winter habitat flammability and propose mitigation measures to preserve habitats. In occupied or potential sage-grouse habitat, fire management objectives should recognize that fire generally burns the better sage-grouse nesting and winter habitat.			
	3) Consider the use of prescribed fire to enhance sagebrush habitat for sage grouse following habitat guidelines (Appendix EO) that improve the forb component in the herbaceous understory if understory is inadequate to meet sage-grouse needs.			
	4) Treat (spray, mechanical reduction) non-native plant species after prescribed fires or wildfires. Evaluate the need to reseed native plants and treat invasive weeds as rehabilitation measures in large (> 40 acres) areas burned by wildfires.			
	5) Consider the use of fire to remove conifers encroaching into sagebrush habitats where feasible.			
	6) Rest burned areas from cattle grazing for two or more years.			
	7) Protect patches of sagebrush within burn area perimeters from further disturbance and manipulation.			
Weather	**Action**	**Responsible Parties**	**Time Schedule**	**Funding Source**
	Objective 1. Encourage the use of habitat management practices that mitigate adverse impacts of weather.			
	Management Actions:			
Recommended Actions	1) During periods of drought, adjust grazing practices and stocking rates to reduce impacts to sage-grouse nesting and brood rearing habitats. Build drought contingency plans into allotment management plans.	USFS, WGFD, NPS, USF&WS, BLM , NRCS all actions	TBD	USFS, WGFD, NPS, USF&WS, BLM , NRCS all actions

Invasive Plants	Action	Responsible	Time Schedule	Funding Source
	Objective 1. Prevent the introduction of invasive plants in sage grouse habitat and promote control of infestations.			
	Management Actions:			
Recommended Actions	1) Maintain records for invasive plant treatment and prevention programs to evaluate site specific and cumulative impacts to sage-grouse habitats.	UW Cooperative Extension Service, Weed and Pest District, Teton Conservation District – all projects	TBD - all projects	TBD - all projects
	2) Identify habitat treatments/invasive weed control projects that have occurred on private lands in Conservation Districts and evaluate their effectiveness. Identify future weed control projects.			
	3) Develop incentives for landowners to control undesirable or invasive plant species to improve sage-grouse habitat.			
	4) Identify appropriate resource materials and offer to support any requests for financial assistance made by the local Weed and Pest Districts and the Jackson Hole Weed Management Association (JHWMA). 5) Conduct rangeland health assessments and manage for resilience and resistance to invasion			
	Objective 2. Proactively manage invasive and noxious plants in sage-grouse habitats through coordination with USRBWG, land management agencies, Jackson Hole Weed Management Association (JHWMA), and the County Weed and Pest Districts.			
	Management Actions:			
Commitments	1) Identify/map areas with invasive weed problems	USFS, NPS, USF&WS, WGFD, County Weed and Pest Districts, Teton Conservation District, JHWMA, UWY	Ongoing	USFS, NPS, USF&WS, WGFD, Weed and Pest District, Teton Conservation District, USRB LWG Project Funds
	Develop a list of invasive plants including spotted knapweed, leafy spurge, cheat grass and other weeds affecting sagebrush communities and sage-grouse habitats in the USRBCA. 1. Conduct Rangeland health assessments and monitoring			
Recommended Actions	1) Aggressively treat invasive species. Manage and treat areas with limited weed problems to decrease spread of plants.	USFS, NPS, USF&WS, WGFD, County Weed and Pest Districts, Teton Conservation	TBD	USFS, NPS, USF&WS, WGFD, Weed and Pest District, Teton
	2) Develop a plan to control the spread of undesirable plants that may result from construction activities, new road and pathways construction, and subdivision development.			

	3) Federal, state, county and private landowners should evaluate the potential for a cheatgrass infestation before implementing any vegetation management action (i.e. consider the timing, and size of area for vegetation treatment etc.).	District, JHWMA		Conservation District, USRB LWG Project Funds
	4) Work with Jackson Hole Weed Management Association (JHWMA), to educate the public, landowners, developers, and land mangers on need to prevent establishment and spread of noxious weeds. Develop educational materials that incorporate best management practices for controlling noxious weeds in sage-grouse habitats.			
	5) Encourage continued funding from Teton Conservation District, JHWMA, and County Weed and Pest Districts for control of noxious weeds and cheat grass.			
	7) Request expanded funding for state and federal support for weed control programs, including the Teton Conservation District, JHWMA, County Weed and Pest Districts, NPS, USFWS, USDA Forest Service and Farm Services Administration (FSA).			
	8) Address invasive weed management in federal agency land use plans.			
	9) Request County Weed & Pest Districts to add cheatgrass to their list of invasive weeds.			
	10) Encourage land management practices which optimize resilience. Continue monitoring.			
Conflicting Wildlife Management	**Action**	**Responsible Parties**	**Time Schedule**	**Funding Source**
	Objective 1. Avoid or minimize impacts on sage grouse populations and habitat when developing management strategies or actions for other wildlife species that use sagebrush habitat.			
	Management Actions:			
Commitments	Relative to sensitive species: a) Maintain sensitive species and habitat components in functional ecosystems.	WGFD, BLM, USFWS, NPS, USFS	Ongoing	BLM, USF&WS, NPS, USFS
	b) Ensure sensitive species are considered in land management decisions.			
	c) Strive to prevent a need for species listing under the Endangered Species Act.			
	d) Prioritize needed conservation work with an emphasis on habitat protection and enhancement.			
Recommended Actions	1) Formally engage local, state and federal agencies to incorporate the elements of the USRB Sage-grouse Conservation Plan in habitat planning and management activities.	USRBWG, Teton County, USFS, NPS, USF&WS, BLM	December 2008 - 1 yr after plan completion	USRBWG, Teton County, USFS, NPS, USF&WS, BLM

	2) Adjust agency sagebrush habitat management guidelines to consider and utilize the recommendations for sage-grouse habitat management in the sage-grouse habitat section of this table. Generally follow the sage-grouse habitat guidelines by Connelly et al. (2000) unless specific or more current information generated locally suggests otherwise.	BLM, USFS, USF&WS, WGFD all actions	TBD	BLM, USFS, USF&WS, WGFD all actions
	3) WGFD and federal land management agencies should strive to maintain big-game populations at mutually agreed upon management objectives that provide adequate habitat for sage-grouse.	BLM, USF&WS, USFS	Ongoing	BLM, USF&WS, USFS
	4) Monitor impacts of wild ungulate and livestock grazing on key brood rearing areas if problems are suspected.			
Residential Land Use and Infrastructure Development	**Action**	**Responsible Parties**	**Time Schedule**	**Funding Source**
	<u>Objective 1.</u> Work with local, state, and federal governments and private landowners to promote positive land management and minimize any negative impacts to sage grouse and their habitats.			
	<u>Management Actions:</u>			
Commitments	1) Provide sage-grouse habitat information to county governments to encourage conservation of important sage-grouse habitats through their land use planning process and county zoning regulations.	WGFD	TBD	WGFD
	2) Work with NPS, Airport Board, and FAA on the Jackson Hole Airport Wildlife Hazard Management Plan to identify wildlife conflicts with airport operations and suggest alternatives to lessen conflicts and/or avoid impacts to the sage-grouse population using the airport as a breeding area and summer brood rearing habitat.	USRBWG, NPS, WGFD, , FAA	Ongoing	USRBWG, NPS, WGFD, FAA
Recommended Actions	1) Consider including appropriate sage-grouse habitat conservation guidelines in zoning laws and regulations that are applied to subdivisions in and adjacent to sage-grouse habitat.	County Governments, USRBWG	TBD	County Governments
	2) Develop sage-grouse habitat conservation guidelines for incorporation in subdivision covenants.	USRBWG	TBD	USRBWG
	3) Land use planners (federal, state and county) should consider sage-grouse and their habitat needs when reviewing development projects.	County Governments, NPS, USF&WS, USFS, BLM,WGFD all actions	TBD	County Governments, NPS, USF&WS, USFS, BLM,WGFD all actions

	4) Work with county government to add sage-grouse to their list of sensitive species.	USRBWG	February 2014	USRBWG
Recreation	**Action**	**Responsible Parties**	**Time Schedule**	**Funding Source**
	Objective 1. Manage impacts on sage grouse where recreational activities are concentrated in important habitat.			
	Management Actions:			
Commitments	1) The Wyoming Game and Fish Department will educate the public on proper viewing etiquette to prevent disturbance.	WGFD	Ongoing	WGFD
	2) Manage viewing opportunities at leks (e.g. Moulton West) in Grand Teton National Park to minimize human disturbance.	NPS	Ongoing	NPS
Recommended Actions	1) Manage recreation to minimize human disturbance in critical habitats and time periods (leks, nesting, early brood-rearing and winter habitats).for sage grouse.	WGFD, BLM, USFS, Park Service	Ongoing	WGFD, BLM, USFS, Park Service
	2) Use education and signage to help keep the public informed of the need to avoid disturbing active grouse leks.			
	3) Limit permitted recreational events to protect important seasonal habitats used by sage-grouse.			
	4) Monitor the effects of public recreation on breeding, nesting and wintering sage-grouse on public lands. If significant impacts are documented, agencies should implement mitigation measures to address problem areas.			
Livestock Grazing	**Action**	**Responsible Parties**	**Time Schedule**	**Funding Source**
	Objective 1. Promote livestock grazing practices that maintain healthy sagebrush habitats on public and private lands (Appendix 2).			
	Management Actions:			
Commitments	1) Develop and distribute recommended livestock grazing practices that benefit producers by promoting a sustainable livestock industry and maintaining and enhancing sage-grouse habitat.	Conservation Districts, WGFD, UW Extension and NRCS, BLM	Ongoing	Conservation Districts, WGFD, UW Extension and NRCS, BLM
	2) Develop and present a workshop series that promotes livestock grazing practices that benefit livestock and sage-grouse			
	3) Promote research to evaluate the effects of different grazing practices on sage-grouse habitat and use by sage-grouse.			

Recommended Actions	1) Encourage landowners to enroll in the NRCS Grazing Land Initiative Program in conjunction with implementing recommended grazing practices in sage-grouse habitat.	NRCS	Ongoing	NRCS
	2) Advocate for continued funding from the Wyoming Governor's Sage-grouse Conservation Program to support livestock grazing programs that benefit sage-grouse and producers.	Sage Grouse Working Groups	Ongoing	Wyoming Governor's Sage-grouse Conservation Fund
	3) Avoid season-long grazing. Promote rotational grazing systems which provide periodic rest for pastures for a full growing season.	WGFD,BLM, USFS,NRCS,WDA, Conservation Districts	TBD	WGFD,USF&WS (LIP), NRCS, BLM, USFS, and Conservation Districts
	4) Encourage the development of forage reserve pastures (grass banks) to allow other allotments to be treated and rested appropriately.			
	5) Seek funding to provide incentives to ranchers to modify grazing systems to improve sage-grouse habitat. Seek state monies to match federal funding available through the NRCS.			
	6) Identify areas where fences are negatively impacting sage-grouse and modify, move, or remove problem fences.			
	7) Consider the habitat requirements of sage-grouse and the sage-grouse habitat guidelines by Connelly et al. (2000) in the development of allotment management plans, grazing plans, and vegetation treatments to increase forage for livestock, while considering ecological, economic**,** and cumulative impacts of the proposed projects.			
	8) Promote grazing practices that result in the retention of residual herbaceous cover to provide for adequate nesting habitat in the following spring (4 inch minimum for residual herbaceous vegetation after grazing).			
	9) Grazing management following sagebrush treatments or manipulations should be designed to benefit long-term sagebrush diversity and ecosystem health.			
	<u>Objective 2.</u> Consider the impacts wild ungulate and livestock grazing has on sage grouse habitat needs (Appendix 1).			
	<u>Management Actions:</u>			
Recommended Actions	1) Manage the timing, stocking, and utilization of livestock grazing to minimize the impacts on sage-grouse.	BLM, USFS, WGFD,NPS, USF&WS, NRCS	TDB	BLM, USFS, WGFD,NPS, USF&WS, NRCS
	2) Avoid structural range improvements (e.g., fences) on or near leks.			
	3) Avoid concentrating livestock near leks during the breeding season, and in nesting and early brooding habitat.			

