Sage-grouse Conservation Plan

for the Big Horn Basin, Wyoming:

Five-Year Addendum, 2007-2013

Prepared by:

The Big Horn Basin Sage-grouse Local Working Group

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Preface

The Sage-grouse Conservation Plan for the Big Horn Basin was finalized in 2007. Updates to the Plan were scheduled to be completed every five years. The Big Horn Basin Local Sage-grouse Working Group developed this addendum to satisfy that schedule. It also serves as an update of activities for the US Fish and Wildlife Service prior to their decision to list or not list sage-grouse under the Endangered Species Act by fall 2015.

A draft of this addendum was released for public review on 16 September 2013, followed by a 30-day comment period which closed 18 October. A public meeting was held in Cody, Wyoming on 23 September to seek comments and input to improve the addendum and management activities. Four working group members and Wyoming Game & Fish's sage-grouse coordinator were present to provide information, answer questions and take public comments. Six members of the public attended and provided input, but no written comments were submitted at that time. Only one letter was received during the public comment period. That letter was from an energy production company and was also submitted to other local working groups in response to their draft addendums. Public input did result in modifications to the addendum for the Big Horn Basin.

Introduction

A meaningful management plan is a dynamic document that continually addresses questions of: where are we, what have we accomplished, where do we want to be and how do we get there. The ***Sage-grouse Conservation Plan for the Big Horn Basin*** was completed in August 2007. At the time of its completion, the conservation plan encompassed the best available science, personal and professional experience and first-hand knowledge of the Big Horn Basin's ecologic and socio-economic conditions to provide management direction with the aim of conserving greater sage-grouse in the Basin.

The purpose of this addendum is to address those questions posed above and to provide an update to the plan. Accomplishments and new information garnered since 2007 are included here, as well as recommendations for future management direction. Since development of the original plan, a number of bio-political changes have occurred and new scientific knowledge has been gathered. These have influenced recent management recommendations. New information considered in this plan update is included in respective sections of the plan. This addendum is not a stand-alone document; please refer to the original conservation plan for the Big Horn Basin Conservation Area (BHBCA) for supplemental information.

State Level Actions

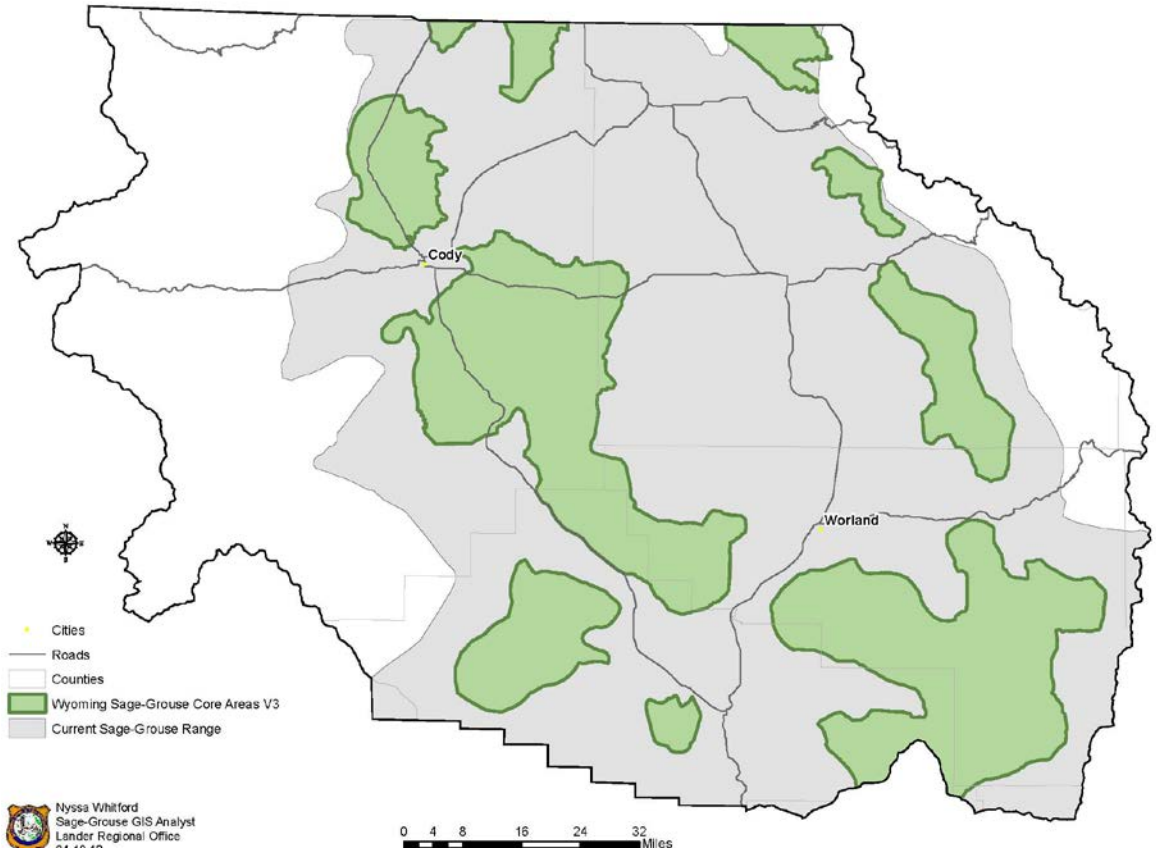
Executive Orders and Core Areas. In 2007, then Wyoming Governor Dave Freudenthal hosted a 2-day Sage-Grouse Summit in Casper and called for development of statewide measures to positively impact sage-grouse numbers and habitats. The summit was clearly motivated by a concern that the US Fish and Wildlife Service (USFWS) might list the greater sage-grouse under the Endangered Species Act. The intent of this summit was not to obviate the work of LWGs, but to supplement those endeavors and provide a more directed statewide approach to sage-grouse conservation. A number of members of the Big Horn Basin Sage-Grouse Local Working Group (BHBLWG) participated in that summit. Following that meeting, Governor Freudenthal appointed a statewide Sage-grouse Implementation Team (SGIT) that included state and federal agencies, conservation groups, industry and landowners. The team supported the Wyoming Game and Fish Department statewide sage-grouse plan that called for utilizing existing Local Working Groups (LWGs) to implement on-the-ground actions to benefit sage-grouse.

To further benefit sage-grouse, Governor Freudenthal issued a sage-grouse conservation policy in 2008 (Executive Order 2008-2 Greater Sage-grouse Core Area Protection). Another executive order (2010-4), to address new issues and science that had emerged since 2008, was issued in 2010. Both executive orders included designation of core areas around some of the most populated sage-grouse breeding habitats. The purpose of these core areas was to protect vital sage-grouse habitats through conservation measures and limitations on new anthropogenic alterations. Initially the SGIT delineated core areas across Wyoming using both population data (lek surveys) and suitable habitats (which included areas of development). In 2010, LWGs participated in give-and-take sessions that helped refine core area boundaries within their areas of responsibility. Many areas with pre-existing development were removed from core area designation; however, on a state-wide level, 357,000 additional acres were added to core areas. Core area boundaries in the BHB were revised that resulted in an increase of 19,900 acres being protected (over version 2). Ten core areas were delineated in the BHBCA (Fig. 1).

Following in the spirit of sage-grouse conservation initiated by Governor Freudenthal, current Governor Matt Mead issued Executive Order 2011-5, replacing Executive Order 2010-4. Governor Mead's new executive order embodies the same core area strategy as in the preceding orders but offers new language intended to add flexibility to development in core areas and also to clarify agency implementation of the strategy.