	4) Avoid management practices that concentrate wild ungulates near leks and in winter, nesting and early brood rearing habitat			
	5) Manage livestock timing and utilization levels to maintain and enhance brood rearing areas (e.g. wet meadows, springs, riparian habitats)			
	6) Consider sage grouse needs when developing allotment management plans and annual operations instructions.			
	7) Evaluate the potential effects of the elk and bison herd management on sage-grouse nesting and early brood-rearing habitat in the USRBCA.			
	8) Evaluate the effects of changes in numbers and distribution of wintering elk on sagebrush habitat in association with proposed changes to elk feedground management plans (if changes are proposed).			
State Lands Management	**Action**	**Responsible Parties**	**Time Schedule**	**Funding Source**
	<u>Objective 1.</u> Encourage the Wyoming Office of State Lands and Investments board to adopt conservation measures to favor sage-grouse.			
	<u>Management Actions:</u>			
Recommended Actions	1) Adopt Wyoming EO 2011-5 and associated BMPs on State Lands for mining and oil and gas development to protect breeding habitat and winter habitat subject to valid existing leases.	Wyoming State Land Board	TBD	Wyoming State Land Board
	2) Apply the following stipulations to existing oil and gas leases in core areas covering state trust lands in Wyoming:			
	a) Avoid surface disturbance or occupancy within 0.6 miles of the perimeter of occupied sage grouse leks.			
	b) Avoid human activity between 8:00 PM and 8:00 AM from March 1 thru May 15 within 0.6 miles of the perimeter of occupied sage grouse leks;			
	c) Avoid surface disturbing activities and geophysical surveys in suitable sage grouse nesting and early brood-rearing habitat within 4 miles of an occupied lek or in identified sage grouse nesting habitat from April 1 to July 15.			
	d) Avoid human activity from November 15 to March 14 in designated important sage grouse winter habitat.			
	e) allow no more than 1 well pad per 640 acres and a maiximum of 5 % distrubance cap in core areas.			

	3) For grazing allotments on state land, require effective reclamation practices for disturbed sites minimize potential impacts of fences and other structures, provide effective water sources for wildlife, and provide bird escape ramps in stock water tanks.			
	4) Any sale or trade of public lands should consider the value of these lands for wildlife habitats including sage-grouse as part of any NEPA analysis and mitigation.			
	5) See EO 2011 -5 for stipulations in general habitat and subsequent land use olan revisions for Forest Service lands.			
Farming	**Action**	**Responsible Parties**	**Time Schedule**	**Funding Source**
	Objective 1. Promote farming practices which maintain or restore sagebrush habitats and, where possible, enhance sage-grouse brood-rearing habitat and summer foraging areas.			
Commitment	1) WGFD actively participates on the USDA State Technical committee to ensure that conservation and restoration of functioning sagebrush ecosystems are considered in Natural Resource Conservation Service (NRCS) and Farm Service Administration (FSA) programs and policies.	WGFD, NRCS,WDA	Ongoing	WGFD, NRCS, WDA
Recommended Actions	1) Work with other working groups to develop farming practices guidelines for sage-grouse which will be distributed to farmers by the Conservation Districts.	Conservation Districts, USRBWG all actions	TBD	Wyoming Governor's Sage-grouse Conservation Fund
	2) Promote farming operations that are compatible with the maintenance and enhancement of sage grouse habitat.	NRCS, Conservation districts actions	Ongoing	NRCS, Conservation districts actions
	3) Map suitable sage-grouse habitat on private lands and focus conservation and management efforts on areas where the most benefit can be realized (NRCS)			
	4) Develop incentives to reward the use of farming practices that maintain and enhance sage-grouse populations (NRCS).			
	5) Recommend that existing sagebrush stands not be disturbed on National Elk Refuge to meet farming objectives to increase forage production for elk and bison.	USF&WS	**TBD**	USF&WS
	6) Identify opportunities to restore sagebrush habitats in GTNP, NER and on private lands that were previously converted to farmland.	NPS, USF&WS	**TBD**	NPS, USF&WS
Energy/Mineral Development	**Action**	**Responsible Parties**	**Time Schedule**	**Funding Source**

	<u>Objective 1</u>. Develop energy and mineral resources and other related infrastructure in a manner compatible with maintenance and enhancement of sage-grouse populations and habitat.			
	<u>Management Actions</u>			
Commitments	1) All energy and mineral developments will be consistent with Wyoming Core Area policy.	BLM/USFS – all actions	Ongoing – all actions	Oil & Gas Companies – all actions
	<u>Objective 2.</u> Insure that sand and gravel operations, rock quarries, and other mineral resources are developed in a manner compatible with maintenance and enhancement of sage grouse populations and habitats.			
	<u>Management Actions</u>			
Recommended Actions	1) See actions in Objective 1 as appropriate.	BLM, USFS, Industry, WGFD	TBD	BLM,WGFD
	<u>Objective 3.</u> Develop the wind energy resource in a manner compatible with maintenance and enhancement of sage-grouse populations and habitat.			
	<u>Management Actions</u>			
Recommended Actions	1) Avoid location of power lines and wind turbines within 0.6 miles of a sage-grouse lek	WGFD, BLM, Industry	TBD	Industry
	2) See actions in Objective 1 as appropriate.			
Pesticides	**Action**	**Responsible Parties**	**Time Schedule**	**Funding Source**
	Objective 1. If necessary, encourage the use and application of pesticides that do not adversely affect sage-grouse populations.			
	<u>Management Actions:</u>			
Commitment	1) Investigate and record deaths and sickness that could be attributed to pesticides.	WGFD, NPS- on revegetation projects in the Park.	Ongoing	WGFD, Wyo. State Vet Lab
Recommended Actions	1) Develop a training program for certified pesticide applicators that emphasizes sage-grouse considerations.	Weed and Pest Districts, WGFD all actions	TBD	TBD
	2) Work with County Weed and Pest Districts to minimize impacts of grasshopper and Mormon cricket control programs on sage-grouse. Address grasshopper infestations issues using Reduced Area Application Treatments (RAATs) approach.			

	3) Minimize potential impacts of mosquito abatement program on sage-grouse by the use of biological control programs where appropriate.			
Predation	**Action**	**Responsible Parties**	**Time Schedule**	**Funding Source**
	Objective 1. Evaluate and address predator management issues to maintain or increase sage-grouse populations when the effects of predation are determined to be the cause of population declines.			
	Management Actions:			
Commitment	1) Support research to identify impacts of predation on the Jackson Hole Sage-grouse population, particularly the potential impacts of raven predation on sage-grouse nests.	WGFD, NPS, USF&WS, USFS, Craighead Beringia South	Completed in 2010	WGFD and others TBD
Recommended Actions	1) Support projects whose goal is to enhance sage-grouse nesting and early brood rearing habitats which would, in turn, help to decrease predation on nests and broods.	Teton Conservation District, WGFD, USFS, NPS, BLM, NRCS	TBD	Teton Conservation District, WGFD, USFS, NPS, BLM, NRCS
	2) Where possible, reduce man-made perch sites, such as above ground powerlines, for raptors and ravens near leks and important brood rearing habitats.			
	3 If predator control is considered outside Grand Teton National Park, target control actions on appropriate predators that have the highest impact to sage-grouse populations such as red foxes in urban and agricultural interface areas.			
	4) Inform public and subdivision dwellers in sage-grouse habitats about the damage cats and dogs roaming at large can have on sage-grouse populations. (i.e. appropriate publications such as Barnyards and Backyards)			
	5) Develop and distribute education materials regarding human practices that may allow establishment/expansion of predator populations. Examples of these activities include ranch carcass pits, landfills and other garbage/waste disposal that may provide artificial food sources for a variety of predators, and buildings/structures that provide nesting/roosting habitat for ravens/raptors.			
Parasites and Disease	**Action**	**Responsible Parties**	**Time Schedule**	**Funding Source**
	Objective 1. Encourage implementation of practices that are shown to reduce the incidence of parasites and disease in sage-grouse.			
	Management Actions			

Commitment	1) Investigate and record deaths that could be attributed to parasites or disease.	WGFD, State Vet Lab<NPS	Ongoing	WGFD, State Vet Lab., NPS
Recommended Action	1) Promote research and disease surveillance coordination to deal with disease outbreaks where appropriate. New threats such as West Nile Virus and Highly Pathenogenic Avian Influenza should be a priority for such disease monitoring programs.	WGFD, BLM, , WY State Vet Lab, USGS	Ongoing	WGFD, BLM, , WY State Vet Lab. USGS
Hunting	**Action**	**Responsible Parties**	**Time Schedule**	**Funding Source**
	Objective 1. Adjust hunting season regulations as needed to maintain or increase sage-grouse numbers.			
	Management Actions:			
Commitments	1) The Wyoming Game and Fish Commission closed the hunting season in Management Areas 1 and 2 which constitute the USRBWGA in 2000. Maintain the existing closure until the population increases to a level which could sustain hunting in the open areas. We recognize this situation is unlikely to be achieved in the near future based on relatively small grouse populations, limited areas where hunting could be allowed, and geographic isolation.	WGFD	Ongoing	WGFD
CONSERVATION GOAL 3: Identify private and state owned lands with existing or potential sage grouse habitat value and minimize future impacts to sage grouse resulting from either transfer of ownership and/or changes in land use practices.				
Private Lands	**Action**	**Responsible Parties**	**Time Schedule**	**Funding Source**
	Objective 1. Identify private lands within the USRBCA that contain sage grouse habitat attributes or are near or adjacent to sage grouse habitat.			
	Management Actions:			
Recommended Action	1) Inventory private lands within the USRBCA assessing their existing or potential value as sage grouse habitat.	WGFD	TBD	TBD
	a) Determine current value as sage grouse habitat			
	b) Estimate potential for sage grouse habitat enhancement.			
	c) Determine how the location of the private land relates to nearby sage grouse habitat			
	d) Rank these lands for protection from top priority to lowest priority in order to provide guidance for future management decisions.			

	Objective 2. Based upon a "willing seller-willing buyer" understanding, identify ways to purchase these lands outright or development rights in order to maintain or enhance their sage-grouse habitat value.			
	Management Actions:			
Recommended Action	1) Identify agencies or organizations most appropriate to be the purchasing agent, e.g. the National Park Service, National Forest Service, Wildlife Refuge System, Wyoming Game and Fish Commission.	WGFD, appropriate land management agencies	TBD	TBD
	2) Identify funding sources, e.g. Land and Water Conservation Fund, incorporate funds as line items in agency budgets.			
	Objective 3. Based upon a "willing seller - willing buyer" understanding, identify ways to trade the private parcels for publicly held lands.			
	Management Actions:			
Recommended Action	1. Appropriate land management agencies need to identify public available for trade.	Land management agencies within the USRBCA, WGFD	TBD	TBD
	a) Availability must be based upon a thorough research inventory determining that the parcel has no habitat value for sage grouse or other species of concern and no more than minimal value for other wildlife species.			
	Objective 4. Based upon a "willing seller - willing buyer" understanding, identify ways to have conservation easements placed on the private parcels which will maintain in perpetuity the existing or enhanced habitat value for sage grouse.			
	Management Actions:			
Recommended Action	1) Identify established land trust organizations interested in operating within the USRBCA.	Land management agencies within the USRBCA, WGFD	TBD	TBD
	2) Identify established and reputable private for-profit organizations capable of acting as an intermediate purchasing agent and placing a conservation easement upon the land to transfer via sale or trade at a later date to a conservation buyer or land trust organization.			
	3) Identify private individual(s) interested in and capable of assisting in the purchase of conservation easements wither to hold into perpetuity or to transfer via sale or trade to a conservation buyer or land trust organization at some later date.			
State Lands	**Action**	**Responsible Parties**	**Time Schedule**	**Funding Source**
	Objective 1. Identify lands within the USRBCA administered by the State Land Board with existing or potential sage grouse habitat values.			