In 2005, the Sage-grouse Conservation Fund was established to aid LWGs in implementing local conservation plans. The Governor and state legislature have included funds in the biennial budget for appropriations for sage-grouse conservation projects again in the 2006–2008, 2008-2010, 2010-12, and 2013-14 budget cycles. Projects funded and implemented by the BHBLWG were directed towards improving the sage-grouse population status largely through habitat improvements. Specific projects are discussed below (**Accomplishments** section) and listed in Appendix A.

Figure 1. Sage-grouse core areas delineated in Big Horn Basin, Wyoming (core areas version 3, 2010).



Federal Agency Actions

US Fish and Wildlife Service. The Greater Sage-grouse became a "candidate" species under the Endangered Species Act in 2010 when the US Fish and Wildlife Service (USFWS) determined that this species was warranted for listing but precluded due to higher priority species. As such, the USFWS will evaluate the status of the species annually, with the expectation of future listing if the status does not improve. The USFWS has also entered into a settlement agreement to remove sage-grouse from the candidate list and declare the bird either "warranted" or "not warranted" in 2015.

USFWS, in conjunction with the Wyoming Governor's Office, the Natural Resources Conservation Service (NRCS), WGFD, Wyoming Department of Agriculture, Wyoming Association of Conservation Districts, Bureau of Land Management (BLM)-Wyoming state office, and the U.S. Forest Service (USFS), have released a draft *Greater Sage-grouse Umbrella Candidate Conservation Agreement with Assurances (CCAA) for Wyoming Ranch Management*. The purpose of this agreement is to encourage landowners to voluntarily implement conservation measures to conserve, restore, or enhance habitat for the greater sage-grouse on non-Federal lands in Wyoming. In return, participating landowners and land managers would receive regulatory assurances concerning land use restrictions that might otherwise apply to them should

the greater sage-grouse become protected under the ESA. The Umbrella CCAA will be in effect for 40 years following its approval.

Under the Umbrella CCAA, each participating landowner, with assistance from participating state and federal agencies, would develop an individual CCAA, selecting conservation measures appropriate to their properties that are described in the Umbrella CCAA. Individual CCAAs would be linked to the Umbrella CCAA. USFWS will issue an enhancement-of-survival permit to each enrolled landowner following approval of the individual CCAA. In the event the greater sage-grouse is listed under the ESA, the permit authorizes incidental take of the species that may result from general farming and ranching operations and recreation. The Service also will not impose commitments or restrictions of land, water, resources, or finances on the enrolled landowner beyond those agreed to in the individual CCAA. Individual CCAAs and enhancement-of-survival permits will have duration of 20 years.

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. These threats were recognized in the Sage-grouse Conservation Plan for the Big Horn Basin; although the degree to which each of those threats is impacting sage-grouse in the BHBCA is unknown. The BHBLWG has funded several projects to address many of the threats (discussed below).

Bureau of Land Management. Because over 80% of core areas occur on lands administered by the BLM in Wyoming, that agency initiated a series of state and national Instructional Memoranda (IMs) designed to provide guidance to their field offices on sage-grouse habitat management for proposed activities and resource management planning. These memoranda incorporated the core area concept and executive orders initiated by the Governors. The state-level IM currently in effect was released in March of 2012 (WY-IM 2012-019).

Related to this effort, the BLM convened the Sage-Grouse National Technical Team (NTT) in 2011, bringing together resource specialists and scientists from the BLM, state fish and wildlife agencies, USFWS, NRCS, and the U.S. Geological Survey (USGS). The NTT developed a series of science-based conservation measures to be considered and analyzed through the land use planning process across 68 land use planning units

which contain greater sage-grouse habitat. The conservation measures developed by the NTT must be considered and analyzed, as appropriate, through the land use planning process by all BLM state and field offices that contain occupied greater sage-grouse habitat (BLM 2012a).

Cody and Worland field offices of the BLM are undertaking revisions to their resource management plans (RMPs), to be released as one document for the entire Big Horn Basin. The RMP will contain measures to enhance sage-grouse and sagebrush management, patterned after and including the state and national IMs. In 2013, two new alternatives were developed that place more emphasis on sage-grouse conservation on BLM lands. Portions of all alternatives may be integrated into the final land management plan. A record of decision on the final plan is not expected until 2014.

Natural Resources Conservation Service. In 2010, NRCS launched the Sage-Grouse Initiative (SGI). Existing conservation programs (Environmental Quality Incentives Program [EQIP] and Wildlife Habitat Incentive Program [WHIP]) were adapted to improve habitat for grouse and improve sustainability of native rangelands. Practices, such as sustainable grazing plans, conifer removal, and fence removal or marking, will be implemented on a landscape scale across a sage-grouse core area. Between 2010 and 2013, approximately $17 million has been allocated for SGI in Wyoming. In the Big Horn Basin, a range management specialist was hired, under the auspices of SGI, to specifically recommend and implement grouse-related management practices on private land.

Several large-scale threats facing sage-grouse are identical to factors impacting the sustainability and productivity of grazing lands throughout the West. SGI aims to remove or reduce those threats common to sustainable ranching and sage-grouse conservation. Fragmentation of sagebrush habitats from a variety of sources is one of the primary causes of the decline in both sage-grouse populations and rangeland productivity. Exotic species invasions, unsustainable grazing systems, sod-busting, subdivision development, and conifer encroachment are other examples of mutual threats. Identifying the species' limiting factors at the level of the individual property owner is essential to ensure that the goals of the Conservation Practice Standard are met through SGI. SGI fosters coordination and implementation on a range-wide scale while ensuring local input and control. NRCS and USFWS came to an agreement in 2012 that is intended to provide "take protections" for producers/landowners that implement specific, approved conservation practices as part of SGI contracts.

In addition to efforts to improve sage-grouse habitat through EQIP and WHIP, the SGI program has secured some of the best remaining sage-grouse habitat in Wyoming through conservation easements. Working with other partners, the NRCS has allocated approximately $100 million for conservation easements through the Farm and Ranchland Protection Program and the Grassland Reserve Program since 2010. (Refer to **Residential Development** section, below, for more information on conservation easements.)

Cooperative state/federal actions. In addition to the state and federal partnerships mentioned above, Wyoming Governor Matt Mead and Secretary of the Interior Ken Salazar co-hosted a meeting in December 2011, to address coordinated conservation of sage-grouse across its range. Ten states within the range of the sage-grouse were represented, as were several federal agencies (USFS, NRCS, BLM, USFWS, and the Department of the Interior). The primary outcome of the meeting was the creation of a Sage-Grouse 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.

Summary. Management direction and projects implemented or funded by the BHBLWG have been, and will be, influenced by the guidance provided in the Wyoming Greater Sage-Grouse Conservation Plan (2003), Governor's executive orders, BLM's instructional memorandum and other programs discussed above. As these directives are updated, the BHBLWG will continue to consult their guidance.

Sage-grouse in the Big Horn Basin Conservation Area

As stated in the Sage-grouse Conservation Plan for the Big Horn Basin, WY, sage-grouse in the Big Horn Basin have been recognized as a distinct sub-population. Recent research has documented movement of grouse from the southeast corner of the Big Horn Basin up in elevation to an area of the Bighorn Mountains where sage-grouse from the Powder River Basin also spend summer (Ostheimer unpublished report). Genetic exchange between these populations is being evaluated.

The sage-grouse population in the Big Horn Basin is still believed to be relatively stable; however, no reliable method for estimating the population exists. Lek attendance by males has been and continues to be widely used as the best available indicator to population trend. Recent efforts to determine population size of lesser prairie chickens (*Tympanuchus pallidicinctus*) in the Midwest (McRoberts 2009, McDonald et al. 2012) may provide a technique that can be applied to sage-grouse. Other data that may indicate population size are inadequate to draw conclusions about sage-grouse in the Big Horn Basin. The number of brood surveys and broods observed is too low to reliably reflect population level trends. Hunter harvest levels fluctuate too widely to be used as an indicator of population trend and are affected by changes in hunting regulations.

Few sage-grouse lek data were collected prior to 1980 (fewer than 25 leks per year). Data collection greatly increased in the late 1990s as the status of sage-grouse

populations became an increased concern. As of 2013, there were 252 known, active leks and 42 inactive or undetermined leks in the BHBCA. Nineteen new leks were documented since the Conservation Plan was written (2008-2013). There has been a decline in average number of males observed per lek since 2006; however, that decline was believed to be natural variation in the population cycle (Table 1, Fig. 2). Trends in male attendance at leks in the Big Horn Basin are similar to trends in statewide grouse numbers (Fig. 3). Other areas in the state have more and better quality sagebrush habitat and thus have larger grouse populations. Lek counts suggest increasing grouse populations in the Big Horn Basin and statewide since 1995. Refer to WGFD's annual sage-grouse reports for more information (refer to WGFD website for job completion reports; http://wgfd.wyo.gov/web2011/wildlife-1000496.aspx).

Table 1. Number of leks checked and male sage-grouse observed in the Big Horn Basin Conservation Area, 1980-2013.

Year	Occupied leks	# Checked	% Checked	Peak Males	Avg Males/ Active Lek[1]	Year	Occupied leks	# Checked	% Checked	Peak Males	Avg Males/ Active Lek[1]
1980	84	32	38	425	14.7	1997	204	81	40	770	13.1
1981	87	43	49	574	16.4	1998	202	75	37	1008	15.8
1982	110	65	59	845	15.1	1999	199	84	42	1948	24.7
1983	141	72	51	1254	18.2	2000	197	104	53	2276	24.0
1984	147	53	36	991	20.6	2001	200	120	60	2129	19.7
1985	158	68	43	1111	17.1	2002	200	126	63	1351	12.5
1986	168	72	43	863	14.4	2003	191	146	76	1698	13.6
1987	183	109	60	1053	12.0	2004	194	144	74	2106	17.6
1988	187	100	53	1449	18.6	2005	193	164	85	2987	20.7
1989	193	61	32	776	15.5	2006	203	161	79	3447	26.1
1990	198	91	46	1456	20.8	2007	205	154	75	3451	25.2
1991	196	39	20	622	18.8	2008	218	175	80	3204	21.2
1992	202	87	43	1336	18.3	2009	219	169	77	2961	22.1
1993	204	136	67	1654	15.3	2010	223	182	82	2737	18.1
1994	207	105	51	820	10.0	2011	230	183	80	1893	14.3
1995	206	124	60	882	9.4	2012	233	178	76	1575	11.5
1996	206	87	42	727	11.5	2013	237	189	80	1251	9.5

[1] Avg Males/Active Lek - Includes only those leks where one or more strutting males were observed and does not include "Active" leks where only sign (feathers, droppings) was documented.

Figure 2. Average number of male sage-grouse observed per lek, trend (black) and 5-year running average (red) from lek counts and surveys in the Big Horn Basin Conservation Area, 1980-2013.

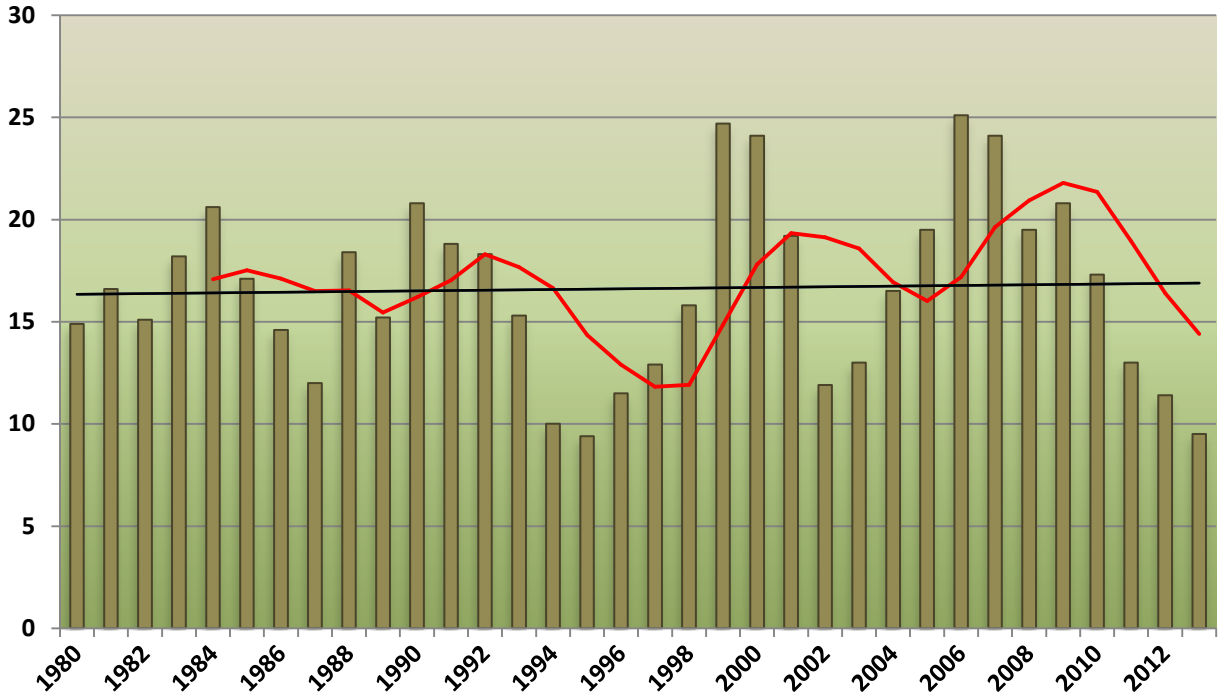
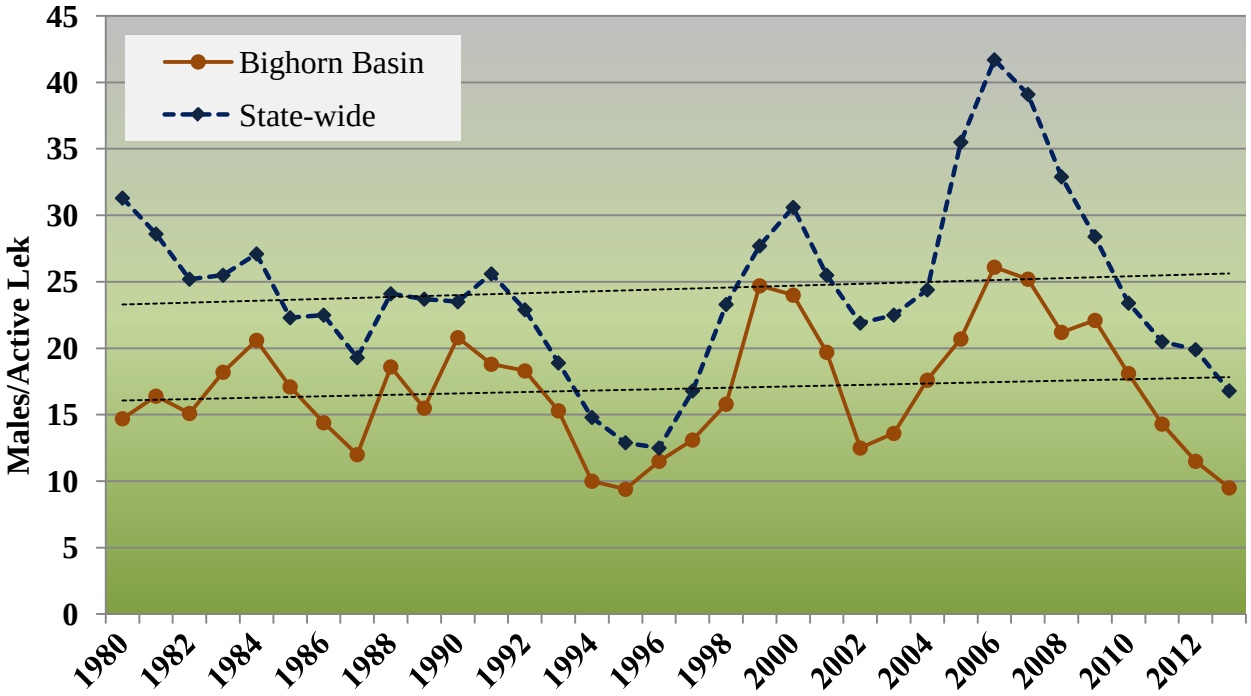


Figure 3. Average number of males observed at active leks in the Big Horn Basin and statewide, including trend lines, 1995-2012.