	Management Actions:			
Recommended Action	1) Inventory state lands for existing or potential sage grouse habitat values.	WGFD, Federal land management agencies with state lands in or adjacent to their lands	TBD	TBD
	2) Determine potential for land if developed to have off-site impacts on adjacent sage grouse habitat.			
	3) Support NPS in acquiring state lands to ensure continued management of land as undeveloped sage-grouse habitat.			
	Objective 2. Determine the potential for land exchanges to conserve sage-grouse habitat.			
	Management Actions:			
Recommended Action	1) Identify public lands available for exchange. a) Availability must be based upon a thorough inventory determining that the parcel identified for exchange has no habitat value for sage-grouse or other species of concern and no more than minimal value for other wildlife species.	WGFD, State Land Board, BLM, Office of Mineral Development	TBD	TBD
	2) Identify other publicly held values such as mineral rights that might be available for exchange.			
	3) Support acquisition of state lands by public/private entities for habitat conservation.	USRBWG	ongoing	NA
	Objective 5. Encourage the State Land Board to carry out management practices on state lands which will meet their mandates while minimizing impacts to sage grouse habitats and where possible enact sage grouse habitat enhancement practices.			
	Management Actions:			
Recommended Action	1) Provide the State Land Board with the final USRBCA sage grouse conservation plan.	WGFD, USRBWG	TBD	TBD
	2) Provide specific management recommendations.			
CONSERVATION GOAL 4: Contribute to sage-grouse research.				
Research and Development	**Action**	**Responsible Parties**	**Time Schedule**	**Funding Source**
	Objective 1. Support research and development to better understand sage-grouse ecology (Table completed projects).			
	Management Actions:			

Commitments	1) Completed research. Holloran, M. J., and S. H. Anderson. 2004. Greater Sage-grouse seasonal habitat selection and survival in Jackson Hole, Wyoming. Completion Report. Wyoming Cooperative Fish and Wildlife Research Unit. University of Wyoming, USA.	Wyoming Cooperative Fish and Wildlife Research Unit, WGFD	Completed	WGFD, NPS, USFS, USF&WS
	2) Complete funding for Craighead Berengia South study: Estimating Sage-Grouse Population Demographics for Population Monitoring, Modeling, and Recovery. The working group is sponsoring this research and the agencies represented on the group are cooperators in the research project.	USRBWG, WGFD, Craighead Beringia South, NPS, USF&WS	Ongoing	WGFD, Wyoming Wildlife Heritage Foundation, Craighead Beringia South and others TBD
Recommended Actions	1) Evaluate the effects of predation on sage-grouse in the USRBCA.	WGFD, NPS, USFWS, USFS,	TBD	TBD
	2) maintain cumulative records of habitat treatments and wildfire across jurisdictional boundaries to determine and evaluate site specific and cumulative impacts to sage-grouse habitats and populations to help identify best management practices for successful vegetation treatments.			
	3) Better define weather and climate related effects on sage-grouse populations and their interactions with other limiting factors in order to correctly understand and assess fluctuations in sage-grouse populations.			
	4) Continue to evaluate movement between the Gros Ventre population and the population in the Upper Green River Basin, the Jackson Hole population and the Gros Ventre population (genetics and telemetry).			
	5) Determine the movements and seasonal habitat use by sage-grouse found in the Hoback Basin.			
	6) Work with the Idaho Fish and Game Department and the East Idaho Uplands Sage-grouse local working group to determine numbers, seasonal distribution and habitat use, and movements of sage-grouse in the Salt River drainage along the Wyoming-Idaho State line.			
	7) Experiments in habitat manipulation should be relatively small in comparison to a specific grouse population.			
CONSERVATION GOAL 5: Inform and educate the public, landowners, government agencies and others effected interest within the USRBCA about issues related to sage-grouse conservation.				
Public Education	**Action**	**Responsible Parties**	**Time Schedule**	**Funding Source**

	Objective 1. Involve and educate the local community on sage grouse conservation efforts			
	Management Actions			
Commitments	1) Provide press releases and articles in local media to educate the public and increase public awareness of sage-grouse conservation issues.	USRBWG, WGFD	Ongoing	WGFD
	2) The WGFD will continue to publish numerous magazine and newspaper articles to educate and bring increased public awareness of sage-grouse conservation issues.	WGFD	Ongoing	WGFD
	3)The WGFD has developed a sage-grouse management link to the agency website and will continue to provide the latest news and information on sage-grouse including the state management plan, research updates, working group news, management updates and conservation news.			
	4) The Moulton lek will be included in a statewide sage-grouse lek viewing brochure to provide public viewing opportunities where disturbance can be minimized. This brochure will foster interest in, and appreciation for, sage-grouse.	WGFD. NPS	Completed	WGFD
Recommended Action	1) Promote sage-grouse conservation and an understanding of the sagebrush biome through educational programs in Grand Teton National Park, the NER, the Bridger-Teton National Forest, and the WGFD.	WGFD,NPS, USF&WS, USFS	TBD	WGFD,NPS, USF&WS USFS
Public Outreach	**Action**	**Responsible Parties**	**Time Schedule**	**Funding Source**
	Objective 1. Develop programs to inform and educate the public and effected interests on appropriate sage-grouse conservation practices.			
	Management Actions			
Recommended Actions	1) Make available Best Management Practices for resource development activities in sage-grouse habitat that protect important habitat and minimize conflicts between the goals of maintaining and enhancing sage-grouse habitat and developing other resources in the sagebrush biome.	WGFD, USRBWG, NRCS, Weed and Pest Districts	TBD	TBD
	2) Develop and provide information on funding options available to landowners who wish to improve sage-grouse habitat.			
	3) Inform the public of the results of ongoing research and management actions conducted on behalf of sage-grouse populations in the USRBCA.			
	4) Facilitate access to existing educational materials such as from the Sage-grouse Initiative (SGI) concerning: human facilitation of predators, impacts of development and recreation.			

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APPENDIX 1. HABITAT REQUIREMENTS.

Stiver et al. (2010) and Connelly et al (2000, 2011) define the attributes needed to provide suitable sage-grouse habitat. These attributes or habitat characteristics are seasonal and associated with the period that sage-grouse are using the habitat. The Sage-grouse Habitat Assessment Framework (HAF) (Stiver et al. 2010) is a multi-scale habitat assessment tool providing a protocol to assess sage-grouse habitat at different scales. The fourth order protocol in that assessment (site-scale) determines the condition of sage-grouse habitat by (1) determining the condition of individual habitat attributes and then (2) assessing the relationship of the attributes in regards to providing sage-grouse habitat at that scale. Although numeric values are provided for acceptable habitat condition for each of the habitat attributes, these values are guidelines only. When determining the quality of sage-grouse habitat, the relationship of the habitat attributes must be analyzed. Individual habitat attributes alone do not accurately indicate sage-grouse habitat conditions. It is also important to understand that these attributes do not occur uniformly over an entire analysis area nor can management hope to achieve these attributes over that same entire area (third order scale). The HAF also provides a methodology and scorecard for determining if these attributes are being met. Land managers including The Bridger-Teton National Forest (BTNF) should consider adopting these tools to evaluate and monitor sage-grouse habitat as part of their rangeland monitoring programs.

The Sage-grouse Habitat Assessment Framework (Stiver et al. 2010) utilizes three values to define habitat conditions: "suitable," "marginal," and unsuitable." In order to lessen the confusion regarding the use of the term "suitable" in regards to other attributes of livestock grazing, the term "suitable" and "unsuitable" are replaced with "acceptable" and "unacceptable". It should be noted that the term acceptable is not synonymous with optimum. The values in these tables are consistent with Stiver et al. (2010) with one exception, Sage-Grouse Riparian Summer Habitat.

Stiver et al. (2010) recommends the use of a properly functioning condition (PFC) assessment to determine the stability of riparian and wet meadow habitats. Stiver et al. (2010) provides direction that if PFC assessments are not available; make a determination of sage-grouse habitat condition based on preferred forb availability and proximity of sagebrush cover. For example, the BTNF generally lacks PFC assessments for most riparian areas. Rather than limit the condition assessment of the riparian summer habitat to only preferred forb availability and proximity of sagebrush cover, it was felt another methodology was needed to help assess the condition of sage-grouse summer riparian habitat. We are suggesting that the BTNF use greenline ecological status (Burton et al. 2011) to replace properly functioning condition assessments as the methodology to assist with the assessment of the sage-grouse summer riparian habitat. A late seral (>61 rating) ecological status rating will be considered as providing acceptable sage-grouse habitat. In order to meet an "acceptable" rating desired condition attributes must be met on >60% of upland summer and riparian summer habitat and >80% of breeding habitat and winter habitat within the geographic or analysis area. These values are derived from Connelly et al. (2000).

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Breeding (nesting and early brood-rearing) habitat life requisites (adapted from Connelly et al. 2000 and Stiver et al. 2010).

General Use Period: March 1 - June 30. Acceptable Habitat Conditions Are to Be Met: May 15 - June 30.

Life Requisite	Habitat Indicator	Suitability Categories		
		Suitable	**Marginal**	**Unsuitable**
Cover	**Sagebrush Canopy Cover (%)**	*15 to 25*	*5 to < 15 or > 25*	*< 5*
	Sagebrush Height (cm) **Mesic Site[2]** **Arid Site**	 *40 to 80* *30 to 80*	 *20 to <40 or > 80* *20 to <30 or > 80*	 *< 20* *< 20*
	Sagebrush Shape	*Spreading*	*Mix of spreading and columnar*	*Columnar*
	Herbaceous Height (cm)	*≥ 18*	*10 – <18*	*< 10*
	Perennial Grass Cover (%) **Mesic[2]** **Arid**	 *≥ 15* *≥ 10*	 *5 to < 15* *5 to < 10*	 *< 5* *< 5*
Cover & Food	**Forb Canopy Cover (%)** **Mesic[2]** **Arid**	 *≥ 10* *≥ 5*	 *5 to < 10* *3 to < 5*	 *< 5* *< 3*
Food	**Preferred Forb Availability[1]**	*Preferred forbs are common with several species present*	*Preferred forbs are common but only a few preferred species are present*	*Preferred forbs are rare*

[1] Relative to ecological site potential.

[2] Mesic and arid sites should be defined on a local basis; annual precipitation, herbaceous understory, and soils should be considered (Connelly et al. 2000b).

Late brood-rearing/summer habitat life requisites, indicators and suitability categories for upland sagebrush fourth order habitat descriptions (adapted from Connelly et al. 2000 and Stiver et al. 2010).

General Use Period: July 1 to September 30th

Period When Acceptable Habitat Conditions Are to Be Met: July 1 to September 30

Life Requisite Feature	Habitat Indicator	Suitability Categories		
		Suitable	**Marginal**	**Unsuitable**
Cover	**Sagebrush Canopy Cover (%)**	*10 to 25*	*5 to < 10 or > 25*	*< 5*
	Sagebrush Height (cm)	*40 – 80*	*20 – <40 or > 80*	*< 20*
Cover & Food	**Perennial Grass and Forb Canopy Cover (%)**	*≥ 15*	*5 to <15*	*< 5*
Food	**Preferred Forb Availability[1]**	*Preferred forbs are common with several species present*	*Preferred forbs are common but only a few preferred species are present*	*Preferred forbs are rare*

[1] Relative to ecological site potential.

Late brood-rearing/summer habitat life requisites, indicators and suitability categories for riparian or wet meadow fourth order habitat descriptions (adapted from Connelly et al. 2000 and Stiver et al. 2010).

General Use Period: July 1 to September 30th

Period When Acceptable Habitat Conditions Are to Be Met: July 1 to September 30

Life Requisite	Habitat Indicator	Suitability Categories		
		Suitable	**Marginal**	**Unsuitable**
Cover and Food	**Riparian and wet meadow stability**	*Majority of areas are in PFC*	*Majority of areas are FAR*	*Majority of areas are NF*
Food	**Preferred Forb Availability**[1]	*Preferred forbs are common with several species present*	*Preferred forbs are common but only a few preferred species are present*	*Preferred forbs are rare*
Cover	**Proximity of sagebrush cover**	*Sagebrush cover is adjacent to brood-rearing areas (< 90m)*	*Sagebrush cover is in close proximity to brood-rearing areas (90-27 m)*	*Sagebrush cover is unavailable (>275 m)*

[1] Relative to ecological site potential.

Lek Habitat requirements (adapted from Connelly et al. 2000 and Stiver et al. 2010).

The general use period is March 1 to May 30, and conditions are to be met then as well.

Life Requisite	Attribute	Acceptable (Desired) Habitat Conditions
Cover	Availability of sagebrush cover	Lek has adjacent sagebrush cover within 100 meters
Security	Proximity of trees or other tall structures	Trees or other tall structures are not within line of sight of lek and none to uncommon within 3km of lek

Desired Habitat Conditions for Sage-grouse Winter Habitat (adapted from Connelly et al. 2000 and Stiver et al. 2010).

General use period is December 1 to February 28th, and the period when acceptable habitat conditions are to be met is December 1 to February 28.

Life Requisite	**Attribute**	**Acceptable (Desired) Habitat Conditions (conditions met on >80% of habitat within the area)**
Cover and food	Sagebrush canopy cover (mean)	≥10%
Cover and food	Sagebrush height above snow (mean)	>25cm

APPENDIX 2. GRAZING

Please see Appendix 1 for Greater Sage-grouse Habitat Requirement Tables.

Wyoming Executive Order 2013-3 Greater Sage-grouse core Area Grazing Adjustment (Supplements 2011-5)

Grazing is considered a *de minimus* activity under EO 2011-5 Appendix C. EO 2013-3 provides additional direction to help improve grazing practices on core or primary sage grouse habitat on federal lands, as needed. Efforts to change grazing practices are triggered when grazing management is out of compliance for 3 out 5 years. However, it remains unclear to what extent federal land management agencies are bound by the stipulations in the EO (see explanation below).

Interim Forest Service Guidance Related to Grazing

The Forest Service is engaged in a forest plan revision process to incorporate sage-grouse habitat conservation measures into its Forest Plans to provide regulatory certainty to assure sage-grouse conservation practices are considered and implemented in project planning. Lack of regulatory certainty is one of the risk factor potentially leading to listing the species under ESA. Regions 1, 2, and 4 have provided this interim guidance to provide direction to conservation recommendations to promote conservation of sustainable sage-grouse populations and their habitats by identifying information sources and considerations that should be included in project analysis and decision making taking place before the plan amendment process can be completed. The recommendations incorporate the following principles to protect and conserve sage-grouse habitat:

- Protect remaining expanses of unfragmented habitats;
- Minimize further loss of fragmented habitat; and
- Enhance and restore habitat conditions to meet sage-grouse life history needs.

Potential impacts of herbivory on sage-grouse and their habitat include:

- Long-term effects of historic overgrazing on sagebrush habitat;
- Sage-grouse habitat changes due to herbivory;
- Direct effects of herbivores on sage-grouse, such as trampling of nests and eggs;
- Altered sage-grouse behavior due to presence of herbivores;
- Direct effects on sage-grouse survival (in-flight) and behavior from structures associated with grazing management (Beck and Mitchell 2000).

- Effects on desired cover and foraging conditions identified by Connelly (2000) and Stiver et al. (2010) (Appendix 1).

Examples of Conservation Measures for Range Management (Grazing)

Livestock grazing is the most widespread type of land use across the sagebrush biome (Connelly *et al.* 2004) and almost all sagebrush areas are managed for livestock grazing (Knick *et al*. 2003). Improper livestock management, as determined by local ecological conditions, may have negative impacts on sage-grouse seasonal habitats (75 FR 13910 and references therein). Management to enhance populations of wild ungulates may also have negative impacts (e.g. removal of sagebrush overstory in an attempt to increase forage production for wild ungulates) (in Greater Sage-Grouse (*Centrocercus urophasianus*) Conservation Objectives Final Report; page 45).

The COT Report provides the following conservation objective for grazing (page 45):
Conservation Objective: Conduct grazing management for all ungulates in a manner consistent with local ecological conditions that maintains or restores healthy sagebrush shrub and native perennial grass and forb communities and conserves the essential habitat components for sage-grouse (e.g. shrub cover, nesting cover). Areas which do not currently meet this standard should be managed to restore these components. Adequate monitoring of grazing strategies and their results, with necessary changes in strategies, is essential to ensuring that desired ecological conditions and sage-grouse response are achieved. Achieving the above objective will require the development of long-term strategies that provide seasonal habitats for sage-grouse. Although grazing management should initially focus on retaining the above habitat conditions within PACs, sound grazing management should be applied across all sagebrush habitats. Grazing management strategies must consider the local ecological conditions, including soil types, precipitation zones, vegetation composition and drought conditions. Livestock and wild ungulate numbers must be managed at levels that allow native sagebrush vegetative communities to minimally achieve Proper Functioning Conditions (PFC; for riparian areas) or Rangeland Health Standards (RHS; uplands). Similar measures should be implemented on non-federal land surfaces.

To address the objective the COT Report offers the following *Conservation Options* (pages 45-46)*:*

- Ensure that allotments meet ecological potential and wildlife habitat requirements; and, ensure that the health and diversity of the native perennial grass community is consistent with the ecological site.

- Inform and educate affected grazing permittees regarding sage-grouse habitat needs and conservation measures.

- Incorporate sage-grouse habitat needs or habitat characteristics into relevant resource and allotment management plans, including the desired conditions with the understanding that these desired conditions may not be fully achievable: (a) due to the existing ecological condition, ecological potential or the existing vegetation; or (b) due to causal events unrelated to existing livestock grazing.

- Conduct habitat assessments and, where necessary, determine factors causing any failure to achieve the habitat characteristics. Make adjustments as appropriate.

- Given limited agency resources, priority should be given to Priority Areas of Conservation (PACs; core areas) and secondarily to adjacent habitats.

The COT Report also addresses related rangeland structures (page 45):
Structures which support range management activities can have negative impacts on sage-grouse habitats by increasing fragmentation (e.g., fences and roads) or diminishing habitat quality (e.g., concentrating ungulates in winter habitats). Typical range management structures include fences, water developments and mineral licks. As fences can be both a positive and negative impact on sage-grouse and their habitats, depending on their location and use, they are addressed in a separate section below.

Conservation Objective: Avoid or reduce the impact of range management structures on sage-grouse.
Conservation Measures:

- Range management structures should be designed and placed to be neutral or beneficial to sage-grouse.

- Structures that are currently contributing to negative impacts to either sage-grouse or their habitats should be removed or modified to remove the threat.

The COT Report also specifically addresses fences (page 52).
Fences can be deleterious to sage-grouse populations and habitats, with threats including habitat fragmentation and direct mortality through strikes (Stevens *et al.* 2012). Fences can improve habitat conditions for sage-grouse (e.g. by protecting riparian areas providing brood-rearing habitats from overgrazing). The assessment of the impact or benefit of fences must be made considering local ecological conditions and the movement of sage-grouse within local areas (Stevens *et al*. 2012).

Conservation Objective: Minimize the impact of fences on sage-grouse populations.
Conservation Options:

- Mark fences that are in high risk areas for collision (Stevens *et al.* 2012) with permanent flagging or other suitable device to reduce sage-grouse collisions on flat to gently rolling terrain in areas of moderate to high fence densities (i.e., more than 1 km of fence per km2) located within 2 kms of occupied leks.

- Identify and remove unnecessary fences.

- Placement of new fences and livestock management facilities (including corrals, loading facilities, water tanks and windmills) should consider their impact on sage-grouse and, to the extent practicable, be placed at least 1 km from occupied leks (Stevens *et al*. 2012).

(FSM 2200 – Rangeland Management)
Ongoing Allotment Administration

- When developing drought contingency plans, evaluate the season of use, stocking rate, and pasture rotation schedules and adjust in accordance with permit terms and applicable regulations to promote retention of herbaceous composition and structure to meet sage-grouse habitat requisites.

- Continue to coordinate with other Federal agencies, state agencies, and non-Federal partners. Implement the 2010 Memorandum of Understanding between the BLM, NRCS, FWS, and USFS for enhancing sage-grouse habitat through grazing practices.

- Conduct effectiveness monitoring of grazing activities to ensure that current management is meeting sage-grouse habitat objectives as described in Allotment Management Plans.

- If periods of drought occur, where appropriate evaluate the season of use and stocking rate and adjust through coordination and annual billings processes.

- When developing drought contingency plans, ensure that sage-grouse habitat requisites are considered, including cover requirements for nesting and brood-rearing periods.

- Continue to coordinate with other Federal agencies, state agencies, and non-Federal partners. Leverage funding to implement habitat projects and implement the recent Memorandum of Understanding between the BLM, NRCS, FWS, and USFS for enhancing PPH through grazing practices.

- Continue to prioritize grazing permit administration and effectiveness monitoring of grazing activities to ensure compliance with permit conditions and that progress is being made on achieving rangeland health indicators.

- Continue to evaluate existing range improvements (e.g., fences, watering facilities) associated with grazing management operations for impacts on Greater Sage-Grouse and its habitat.

- When several small or isolated allotments occur within a watershed or delineated geographic area, strive to evaluate all of the allotments together. Prioritize this larger geographic area against other PPH areas for processing permits for renewal.

- Coordinate BMPs and vegetation objectives with NRCS for consistent application across jurisdictions where the USFS and NRCS have the greatest opportunities to benefit Greater Sage-Grouse, particularly as it applies to the NRCS's National Sage-Grouse Initiative (http://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/programs/farmbill/initiatives/?&cid=steldevb1027671).

- Pursue opportunities to incorporate multiple allotments under a single management plan/strategy where incorporation would result in enhancing Greater Sage-Grouse populations or its habitat as determined in coordination with respective state wildlife agency.

- Evaluate progress towards meeting standards that may affect Greater Sage-Grouse or its habitat prior to authorizing grazing on an allotment that was not achieving rangeland health indicators in the last renewal cycle, and livestock was a significant causal factor. Where available, use current monitoring data to identify any trends (e.g., progress) toward meeting the standards. Where monitoring data are not available or inadequate to determine whether progress is being made toward achieving Rangeland health indicators, an interdisciplinary team should be deployed as practicable to conduct a new land health assessment. The NEPA analysis for the permit issuances must address a range of reasonable alternatives including alternatives that improve Greater Sage-Grouse habitat.