Factors Affecting Sage-grouse Populations and Habitats

The Sage-grouse Conservation Plan for the Big Horn Basin identified several factors that could potentially impact this sage-grouse population. Those factors were similar to factors listed in the statewide conservation plan (Wyoming Game & Fish 2003) and by the US Fish and Wildlife Service's Endangered Species Act listing decision in 2010. Refer to the local conservation plan, the state-wide plan and/or the listing decision for specifics on how these factors may affect sage-grouse. This addendum will only review impacts that may have changed, new research findings, and projects that have been conducted to address those factors since the local conservation plan was written in 2007.

In the local plan, the BHBLWG felt that sage-grouse populations could be most affected by (in order of initial ranking): predation, weather, livestock grazing, vegetation management, mineral development, invasive plants, parasites and diseases, residential development, recreation, conflicting wildlife management goals, conflicting wild horse management, farming and hunting. The initial ranking was based on personal opinion and experiences; and not on scientific research. Some research on sage-grouse in the Big Horn Basin has been conducted, or is currently on-going, since the plan was written; however, a comprehensive investigation into limiting factors has not been attempted. We chose not to re-evaluate the initial ranking of factors for this addendum.

Predation. There has been little information collected to estimate numbers or density of possible predators of sage-grouse across the Big Horn Basin prior to 2007 or since. Numbers and densities of predators should not have dramatically increased since 2007; however, little data have ever been collected. Predation of sage-grouse, however, may have increased somewhat since rabbit populations appear to have been at a low in the population cycle during the past several years. Raven populations in the BHBCA are suspected to have increased. Research has identified common raven (*Corvus corax*) as being a predator of sage-grouse eggs and young (Coates et al. 2008, Bui et al 2010).

A research project is currently underway to assess rates of predation and identify which predators prey on sage-grouse in the Big Horn Basin (Orning and Young 2012). The research study is being conducted through a contract with U.S. Department of Agriculture-Animal and Plant Health Inspection Service (USDA-APHIS) Wildlife Services' National Wildlife Research Center (NWRC) by a graduate student and lead researcher from Utah State University with assistance from local predator management districts (PMDs) and local personnel with USDA-APHIS Wildlife Services. Primary support for the project is through the seven Bighorn Basin conservation districts, the four county PMDs, APHIS, the Wyoming Animal Damage Management Board, and substantial funding from additional sources. Although the LWG failed to reach consensus in support of the project as a whole, it has provided grant funding specific to sage-grouse location and habitat utilization.

That research is focusing on impacts of predators on nest success, brood survival and hen survival. Sage-grouse hens at four lek complexes were captured and fitted with radio transmitters. Trail cameras were placed at nest sites to document predation rates and species of predators visiting nests. Various types of predator surveys are being conducted in areas around those lek complexes to determine type and density of possible predators. The project will evaluate effects of specific predator removal on hen survival and nest success. The first graduate student's work will be completed in 2013 and the project's contract is being extended into 2016 with a NWRC lead researcher affiliated with Oregon State University.

Weather. Since 2007, little has changed regarding our opinions on the impacts of weather on sage-grouse and their habitats. Weather patterns and daily weather events all influence sage-grouse populations by stressing them and modifying their habitats. There remains little that can be done to change weather patterns, but habitat of sufficient quality and quantity can help ameliorate weather impacts on sage-grouse populations. Recently, considerable attention has been focused on the impacts of climate change to sage-grouse and their habitats.

Johnson and Holloran (2010) concluded from their literature review that climate change presents a significant threat to maintenance of healthy sage-grouse populations throughout the west. These threats may be manifest through direct impacts to populations from severe weather events and prolonged droughts, increase of risk from disease such as West Nile virus (WNv), alterations of habitats and synergistic interactions of all these factors. Climate change models for sagebrush regions predict more variable and severe weather events including droughts and storms, increased levels of carbon dioxide and possibly nitrogen, greater fire incidence, higher temperatures, wetter winters, shifts from snowfall to rainfall, earlier onset and warmer springs coupled with longer summer conditions. Results of these conditions would lead to periods of heat and drier soils creating stress for sagebrush. Potential impacts could be manifest in a shift in competitive advantage of plants from native communities to those dominated either by woodlands or exotic annual grasslands, depending on ecological site characteristics.

In the Big Horn Basin, these predictions translate to increased cheatgrass invasion in lower elevation xeric sites and juniper encroachment at more mesic, higher elevation sites. Cheatgrass invasion and juniper encroachment are already evident in the Basin and have been the focus of habitat projects supported by the BHBLWG. Concurrent with increased establishment of cheatgrass is increased fire frequency because of the accumulation of highly flammable fine fuels (cured cheatgrass). Increased fire frequency coupled with hotter conditions and drier soils favors conversion of sagebrush communities to cheatgrass dominated grasslands. Conversely, with drier conditions and without periodic (50-200 years) disturbance, juniper has encroached on sagebrush habitats. Thus, sagebrush communities in the Big Horn Basin are sandwiched in the jaws of new selection pressures; cheatgrass invasion on the one side and juniper encroachment on the other.

Schrag et al. (2010) concluded that from alterations posited from climate change models, the risk of WNv infections in sage-grouse would also increase. These changes would be influenced by increased temperatures that could lead to earlier onset of WNv transmission and facilitate spread to higher elevations. Those authors also suggested that increased drought might cause sage-grouse to move toward water earlier in the year and thus come into contact with mosquitoes for longer periods of time. The risk of WNv transmission could be further exacerbated by the presence of stagnant water resulting from coalbed methane development and water sources intentionally developed to ameliorate the impacts of drought on both domestic and wild animals.

The BHBLWG will continue to support habitat projects that strive to reduce cheatgrass invasion and juniper encroachment into sagebrush communities. The potential for cheatgrass invasion will be carefully scrutinized when we evaluate any potential habitat improvement project. Furthermore water development projects will be evaluated on potential to increase WNv occurrence as well as their influence on ungulate distributions. We will also encourage permitting agencies to consider WNv-related impacts from water sources associated with anthropogenic development.

Livestock grazing. No major changes have occurred across the Big Horn Basin concerning livestock grazing since 2007. There have been site specific changes to some grazing allotments and annual grazing plans (e.g., season of use, partial deferments). Landowners are implementing new grazing plans drafted by NRCS on over 45,000 acres of rangeland in core habitat specifically to improve sage-grouse habitat by ensuring adequate residual vegetation to screen hens when on the nest. Changes to grazing plans were based on intensive vegetative monitoring to set acceptable stocking rates to ensure long-term rangeland health. Additionally, BLM has performed sage-grouse habitat assessments on 85 allotments in BHBCA to ensure sage-grouse habitat requirements are being met with existing grazing plans. To reduce number of grouse mortalities due to collision with wires, modification (26 miles) and marking (24 miles) of some allotment/pasture fences has occurred on BLM lands. Refer to Table of Accomplishments for specifics (Appendix B).