- If livestock grazing is the cause of not achieving rangeland health indicators that have potential to impact Greater Sage-Grouse or its habitat in the last permit renewal cycle, an interdisciplinary team should be deployed as practicable to conduct a new rangeland health evaluation to determine if the allotment is making progress and if livestock grazing remains a casual factor. Use adaptive management strategy in FSH 2209.13, Chapter 92.23.

<u>Proposed Authorizations/Activities</u>

- When several small or isolated allotments occur within a watershed or delineated geographic area, strive to evaluate all of the allotments together. Pursue opportunities to incorporate multiple allotments under a single management plan/strategy where incorporation would result in enhancing sage-grouse or sage-grouse habitat.

- Coordinate BMPs and vegetation objectives with BLM, NRCS and adjacent private land owners for consistent application across all jurisdictions as described in NRCS's National Sage-grouse Initiative.

- When revising allotment or grazing management through an environmental analysis, utilize an interdisciplinary team, as practicable, to identify reasonable sage-grouse habitat objectives and evaluate a range of reasonable alternatives to accomplish those objectives.

- Incorporate management objectives that that promote the growth and persistence of native shrubs, grasses, and forbs beneficial to sage-grouse. Utilize Ecological Site Descriptions or other State and Transition Models, where they are available, to develop realistic objectives.

- Plan and authorize livestock grazing and associated range improvement projects on USFS lands in a way that maintains and/or improves Greater Sage-Grouse and its habitat. Analyze through a reasonable range of alternatives any direct, indirect, and cumulative effects of grazing on Greater Sage-Grouse and its habitats through the NEPA process:

- Incorporate available site information collected using the Sage-Grouse Habitat Assessment Framework (Stiver et al. 2010) when evaluating existing resource condition and developing resource solutions,

- Incorporate management practices that will provide for adequate residual plant cover (e.g., residual grass height) and diversity in the understory of sagebrush plant communities as part of viable alternatives. Evaluate and implement grazing practices that promote the growth and persistence of native shrubs, grasses, and forbs. Grazing practices include kind and numbers of livestock, distribution, seasons of use, and livestock management practices needed to meet both livestock management and Greater Sage-Grouse habitat objectives.

- Evaluate the potential risk to Greater Sage-Grouse and its habitats from existing structural range improvements. Address those structural range improvements identified as posing a risk during the renewal process.

- Balance grazing between riparian habitats and upland habitats to promote the production and availability of beneficial forbs to Greater Sage-Grouse in meadows, mesic habitats, and riparian pastures for Greater Sage-Grouse use during nesting and brood-rearing while maintaining upland conditions and functions. Consider changes to season-of-use in riparian/wetland areas before or after the summer growing season.

Suggested Guidelines for Achieving Quantifiable Objectives for Grazing Related Activities

Managing livestock grazing to maintain residual cover of herbaceous vegetation so as to reduce predation during nesting may be the most beneficial for sage-grouse populations (Beck and Mitchell 2000, Aldridge and Brigham 2003). Other management objectives that control livestock movements and grazing intensities can be achieved broadly through rotational grazing patterns or locally through water and salt placements (Beck and Mitchell 2000). Treatments used to manipulate vegetation ultimately may have far greater effect on sage-grouse through long-term habitat changes rather than direct impacts of grazing itself (Freilich et al. 2003, Knick et al. 2011). An important objective in managing livestock grazing is to maintain residual cover of herbaceous vegetation to reduce predation during nesting (Beck and Mitchell 2000) and to maintain the integrity of riparian vegetation and other wetlands (Crawford et al. 2004). Proper livestock management (timing, location, and intensity) can assist in meeting sage-grouse habitat objectives and reduce fuels (Briske et al. 2011).

- Within priority sage-grouse habitat, incorporate sage-grouse habitat objectives and management considerations into all grazing allotments through AMPs or permit renewals.

- Work cooperatively on integrated ranch planning within sage-grouse habitat so operations with deeded allotments can be planned as single units.

- Prioritize completion of land health assessments and processing grazing permits within priority sage-grouse habitat areas. Focus this process on allotments that have the best

opportunities for conserving, enhancing or restoring habitat for sage-grouse. Utilize Ecological Site Descriptions (ESDs) to conduct land health assessments to determine if standards of range-land health are being met.

- Conduct land health assessments that include (at a minimum) indicators and measurements of structure/condition/composition of vegetation specific to achieving sage-grouse habitat objectives (Doherty et al. 2011). If local/state seasonal habitat objectives are not available, use sage-grouse habitat recommendations from Connelly et al. 2000b and Stiver et al. 2010).

Implementing Management Actions after Land Health and Habitat Evaluations

- The drought in priority sage-grouse habitat areas relative to their needs for food and cover. Since there is a lag in vegetation recovery following drought (Thurow and Taylor 1999, Cagney et al. 2010), ensure that post-drought management allows for vegetation Develop specific objectives to conserve, enhance or restore priority sage-grouse habitat based on ESDs and assessments (including within wetlands and riparian areas). If an effective grazing system that meets sage-grouse habitat requirements is not already in place, analyze at least one alternative that conserves, restores or enhances sage-grouse habitat in the NEPA document prepared for the permit renewal (Doherty et al. 2011b, Williams et al. 2011).

- Manage for vegetation composition and structure consistent with ecological site potential and within the reference state to achieve sage-grouse seasonal habitat objectives.

- Implement management actions (grazing decisions, AMP/Conservation Plan development, or other agreements) to modify grazing management to meet seasonal sage-grouse habitat requirements (Connelly et al. 2011c).

- Consider singly, or in combination, changes in:

  - Season or timing of use;
  - Numbers of livestock (includes temporary non-use or livestock removal);
  - Distribution of livestock use;
  - Intensity of use; and
  - Type of livestock (e.g., cattle, sheep, horses, llamas, alpacas and goats) (Briske et al. 2011).
  -

- During drought periods, prioritize evaluating effects of recovery that meets sage-grouse needs in priority sage-grouse habitat areas.

Riparian Areas and Wet Meadows

- Manage riparian areas and wet meadows for late seral condition within priority sage-grouse habitats.

- Within priority and general sage-grouse habitats, manage wet meadows to maintain a component of perennial forbs with diverse species richness relative to site potential (e.g., reference state) to

facilitate brood rearing. Also conserve or enhance these wet meadow complexes to maintain or increase amount of cover along the edge of the meadow to minimize elevated mortality during the late brood rearing period (Hagen et al. 2007, Kolada et al. 2009, Atamian et al. 2010).

- Where riparian areas and wet meadows meet late seral conditions, strive to attain reference-state vegetation relative to the ecological site description.

- For example: Within priority sage-grouse habitat, reduce hot season grazing on riparian and meadow complexes to promote recovery or maintenance of appropriate vegetation and water quality. Utilize fencing/herding techniques or seasonal use or livestock distribution changes to reduce pressure on riparian or wet meadow vegetation used by sage-grouse in the hot season (summer) (Aldridge and Brigham 2002, Crawford et al. 2004, Hagen et al. 2007).

- Authorize new water development for diversion from spring or seep source only when priority sage-grouse habitat would benefit from the development. This includes developing new water sources for livestock as part of an AMP/conservation plan to improve sage-grouse habitat.
- Analyze springs, seeps and associated pipelines to determine if modifications are necessary to maintain the continuity of the predevelopment riparian area within priority sage-grouse habitats. Make modifications where necessary, considering impacts to other water uses when such considerations are neutral or beneficial to sage-grouse.

Treatments to Increase Forage for Livestock/Wild Ungulates

Priority (Occupied /breeding and winter) sage-grouse habitat areas:

- Only allow treatments that conserve, enhance or restore sage-grouse habitat based on Connelly et al 2000 which indicates up to 20% of nesting, early brood rearing, and winter sage-grouse habitat or 40% of late brood rearing habitat could be treated to restore degraded sagebrush habitats if necessary (this includes treatments that benefit livestock as part of an AMP/Conservation Plan to improve sage-grouse habitat.

- Evaluate the role of existing seedings that are currently composed of primarily introduced perennial grasses in and adjacent to priority sage-grouse habitats to determine if they should be restored to sagebrush or habitat of higher quality for sage-grouse. If these seedings are part of an AMP/Conservation Plan or if they provide value in conserving or enhancing the rest of the priority habitats, then no restoration would be necessary. Assess the compatibility of these seedings for sage-grouse habitat or as a component of a grazing system during the land health assessments (Davies et al. 2011).

    - For example: Some introduced grass seedings are an integral part of a livestock management plan and reduce grazing pressure in important sagebrush habitats or serve as a strategic fuels management area.

Structural Range Improvements and Livestock Management Tools

Priority sage-grouse habitat areas:

- Design any new structural range improvements and location of supplements (salt or protein blocks) to conserve, enhance, or restore sage-grouse habitat through an improved grazing management system relative to sage-grouse objectives. Structural range improvements, in this context, include but are not limited to: cattleguards, fences, exclosures, corrals or other livestock handling structures; pipelines, troughs, storage tanks (including moveable tanks used in livestock water hauling), windmills, ponds/reservoirs, solar panels and spring developments. Potential for invasive species establishment or increase following construction must be considered in the project planning process and monitored and treated post-construction.

- When developing or modifying water developments, use best management practices (BMPs) to mitigate potential impacts from West Nile virus (Clark et al. 2006, Doherty 2007, Walker et al. 2007b, Walker and Naugle 2011).

- Evaluate existing structural range improvements and location of supplements (salt or protein blocks) to make sure they conserve, enhance or restore sage-grouse habitat.

    - To reduce outright sage-grouse strikes and mortality, remove, modify or mark fences in high risk areas within priority sage-grouse habitat based on proximity to lek, lek size, and topography (Christiansen 2009, Stevens 2011).

    - Monitor for, and treat invasive species associated with existing range improvements (Gelbard and Belnap 2003 and Bergquist et al. 2007).

Retirement of Grazing Privileges

- Maintain retirement of grazing privileges as an option in priority sage-grouse areas when base property is transferred or the current permittee is willing to retire grazing on all or part of an allotment. Analyze the adverse impacts of no livestock use on wildfire and invasive species threats (Crawford et al. 2004) in evaluating retirement proposals.

Planning direction Note: Each planning effort should/will identify the specific allotment(s) where permanent retirement of grazing privileges is potentially beneficial.

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APPENDIX 3. WINTER HABITAT ANALYSIS.

A Remote Sensing Analysis of Sage-Grouse Winter Habitat in Grand Teton National Park and Bridger-Teton National Forest, Wyoming

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Abstract. *Over the past 50 years, greater sage-grouse (*Centrocercus urophasianus*) populations have declined throughout their range in Wyoming due to a variety of factors, including increased livestock grazing, farming, residential development, invasive plants, and oil and gas development. The Jackson Hole, Wyoming sage-grouse population has followed this same trend of decline. Holloran & Anderson (2004) suggested that winter habitat availability and condition could be a limiting factor for the Jackson Hole population. We utilized satellite imagery to identify and map exposed winter sagebrush habitat for average and high snowfall winters in the Jackson Hole area. We also performed a Kernel density analysis to determine sage-grouse home range and winter habitat use areas. We identified six key winter habitat areas that sage-grouse use, based on our Kernel density analysis coupled with the satellite image classification. We were unable to detect any exposed sagebrush on the high snowfall winter image. Our results support the suggestion by Holloran & Anderson (2004) that winter habitat may be a limiting factor for the Jackson Hole sage-grouse population, especially during high snowfall winters. However, during average snowfall years the six sage-grouse use areas we identified may represent the most critical areas to the population. This may also suggest that other factors, in addition to winter sagebrush availability are limiting population sizes.*

Introduction

Historically, the greater sage-grouse (*Centrocercus urophasianus*) has ranged across nearly all of Wyoming, utilizing its extensive sagebrush (*Artemisia spp*.) habitat. However, sage-grouse populations have declined throughout their range during the past 50 years, most likely due to a combination of factors, including increased livestock grazing, farming, residential development, invasive plants, and oil and gas development which has reduced the quantity and quality of available sagebrush habitat (Wyoming Sage-Grouse Working Group, 2003). The Jackson Hole sage-grouse population has experienced this same decline, despite ranging in an area with a high density of public lands and protected habitat.