NRCS is in the process of completely revamping all of the Ecological Site Descriptions (ESDs). One significant change included modifications to the State-and-Transition models that would eliminate connections between states that have never been observed to actually occur. As new descriptions are approved, they will be made available to the public. Until then, old descriptions will remain available. This process is expected to take another eight years to complete. To access ESD's log on to: http://esis.sc.egov.usda.gov/ (new web link).

"Grazing influence, objective development, and management in Wyoming's greater sage-grouse habitat with emphasis on nesting and early brood rearing" (Cagney et al. 2010) was prepared by a group of Wyoming range and wildlife scientists to advise with livestock management. This peer-reviewed document is available as a University of Wyoming Extension Bulletin (B-1203).

Vegetation management. Since the Sage-grouse Conservation Plan for the Big Horn Basin was adopted in 2007, the BHBLWG has concentrated support and funding for vegetation treatments, particularly treating invasive vegetation species. Some of these vegetation management projects include: mechanical removal of junipers within upland sagebrush communities/nesting habitat; using chainsaws or tracked vehicles with masticating heads to remove junipers, Russian olive, and/or salt cedar from riparian, brood-rearing habitats; and chemical treatment of cheatgrass with Plateau®. Baruch-Hordo et al. (2013) calculated that as little as 4% canopy cover of juniper on a sagebrush landscape may result in population level impacts to sage-grouse. Thus, early removal of expanding junipers across the Big Horn Basin could have beneficial effects on sage-grouse. These and other types of vegetation management projects being implemented within the BHBCA can be found in the Table of Accomplishments (Appendix B).

Research in Wyoming and other states suggested that treatments in sagebrush habitat are not beneficial to sage-grouse (Karhu and Anderson 2002, Rhodes et a. 2010, Beck et al. 2011). The effects of vegetation treatments on sage-grouse habitat were researched in the Big Horn Basin by a graduate student in 2008-09 and culminated in a Master of Science thesis (Hess 2010) and peer reviewed publications (Hess and Beck 2012a). That project investigated effects of burning and mowing treatments in Wyoming big sagebrush communities. As part of her work, Hess (2010) also compiled a centralized database to document location, acreage, and type of treatments in the BHBCA. In summary, that research revealed two findings that should be considered by managers pursuing these types of projects to enhance Wyoming big sagebrush for sage-grouse in arid habitats similar to the Big Horn Basin:

> "First, burning never resulted in Wyoming big sagebrush of adequate height or canopy cover for recommended breeding habitat guidelines and mowing only resulted in adequate Wyoming big sagebrush height and canopy cover in one year (height in 2008 and for canopy cover in 2009) on sites mowed on aridic soils. Second, if Wyoming big sagebrush characteristics in untreated communities do not meet the minimum Connelly et al. (2000b) guidelines, managers should consider consequences of sagebrush-reduction treatments in those areas, and instead consider other practices such as grazing management to increase perennial grass cover and height (Beck and Mitchell 2000) or managing areas without treatment" (Hess and Beck 2012a).

Hess (2010) and Hess and Beck (2012a) did not monitor sage-grouse to determine how habitat treatments affected sage-grouse individuals and/or populations within the BHBCA. Slater (2003) found that sage-grouse will use burned areas for foraging, nesting and brood-rearing. More research on habitat treatments using radio-marked birds has begun in another part of Wyoming. Cumulative impacts of vegetation treatments on sage-grouse cannot be assessed without that information.

Hess (2010) and Hess and Beck (2012a) also did not address spatial effects of vegetation treatments on sage-grouse habitats and did not compare treatment mosaic to spatial recommendations of Connelly et al. (2000a). Connelly et al. (2000a)

specifically stated that when sagebrush overstory is intact but understory vegetation has been degraded, appropriate techniques can be used to retain some sagebrush and open the shrub canopy to encourage forb and grass growth. Studied treatment areas met the 20% criteria recommended on a landscape scale. Treatment objectives were not to increase sagebrush height or cover, but objectives were to produce multiple seral stages in a patchwork providing habitat diversity and restoration. Treatment areas should be designed to achieve a fine-grained mosaic of small open areas surrounded by cover patches to safeguard nesting and early brood-rearing habitats. There are still sagebrush treatments being proposed and conducted within sage-grouse habitats, some specifically for sage-grouse.

Guidance on conducting habitat treatments in sage-grouse habitat was included in Governor Mead's Executive Order (2011-5) and the BLM's most recent Instructional Memorandum (No. WY-2012-019). Both documents define and provide policy for sagebrush treatment criteria that maintain or enhance sage-grouse habitat. These criteria, or treatment protocols, are described in Wyoming Game & Fish Department's protocols for treating sagebrush to be consistent with Wyoming Executive Order 2011-5 (greater sage-grouse core area protections; WGFD 2011).

Mineral development. Mining for bentonite has continued in the Big Horn Basin at a pace about equal to levels prior to completion of the Conservation Plan. As awareness of possible plight of sage-grouse increased, possible impacts of mining to sage-grouse have become more of a concern. The mining industry partnered with researchers from University of Wyoming to begin a graduate research project to evaluate sage-grouse response to bentonite mining (Pratt and Beck 2011). The first objective is to monitor the effects of bentonite mining on sage-grouse by comparing demographic rates (i.e., hen survival, nest survival, and brood survival) of sage-grouse in an area actively mined to a reference area where mining is not currently taking place. The second objective is to model the migration patterns of sage-grouse in the eastern Big Horn Basin. This information will provide baseline information on this population that can be used to help mitigate any potential negative effects by mining or other land use activities. The third objective of this study is to monitor the use of reclaimed lands by sage-grouse. Mine reclamation is an integral component of bentonite mining, however little is known about sage-grouse use of reclaimed sites.

Other efforts to lessen possible impacts of mining are being conducted in relation to mine reclamation. The Wyoming Reclamation & Restoration Center at University of Wyoming (WRRC) conducted research on establishment of sagebrush on mined lands (Liesenfeld 2012). He found that conventional methods of sagebrush reestablishment used in bentonite mine reclamation were ineffective in the short term (15 years or less). That is, initial seeding efforts during site reclamation resulted in very little sagebrush establishment. However, over the long term, seed dispersal of native sagebrush from undisturbed areas surrounding reclaimed mine sites appears to have resulted in reestablishment of sagebrush plants. Tarasoff (2013) investigated use of containers lined with a thin layer of cupric carbonate to improve root development of sagebrush

seedlings grown in a greenhouse then planted on livecast soil at reclaimed mines in the Big Horn Basin. Wyoming big sagebrush does not respond to cupric carbonate like other plant species (Tarasoff 2013). Annual survival of sagebrush was poor primarily due to soil type and condition, competition from other vegetation, and drought. Lastly, WRRC, BLM and several mine companies collected native forb seed during summer 2011. Seed was planted at various reclaimed mines. Dry conditions during spring 2012 resulted in poor germination rates. When successful, locally adapted forb seeds could be used in mine reclamation seed mixes.

Oil and gas development across the Intermountain West has accelerated rapidly since 1990. Some areas being intensively developed contain large sage-grouse populations (Copeland et al. 2009). The bulk of studies researching the impact of oil and gas development to sage-grouse have been conducted in Wyoming and most of the peer-reviewed papers resulting from this research were published after the local conservation plan was completed in 2007, including one in the Big Horn Basin (Hess and Beck 2012b).