During the winter, sage-grouse require exposed, dense, tall sagebrush for forage and shelter. Holloran & Anderson (2004) suggested that the quantity and condition of sage-grouse winter habitat could be a limiting factor for the Jackson Hole population.

The objective of this study was to use remote sensing analysis to identify and map potential sage-grouse winter habitat for both average and severe winters in the Jackson Hole, Wyoming area. Much of the needed information had already been compiled, including vegetation maps produced by Grand Teton National Park and Bridger-Teton National Forest and sage-grouse observation locations by the Wyoming Game and Fish Department and Holloran & Anderson (2004). This study was

designed to combine this existing data with remote sensing satellite imagery to yield a better understanding of the Jackson Hole sage-grouse population's winter habitat availability, distribution, and use.

Study Area

The study area encompasses the Jackson Hole sage-grouse population's known range, which includes parts of Grand Teton National Park, Bridger-Teton National Forest, the National Elk Refuge, and private land. The study area also includes the towns of Jackson, Kelly, and Wilson. The major topographical features are the Teton Range, the Snake and Gros Ventre River drainages, Jackson Lake, and the extensive flats, including Antelope Flats and Baseline Flat (Figure 1).

The study area has a wide range of vegetation types, ranging from mixed conifer and deciduous forests in the foothills of the Teton Range, to cottonwood riparian forests and willow shrublands along the Snake and Gros Ventre Rivers, to mixed shrublands and grasslands extending along Baseline and Antelope Flats. In addition, various sagebrush habitats exist throughout Grand Teton National Park and Bridger-Teton National Forest. Baseline Flat and Antelope Flats, as well as the northern National Elk Refuge are dominated by sagebrush dry shrubland and mixed sagebrush antelope bitterbrush shrubland; the Gros Ventre drainage has primarily mountain big sagebrush; and mixed sagebrush shrubby cinquefoil shrubland is found scattered along the Snake River and Elk Ranch (Figure 2).

Fire has highly influenced the landscape within and surrounding Jackson Hole. Likely the most influential fires on the sage-grouse population have been those near Blacktail Butte. Since 1998, approximately 2110 hectares of sagebrush habitat to the south and east of the butte have burned with the most extensive burn happening in 2003. Prior to these fires, Blacktail Butte served as a popular wintering area for sage-grouse, but since the fires, the vegetation has been replaced by mostly grassland with only scattered sagebrush. Additionally, increasing habitat fragmentation on private lands has reduced the quantity of sagebrush habitat available for the sage-grouse population.

Methods

Satellite Image Analysis

We purchased a U.S. Geological Survey (USGS) Landsat 5 TM (Thematic Mapper) satellite image from March 6, 1996, which was an average snowfall winter in our study area. We also purchased a USGS Landsat 7 ETM+ (Enhanced Thematic Mapper Plus) satellite image with Systematic Correction from March 10, 2006, a high snowfall winter. We selected images based on their absence of cloud cover and similarity in time of year. Both of these satellite images had pixel areas of 28.5 x 28.5 meters (812.25 m^2), or about 0.2 acres.

We also acquired summer vegetation classification maps from Grand Teton National Park and Bridger-Teton National Forest. Using ESRI ArcMap 9.1 Spatial Analyst, we extracted all classes containing sagebrush (low sagebrush, sagebrush/bitterbrush, sagebrush/shrubby cinquefoil, sagebrush dry shrubland, mountain big sagebrush, and spiked big sagebrush) from the vegetation layers.

We performed an unsupervised land cover classification for each satellite image and used it to identify exposed winter sagebrush from the known summer sagebrush habitat areas. After the ground-

truthing was completed, we refined the classification even more to reflect a more accurate winter sagebrush representation.

Ground-Truthing

In order to verify the sagebrush identified on the satellite images through the unsupervised classification, we conducted ground-truthing of sagebrush sites during summer 2006. We extracted the center location coordinates of 113 pixels classified as sagebrush on the March 1996 satellite image. These pixels were grouped around the areas of Kelly, the northern National Elk Refuge, Slide Lake, the Gros Ventre Drainage, Blacktail Butte, and Ditch Creek (Figure 3). We chose these sites because they showed high concentrations of winter sagebrush in the unsupervised classification, they were known to be within sage grouse winter range (Holloran & Anderson, 2004), and they were easily accessible to the study team.

Of the 113 identified sites, we visited thirty-four. At each site, we set up a 30x30 meter plot. From the center of the plot, we set 1 m^2 subplots extending in each cardinal direction at 1, 4.5, and 14 meter distances (Figure 4). Within each 1 m^2 subplot, we recorded the height and percent cover for all shrub species present as well as the percent cover for all tree species with canopy overhanging the plot. We also recorded additional shrub or tree species and their heights within the main plot that did not occur in the 1 m^2 subplots.

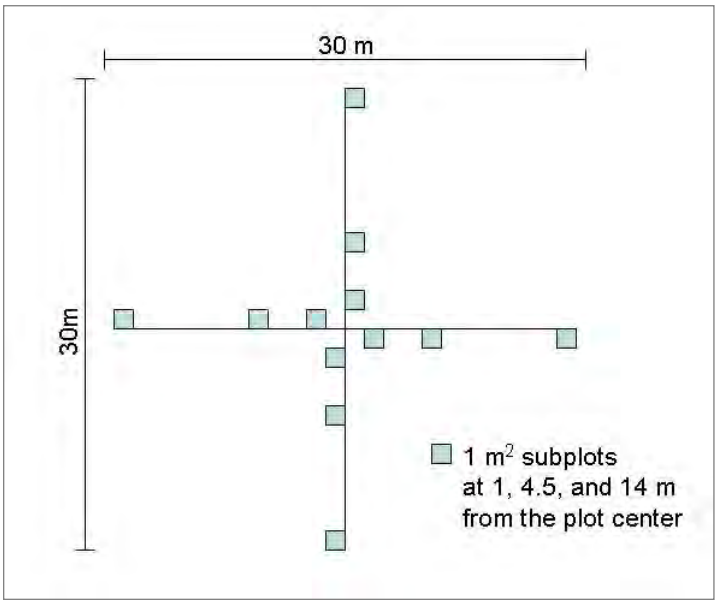

Figure 4. Layout for the sagebrush ground-truthing plots

Kernel Density Home Range Analysis

We conducted a Kernel density home range analysis for sage-grouse winter locations in Grand Teton National Park and Bridger-Teton National Forest using ESRI ArcMap 9.1 Spatial Analyst. We acquired sage-grouse winter Geographic Positioning System (GPS) data from 1978 to 2006 from the Wyoming Game and Fish Department's wildlife observation database, which included winter flight

observations, ground observations, and radio-collared sage-grouse locations (Holloran & Anderson, 2004).

Results

Kernel Density Home Range Analysis

The Kernel density home range analysis yielded the highest density probability south of Blacktail Butte, followed by areas around Kelly, the Teton Science School, and the upper Gros Ventre drainage. The analysis also identified medium and low densities further east in the Gros Ventre drainage, on Elk Ranch, Upper Antelope Flats, Upper Baseline Flat, and the Potholes (Figures 5 and 6).

Satellite Image Analysis

On the March 1996 satellite image, which represented an average snowfall winter, we identified exposed sagebrush within three summer sagebrush classes, mountain big sagebrush, sagebrush dry shrubland, and a small amount in the sagebrush/bitterbrush class (Figure 7). We were unable to identify any exposed sagebrush on the March 2006 satellite image, most likely due to high snowfall levels.

When we overlayed the Kernel home range density results with our identified winter sagebrush areas, the high density sagebrush areas generally matched the Kernel density polygons. Using both the Kernel density and the winter sagebrush results, we identified six main sage-grouse winter habitat areas: Airport/Gros Ventre Junction, Kelly/Northern National Elk Refuge, Teton Science School, Gros Ventre Drainage, Elk Ranch/Spread Creek, and Potholes/Burned Ridge/Upper Antelope Flats (Figure 8).

Ground-Truthing

Of the 34 summer ground-truthing sites that we visited, 23 had sagebrush occur within the 1 m^2 subplots (68%). The average height for sagebrush in these plots was 68 cm and the average cover was 12 percent. Seven of the 34 sites (20%) had sagebrush, but it did not occur within the 1 m^2 subplots, and four sites had no sagebrush present, even in the main plot (12%) (Table 1). Overall, 88% of the ground-truthing sites contained sagebrush.

Table 1. Sagebrush characteristics, number of sites, and percent of total sites results for ground-truthing sagebrush analysis

Sagebrush Characteristics	Number of Sites (Total = 34)	Percent of Total Sites (%)
Present in 1 m^2 subplots	23	68
Present in main plot, but not 1 m^2 subplots	7	20
None present	4	12

Discussion

Sixty-eight percent of the ground-truthing sites contained sagebrush in the 1 m^2 subplots, suggesting that the majority of our March 1996 winter sagebrush results were correct. At sites where sagebrush was either not present or had a low percent cover, other species such as aspen (*Populus tremuloides*), Canada buffaloberry (*Shepherdia canadensis*), snowberry (*Symphoricarpos albus*), rabbitbush (*Chrysothamnus nauseosus*), and narrow-leaved cottonwood (*Populus angustifolia*) were present, suggesting that there is a close spectral similarity between these species and therefore some overlap in the classification. Through a more extensive ground-truthing effort, it is possible that the classification could be improved, however we believe this would result in changes in some individual pixels but would probably not significantly change the overall landscape distribution of winter sagebrush seen in our results.

Our winter sagebrush classification results suggest that mountain big sagebrush and sagebrush dry shrubland are the most critical vegetation classes for the sage-grouse population, as the majority of exposed winter sagebrush falls into one of these two classes (Figure 7). Most likely, the other four sagebrush vegetation classes are covered with snow and inaccessible to sage-grouse, even during average snowfall winters.

Generally, the winter sagebrush distribution in our study area corresponds with the observed sage-grouse winter locations from 1978-2006, as shown in Figure 8. Even though winter sagebrush habitat exists throughout Grand Teton National Park and Bridger-Teton National Forest, our results suggest that the sage-grouse population is using only select areas of exposed sagebrush, as shown by the Kernel density home range polygons (Figure 8). This selection could be due to factors such as decreased predation risk, warmer temperatures, or better forage quality.

It is important to note that our results do not reflect the habitat changes since the Blacktail Butte fires of 1998-2003. Our satellite image is from March 1996 and our Kernel density data is from 1978-2006, with the major of it (238 of 266 sage-grouse locations) collected prior to the largest fire in 2003. Unfortunately, we were unable to accurately compare differences in sage-grouse habitat use before and after the fires because the data imbalance. Therefore, our Kernel density results that show Blacktail Butte as the highest density area for sage-grouse are likely out-dated. This suggests an importance in continuing to collect winter sage-grouse location data and more recent satellite images in order to get a more accurate picture of current winter habitat distribution and use.