The Big Horn Basin has not experienced increases in exploration or production of oil or gas as has occurred in other portions of the state/country. Well densities and drilling activity are much lower in the Big Horn Basin than in the Pinedale Anticline or Powder River Basin, where impacts to sage-grouse have been documented. Most of the oil and gas activity in the Basin has been within mature fields that were established between 1900s and 1940s. Active fields already occur on most of the areas that are estimated to have high potential for production. Active wells and sites of high potential do not overlap greatly with current distribution of sage-grouse leks in the BHBCA. Currently there is no coal-bed methane development in BHB primarily due to unsuitable geology. Future impacts of oil and gas development on sage-grouse in the Basin may be minimal unless technical advances in oil/gas recovery make production of marginal reserves more economically feasible.

Numbers of sage-grouse observed at leks are impacted at oil and gas well densities that were commonly permitted in Wyoming (Naugle et al. 2011, Hess and Beck 2012b). Impacts have not been detected at well densities less than about 1 well/mi^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 declined by 32 to 77% (Doherty et al. 2010). The magnitude of loss has varied from one field to another, but impacts are always negative (Harju et al. 2010). Yearling females avoided gas field infrastructure when selecting nest sites, and yearling males avoided leks inside areas of development and were displaced to the periphery of the gas field (Holloran et al. 2010). Time lags of 2-10 years between when development began and the loss of local sage-grouse leks has been documented (Holloran 2005, Walker et al. 2007, Harju et al. 2010). It is believed that noise from development and production facilities may affect attendance of males at adjacent leks (Blickley et al. 2012); however, there has been limited research on impacts from noise and questions remain on ambient noise levels, grouse tolerance thresholds, and population-level impacts.

Energy development can also impact sage-grouse habitats and vital rates (e.g., nest success, hatching success and survival) away from leks and outside the breeding

season. 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). Sage-grouse avoided otherwise suitable habitat as the density of roads, power lines, or energy development increased (Doherty et al. 2008, Carpenter et al. 2010, Hess and Beck 2012b, Gillian et al. 2013). *Ponds built for coal bed natural gas (CBNG) development in the Powder River Basin created habitat suitable for mosquitoes (Zou et al. 2006). CBNG development has not occurred in the Big Horn Basin."*

Mitigation measures have been integrated into oil/gas exploration and development to decrease possible impacts to sage-grouse. The establishment of regulations for core areas that limit disturbances to one well per square mile (Wyoming Governors' Executive Orders) will reduce new well densities in the future. Technology advances in the oil and gas industry, such as directional and horizontal drilling, are being utilized to reduce the footprint of the industry, by allowing multiple wells to be drilled from a single well pad. Automation of field equipment and remote monitoring are used to reduce traffic and anthropogenic disturbance in oil and gas fields. CBNG operators in the Powder River Basin utilize mosquito control efforts to minimize the chance of West Nile Virus impacts to sage-grouse. Additionally, improved reclamation practices are being developed and used to return disturbed habitat to productive sage-grouse habitat, in a shorter time frame than previous reclamation practices.

Wind energy. Wind energy development in Wyoming has been proceeding at an accelerated pace over the last few years. Recently, there has been some interest in developing wind energy within the BHBCA. While additional research is needed to better understand potential impacts of wind development on sage-grouse, the best information available to date indicates that significant population impacts could be expected to take place within core areas of sage-grouse populations. Concerns such as habitat fragmentation, effects of wind tower heights, and loss of birds to blade strikes need to be more fully researched and understood.

Invasive plants. Invasive species such as cheatgrass, salt cedar, tamarisk, and Russian olive are of growing concern relative to sagebrush communities. Projects dealing specifically with those species were sought through requests for proposals. Major disturbances to sagebrush habitats, which could increase infestations of noxious weeds, have occurred in the Basin since 2008: 9856 acres of wild fire and 6376 acres of new bentonite mining. Efforts to identify and map existing noxious weeds continue. BLM calculated approximately 57,500 acres of cheatgrass infestation in the Worland field office alone. Several projects have occurred to treat cheatgrass with Plateau© (Imazapic), which was approved for use on BLM lands in 2007: Cottonwood Creek Riparian Restoration (580 acres), Renner Habitat Area (2530 acres), Lower Nowater (1491 acres) and Paintrock wild fire (401 acres). Those projects are included in the Table of Accomplishments (Appendix B). Outside BHBCA, biological controls (e.g., smut, fungus, bacteria) to control cheatgrass are being investigated. No new invasive

plant species that could potentially impact sage-grouse habitats have been documented in the Big Horn Basin since the Conservation Plan was finalized in 2007.

Parasites and diseases. West Nile virus (WNv) has been found in horses and humans in the Big Horn Basin, but only a couple mortalities of sage-grouse have been documented. Locating sage-grouse carcasses prior to being scavenged is difficult. All sage-grouse carcasses found during late summer should be submitted for WNv testing.

Naugle and Walker (2011) cautioned against developing artificial water sources (such as stock ponds and overflowing stock tanks) that could increase the distribution or abundance of mosquitoes (*Culex tarsalis*) that carry WNv. BHBLWG has been involved with several projects that developed water sources for sage-grouse and other wildlife. We believe that water may be a limiting factor in xeric sagebrush habitats within the Basin. A couple projects were also designed to allow overflow water to create mesic areas that ultimately would provide forbs and insects needed by juvenile grouse. New water development projects should include measures to minimize potential for mosquito habitat. Water developments should be designed to allow for flowing water since stagnant water is more conducive to mosquitoes. Care should be taken to assure that new water developments do not redistribute big game animals and livestock to the extent that they negatively affect sage-grouse habitats.

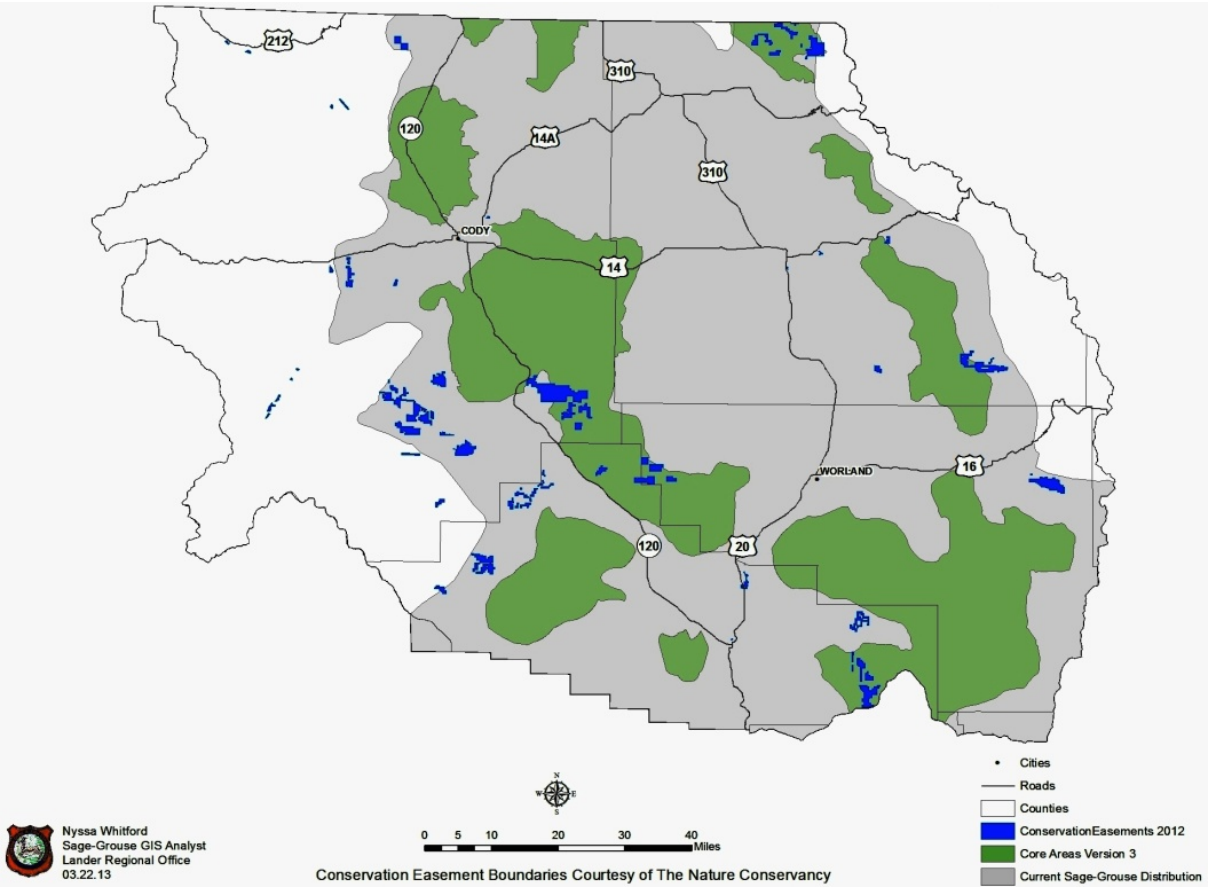
Residential development. Construction of new housing subdivisions continues on private land sites in the BHBCA, but has slowed when the national economy went into recession. Impacts to sage-grouse habitat were stated in the original conservation plan.