Our failure to identify any pixels containing sagebrush on the March 2006 satellite image suggests that during high snowfall winters, exposed sagebrush is found in low density, scattered patches, making it undetectable within our 28.5 x 28.5 meter pixels. We believe that even during high snowfall winters, exposed sagebrush exists, but it is undetectable using satellite imagery. Other studies have also found that it is difficult to use satellite imagery to detect small, scattered areas of vegetation in landscapes dominated by highly reflective surfaces, such as sand or snow (Edwards et al. 1999; Milich & Weiss 2000) because high reflectivity washes out other weaker spectral signatures.

Our results support the suggestion by Holloran & Anderson (2004) that winter habitat may be a limiting factor for the Jackson Hole sage-grouse population, especially during high snowfall winters. However, during average snowfall years, it appears that the sage-grouse are still favoring the six winter habitat areas that we identified (Figure 8). These areas may represent the most critical areas to the population, but this may also suggest that other factors, in addition to winter sagebrush availability are limiting population sizes. The fact that populations have not declined following the 2003 Blacktail Burn adds to our curiosity regarding what factors limit the local population size. We believe that continuing to monitor sage-grouse winter movements along with sagebrush distribution changes in the future will yield information useful for management decisions affecting the Jackson Hole population.

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Milich, L. and E. Weiss. 2000. GAC NDVI images: relationship to rainfall and potential evaporation in the grazing lands of The Gourma (northern Sahel) and in the croplands of the Niger-Nigeria border (southern Sahel). *International Journal of Remote Sensing*. 21(2): 261-280.

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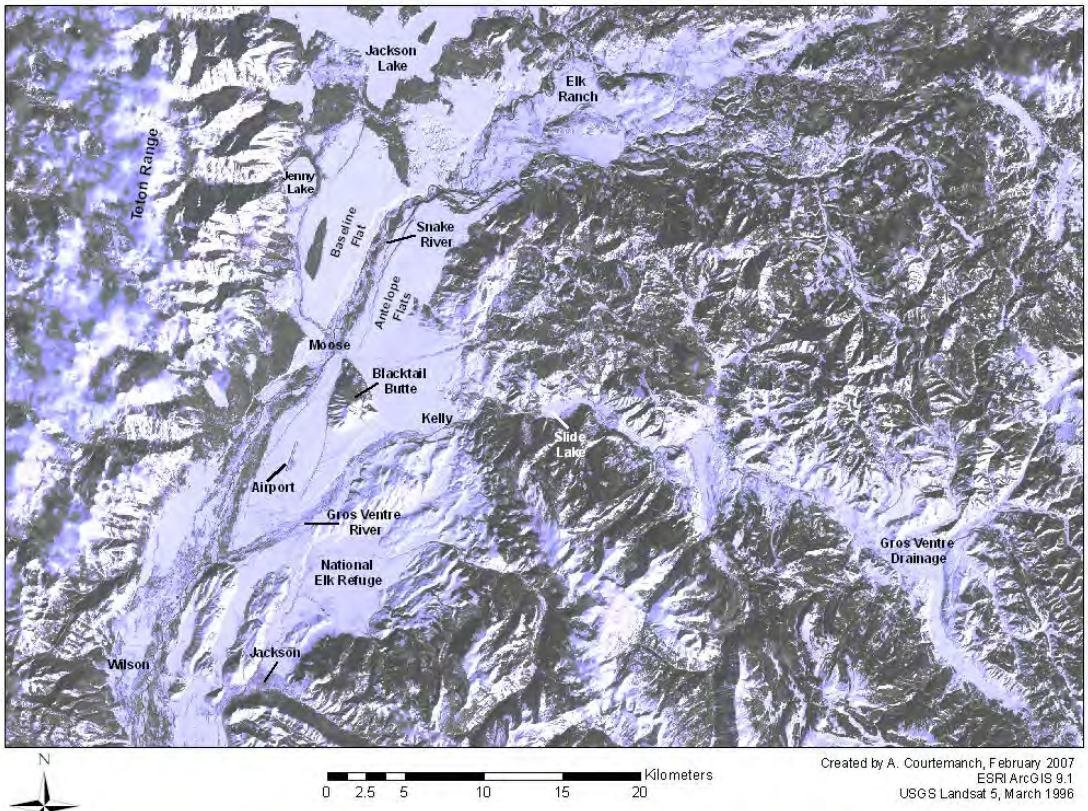

Figure 1. Study area, showing Grand Teton National Park, Bridger-Teton National Forest, National Elk Refuge, towns, and major landmarks.

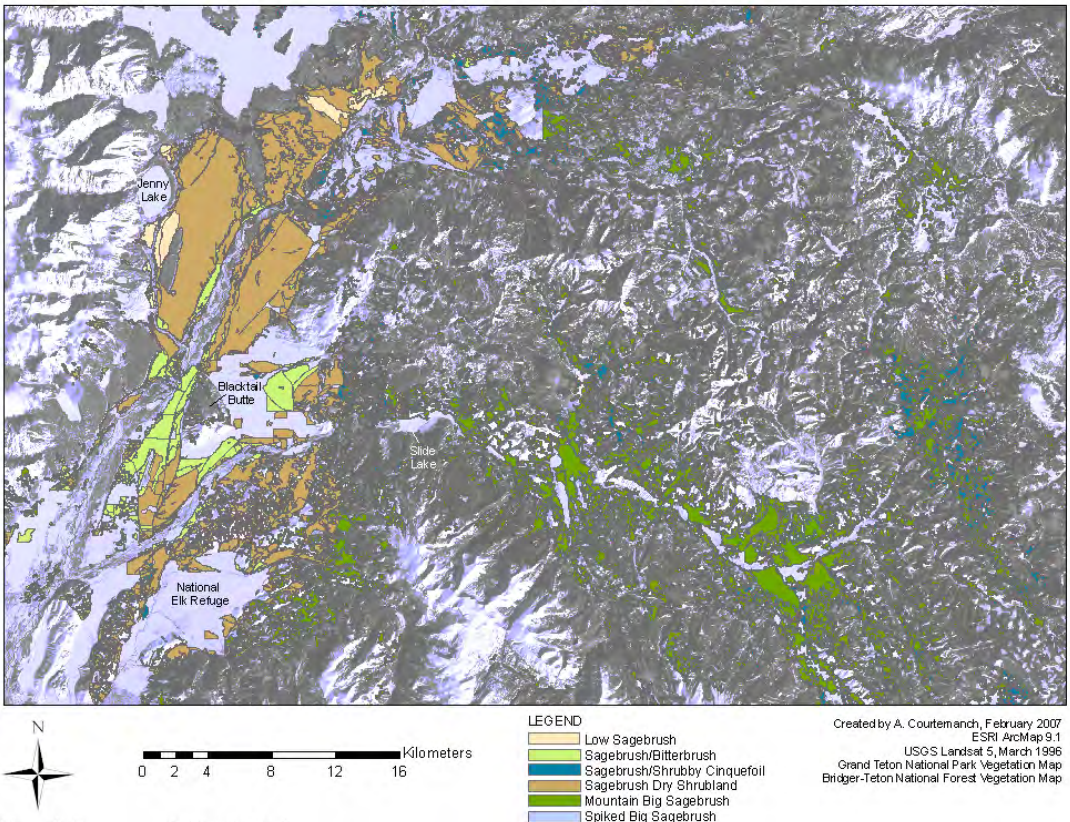

Figure 2. Summer sage habitat distribution in Grand Teton National Park and Bridger-Teton National Forest

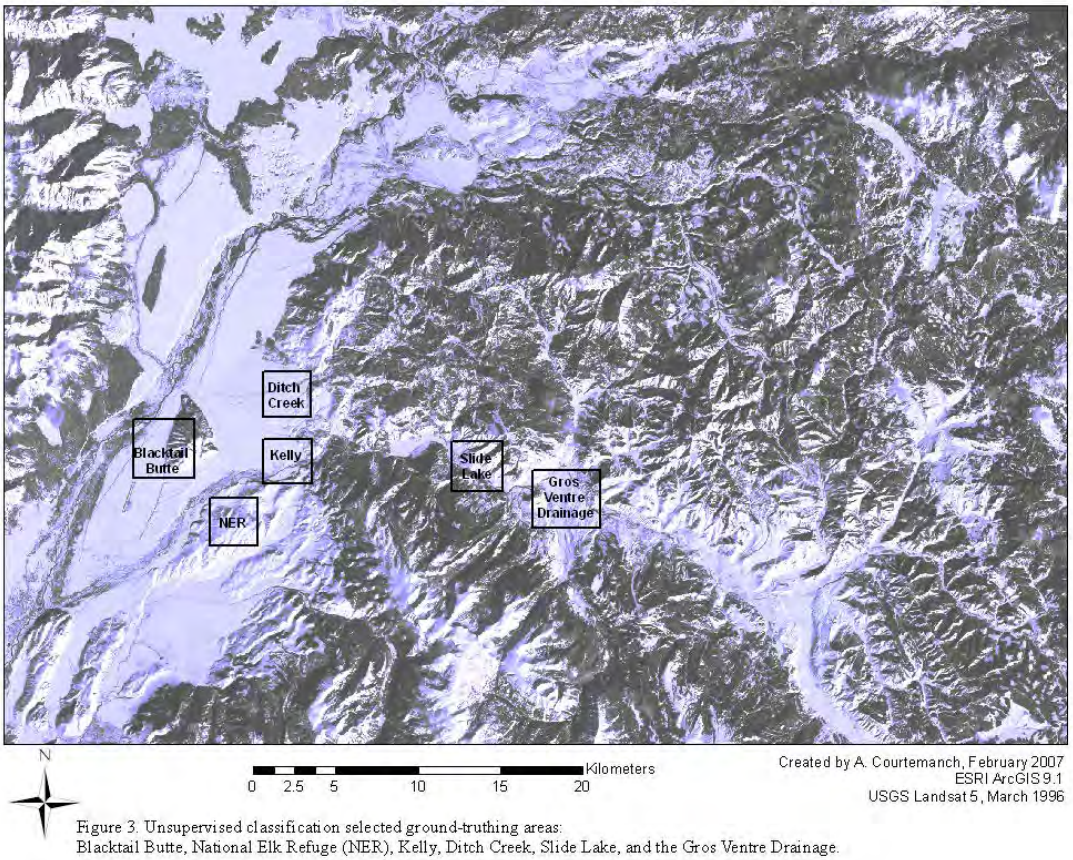

Figure 3. Unsupervised classification selected ground-truthing areas:
Blacktail Butte, National Elk Refuge (NER), Kelly, Ditch Creek, Slide Lake, and the Gros Ventre Drainage.