Copeland et al. (2013) estimated that Wyoming's core area policy along with targeted conservation easements provide a unified approach that could effectively contribute to maintaining sage-grouse populations. Conservation easements are legal agreements with willing landowners to restrict development rights (residential and/or extractive) on their lands in exchange for tax incentives and/or money. Some easements are for long-term (e.g., 30 years) and some are for perpetuity. Targeting easements to areas with a high threat of residential subdivision and dense sage-grouse populations is critical to reducing potential declines in sage-grouse populations by as much as 50% (Copeland et al. 2013). Most conservation easements in Wyoming have been purchased opportunistically (when a landowner approaches an agency or organization) and typically not specifically for conservation of sage-grouse habitats. In the Big Horn Basin, approximately 71,825 acres on 73 properties are currently in conservation easements (Fig. 4). Many of these lands do provide habitat for sage-grouse.

Recreation. There may be impacts on sage-grouse from various recreational activities; however individual recreational activities have not been analyzed. Lek viewing and photographing may be impacting attendance of birds at specific leks if done too closely, too frequently or not ethically (e.g., excessive noise or movement). WGFD produced a pamphlet to emphasize proper etiquette while viewing strutting grouse.

Conflicting wildlife management. There is no specific guidance in the Governor's Executive Order (2011-5) or WGFD policy relative to potential conflict between managing for sage-grouse versus managing for other wildlife. Conflicts should be minimal if big game management is directed at maintaining habitat. High concentrations of elk, deer and/or antelope may affect sagebrush-grassland habitats in localized areas. Several papers have been prepared that serve as guidelines to assist management of habitats for multiple species: Wyoming Game and Fish Department protocols for treating sagebrush to be consistent with Wyoming Executive Order 2011-5; greater sage-grouse core area protection (2011), Sage-Grouse Habitat Management Guidelines for Wyoming (Bohne et al. 2007).

Figure 4. Approximate location of core areas (green) and conservation easements (blue) held by land trusts and agencies in the Big Horn Basin, 2013.



Conflicting wild horse management. The Cody and Worland BLM Resource Areas have wild horse herds sharing the landscape with sage-grouse. The Fifteenmile and McCullough Peaks wild horse management areas (HMAs) are managed for established number of horses (100-230 and 70-140, respectively). Current population estimates are

140 for Fifteenmile and 155 horses in McCullough Peaks. There have been no changes or projects within the Fifteenmile herd management area that would affect sage-grouse or their habitat. In the McCullough Peaks herd, 70 mares were treated with contraceptive drugs to manage population growth. A cooperative effort among the BLM, Friends of a Legacy (FOAL; a wild horse advocacy group) and Double Doc Ranch resulted in the cleaning of five reservoirs to increase water retention for the benefit of both horses and sage-grouse. A Memorandum of Understanding (MOU) was recently signed by Marathon Oil, FOAL, and the BLM to clean additional reservoirs to improve water retention. Additionally, those entities may consider pumping water out of Dry Creek to fill existing reservoirs and to find additional produced water sources that will improve distribution of horses, livestock, sage-grouse and other wildlife

Farming. While converting sagebrush habitat to agricultural fields has resulted in a net loss of sagebrush habitat, many sage-grouse in the BHBCA use alfalfa fields and irrigated meadows during late brood-rearing. Since the original sage-grouse conservation plan was adopted, alfalfa production in the Big Horn Basin has fluctuated with water availability, crop prices and markets. In 2006, 91,000 acres were planted to alfalfa in the Big Horn Basin, while in 2012 only 66,800 acres (Wyoming Agricultural Statistics 2006, 2013). Acreages are expected to increase due to the high value of alfalfa hay, which increased due to shortages in other parts of the country (drought). Changes in location of irrigated fields also affect use of a field by sage-grouse. Fields near quality sagebrush habitat receive a lot of use by grouse. It is possible that reductions in alfalfa fields on specific drainages have altered brood survival and distribution of sage-grouse.

Hunting. Generally, sage-grouse hunting seasons in Wyoming have remained unchanged over the past five years. The season opened the 3rd Saturday in September and closed at the end of the month; resulting in a season length of 11 to 16 days. Bag and possession limits were unchanged at two and four, respectively. Changes were made to hunting seasons in Wyoming prior to elevated public concerns over grouse numbers (beginning in 1995), which significantly reduced sage-grouse hunter numbers and harvest. Research investigating the impacts of hunting on sage-grouse populations indicated a late September opening date had a decreased impact on hen survival, and may increase recruitment compared to an early September season (Heath et al. 1997, Connelly et al. 2000b).

Based on a review of the literature, the Connelly et al. (2000a) guidelines suggested that no more than 10% of the autumn population be removed through harvest to ensure minimal impacts to a sage-grouse population. Given the uncertainty in abundance estimates for breeding season populations, adequately determining size of a population of sage-grouse in fall is not realistic. Since 2007, sage-grouse harvest in the BHBCA averaged 424 birds (range from 166 to 585). During that same interval, an average of 19 males and 7 females were observed at “count” leks. Applying those averages across all known, occupied leks (average=242 leks), gives a very rough population

estimate of 6300 breeding sage-grouse in the Big Horn Basin. That estimate is very conservative in that females are undercounted on leks and potentially outnumber males by approximately 2:1; and the estimate does not include chicks produced that year, which often make up a large percent of harvested grouse. Thus, on average (2007-2011), harvest in the BHBCA has been less than 6.7% of the spring of the population.

For the 2012 season, a proposal to close sage-grouse hunting in the northeast corner of Wyoming was advanced to the Game & Fish Commission. Public input argued that the decision was political and not biologically based. The Commission eventually voted to leave the modest (3 day) season in place. WGFD contends that hunting does not remove a significant portion of a population ($\leq$ 10%) and does not negatively impact a healthy population (Christiansen 2010).

Accomplishments in the Big Horn Basin

The Sage-grouse Conservation Plan for the Big Horn Basin, Wyoming identified four general goals (habitat, populations, research, and education) as important components to focus resources in conserving sage-grouse in the Basin. Sub-goals addressed specific threats to grouse and/or their habitats. Goals/sub-goals contained objectives or action items designed to enhance conditions or mitigate impacts. Below, we listed the accomplishments of the BHBLWG and other agencies/organizations, since 2007, to address each objective listed in the Conservation Plan or an explanation of why that objective was not addressed. Other efforts, mostly outside the BHBLWG, are listed in the Table of Accomplishments at the end of this section.