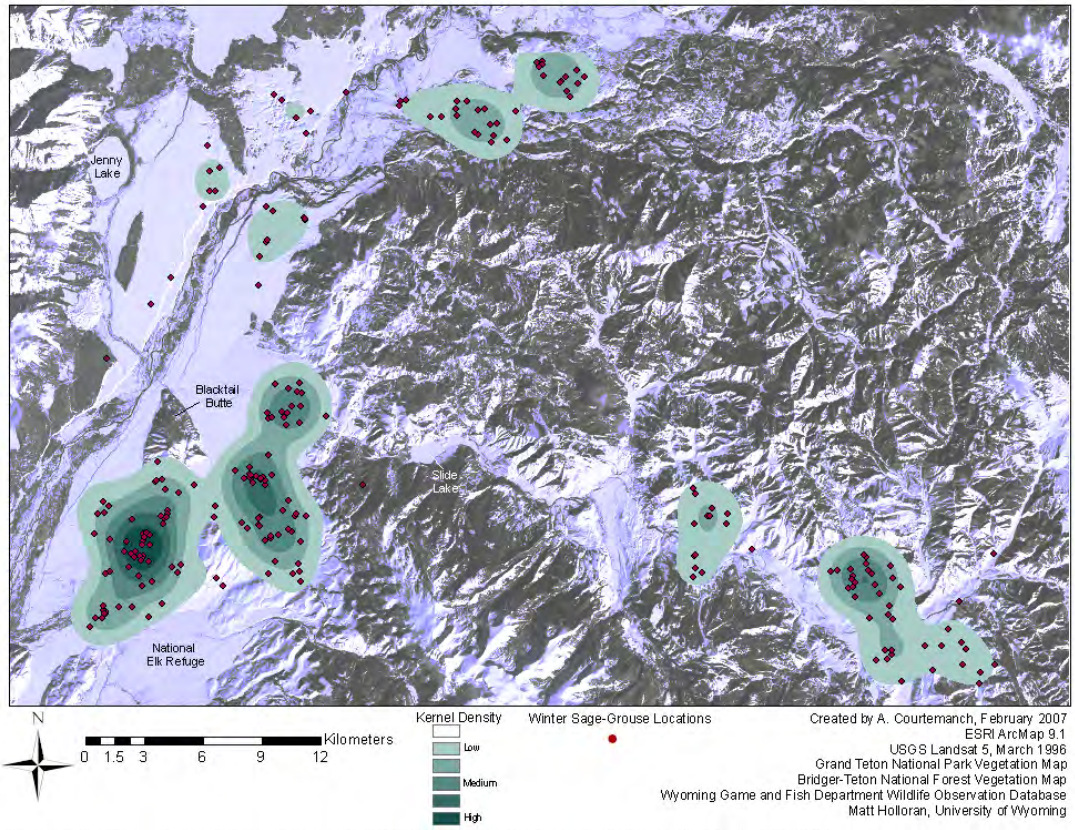

Figure 5. Sage-grouse winter observation locations (1978-2006) and corresponding sage-grouse Kernel density analysis for Grand Teton National Park and Bridger-Teton National Forest

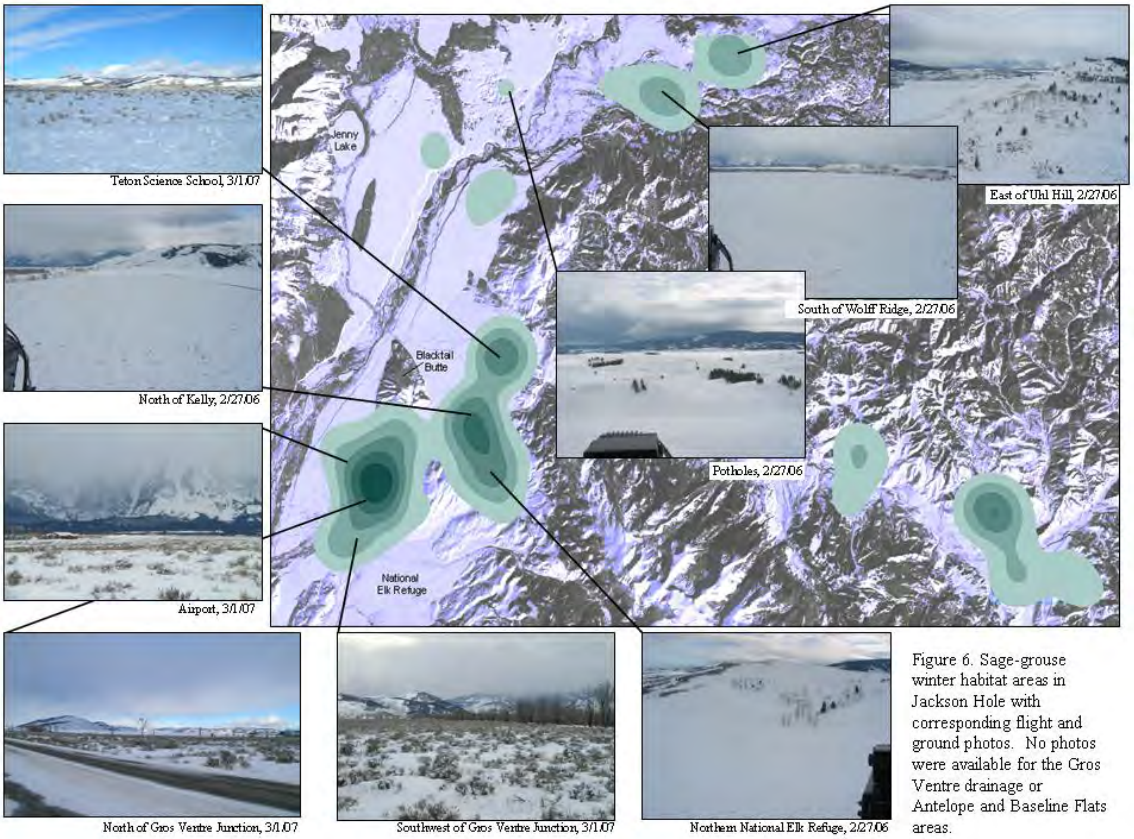

Figure 6. Sage-grouse winter habitat areas in Jackson Hole with corresponding flight and ground photos. No photos were available for the Gros Ventre drainage or Antelope and Baseline Flats areas.

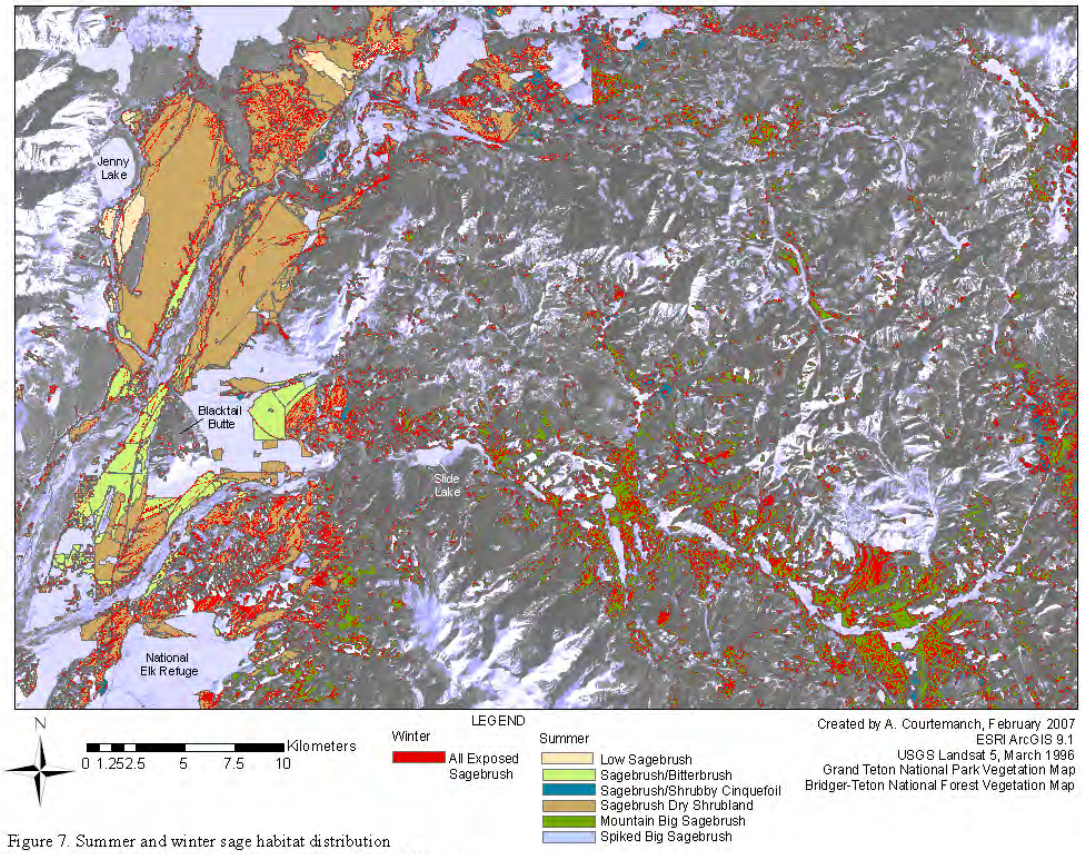

Figure 7. Summer and winter sage habitat distribution in Grand Teton National Park and Bridger-Teton National Forest

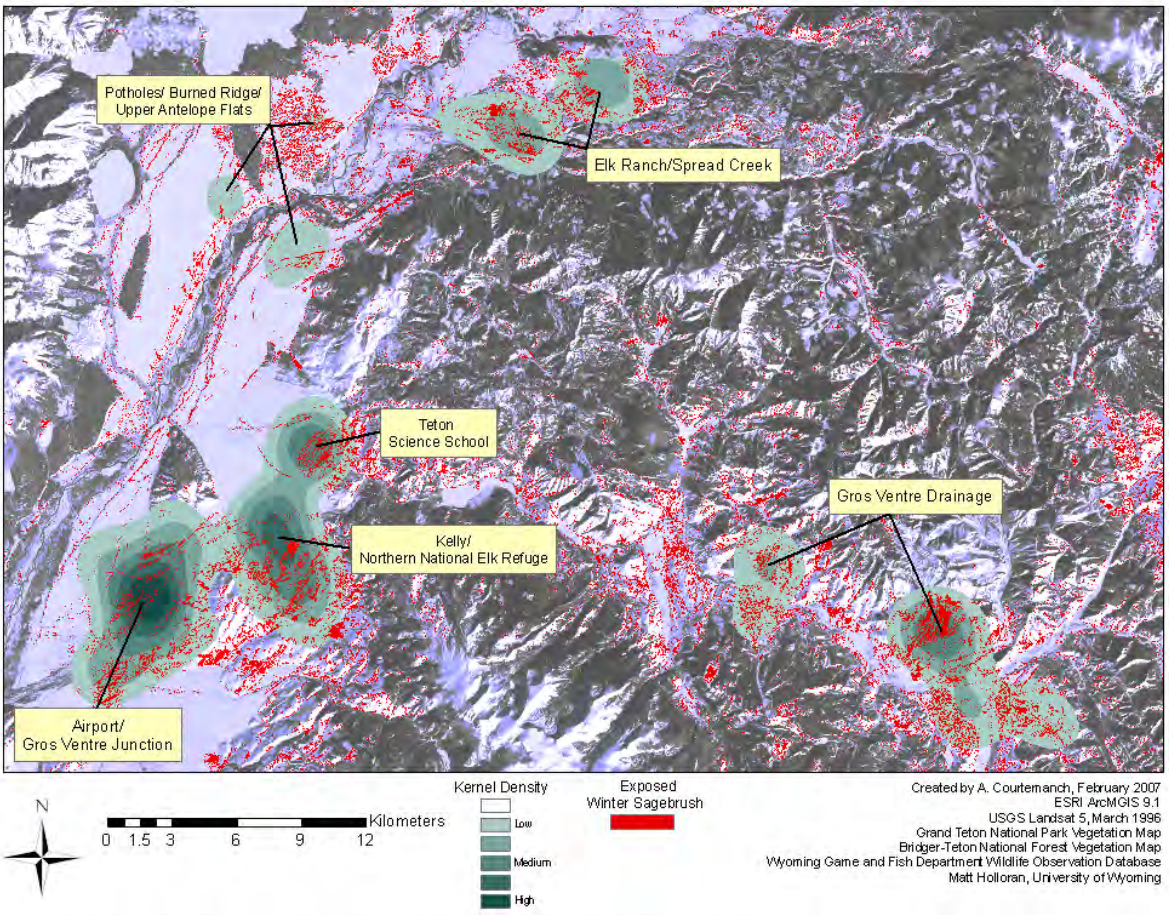

Figure 8. Sage grouse winter Kernel density homeranges and exposed sagebrush areas (March 1996) in Grand Teton National Park and Bridger-Teton National Forest