Conservation Goal #1: **MAINTAIN, ENHANCE, AND/OR RESTORE QUALITY HABITAT FOR SAGE-GROUSE**

Sub-goal: **Livestock Grazing**. Promote grazing practices that maintain suitable sage-grouse habitats on federal, state, and private land in the Big Horn Basin. Managers and owners of the land and livestock should be aware of and address potential impacts of livestock grazing on sage-grouse populations and habitats.

Objective: The BHBLWG will conduct/host two workshops/field tours in the Big Horn Basin by the end of 2008 to demonstrate livestock management practices that can be beneficial to sage-grouse habitat.

Given that the Plan was not completed and formally adopted until August 2007, conducting two workshops/tours by end of 2008 would have been difficult for the (mostly) volunteer LWG. At that time, various agencies were working to develop grazing management recommendations for sage-grouse conservation. Since those recommendations had not been formally identified, we felt it would be premature to present them to a wide audience. Many ranches across the Basin do implement grazing practices that benefit sage-grouse; unfortunately, we have not identified those ranches or recognized their efforts. This objective could still be accomplished and used to educate other landowners interested in conserving grouse, especially if landowners are interested in Candidate Conservation Agreements with Assurances. Several workshops/tours have occurred in the Basin that demonstrated compatibility of livestock grazing and sage-grouse habitats. This objective was accomplished by interests outside of the LWG, even though several working group personnel were involved with those workshops.

Objective: Within one year of plan adoption, the BHBLWG will identify and work with willing landowner(s), BLM and NRCS to apply the Ecological Site Description (ESD)/Adaptive Management process to manage at least one project area for improved sage-grouse habitat.

In 2008, NRCS and BLM began work with Gooseberry Creek Ranch (David Slover) to inventory and monitor range resources, identify ESD across the

ranch, and develop a grazing strategy to improve range conditions. BHBLWG participated by awarding funds from the Marathon Oil Company donations for a water pipeline project. The project consisted of over 53,000 feet of pipeline on BLM allotments and 8 watering tanks to assist in livestock grazing management. This pipeline project is one component of a much larger project designed to incorporate adaptive management in livestock grazing to improve ecological conditions for those ranges. Slovers are following grazing plans developed with NRCS and have invested hundreds of hours monitoring vegetation throughout their allotments. They are also submitting vegetation samples for nutritional analysis to aid in assessing current conditions and aid in grazing prescriptions. BLM continues to monitor vegetation to meet their range management obligations on the allotments.

The project with Gooseberry Creek Ranch was a precursor to and similar in content to NRCS's Sage-Grouse Initiative (SGI). NRCS hired a range conservationist to focus primarily on SGI in the Big Horn Basin. The SGI range con has begun cooperative programs with several willing landowners to follow many of the same monitoring and management practices as described above on the Gooseberry Creek Ranch. Other ranches that do not qualify under SGI programs are also voluntarily implementing similar efforts with NRCS and BLM assistance.

Objective: Land managers should use the Adaptive Management process to evaluate habitat conditions for sage-grouse, identify desired vegetation communities best suited for the site and obtain a list of RMPs to use for management of the site when grazing plans are revised.

Beginning in 2009, BLM conducts an assessment of sage-grouse habitat conditions on public land grazing allotments as part of grazing lease renewals. Habitat assessments include measurement of canopy cover, age class, and height of sagebrush and other shrubs, cover class and height of herbaceous vegetation (grasses and forbs), browse utilization, and presence of grouse and other wildlife. Sage-grouse habitat assessments have been completed on 77 allotments within priority sage-grouse habitats; this effort is on-going.

NRCS developed and implemented RMPs on approximately 45,000 acres as part of SGI efforts (described above) specific for each ranch and allows management to be adaptive as conditions respond and change.

Sub-goal: **Vegetation Management**. Endorse habitat treatments that are beneficial to sage-grouse and provide a mix of early, mid and late seral vegetation stages on a landscape scale. Sagebrush communities evolved with disturbance, but the frequency of disturbance has been debated. Habitat treatments (e.g., mowing, burning, spraying) should be used to reduce sagebrush density and increase herbaceous vegetation. Treatments should promote a mosaic of early, mid and late seral stages of plant

succession on a landscape. We provide RMPs to be considered in project planning (page 64).

Objective: Beginning with the adoption of this plan, vegetation treatments on public lands or on private land with public funds should be designed to maintain or enhance sage-grouse habitat on a landscape scale, while considering ecological, economic and cumulative impacts.

BLM's IMs, National Environmental Policy Act (NEPA), and Wyoming Governor's Executive Orders mandate that impacts to sage-grouse habitat will be assessed prior to vegetation treatments. Please refer to those documents for more information. In addition, NRCS modified their NEPA review process and it is now more comprehensive in analysis of impacts to sagebrush habitats.

Objective: The BHBLWG will initiate efforts to create a GIS data layer that encompasses all of the available habitat treatments that have taken place Basin-wide for use in assessing cumulative impacts and guidance on future habitat treatments by 2008.

At the request of BHBLWG, a UW graduate student (Jennifer Hess) compiled all available habitat treatments that have taken place on public lands in the Big Horn Basin Conservation Area. The extent to which those data have been used for cumulative impacts or guidance on future treatments is unknown. Each agency had begun this effort prior to Hess's effort, but data had not been compiled into a single database. Mapping efforts will continue as treatments are conducted in the future.

Hess also researched habitat conditions on treated (mowed, burned) sagebrush habitat sites as compared to sage-grouse habitat guidelines in Connely et al (2004). Please refer to Hess (2010), Hess and Beck (2010) and Hess and Beck (2012a) for more information.

Sub-goal: **Mineral Development**. Minimize negative impacts of exploration and/or development of mineral resources on sage-grouse habitat and encourage reclamation that restores or improves sage-grouse habitats. The BLM, Wyoming Department of Environmental Quality (WDEQ)-Land Quality Division, mining companies and oil/gas exploration and development companies should be aware of potential impacts to sage-grouse and work to lessen those impacts.

Objective: By 2008, conduct at least one workshop/field tour to present successful low impact exploration, production, and/or reclamation techniques that could be used throughout the Basin.

BHBLWG conducted a tour of several bentonite mines to learn about mining and reclamation. Although this tour was not intended to educate mining companies about successful techniques, several company personnel were in attendance. The tour highlighted two of the projects funded by the Sage-grouse Conservation Fund (through BHBLWG) to improve reclamation of

mined sites. Those projects used new techniques to improve establishment of sagebrush on reclaimed sites (King and Petty 2008, King et al. 2009).

Several tours and clinics have been held by the Wyoming Reclamation and Restoration Center (WRRC; University of Wyoming) to demonstrate successful reclamation techniques. Many bentonite company employees have attended those educational workshops. On 13 June 2013, another tour was conducted to highlight reclamation and other efforts to mitigate affects of mining on sage-grouse; BLM, WGFD and all bentonite companies that operate in the Basin were represented.

Objective: Where and when loss of sage-grouse habitat is unavoidable, industry should use off-site mitigation to produce similar habitat values, effective upon adoption of this plan.

Although off-site mitigation is still uncommon, at least one company has begun considering and implementing such practices. American Colloid Company (ACC) included off-site mitigation as part of a mine plan and has treated cheatgrass on a parcel of their private land to improve sage-grouse habitat. The cheatgrass treatment was partially funded by BHBLWG through the Sage-grouse Conservation Fund.

Objective: The BHBLWG will write a letter in 2007 requesting that permitting agencies allow use of appropriate, non-native vegetation species to aid in reclamation of difficult areas.

Neither BLM nor Wy-DEQ prohibited use of non-native vegetation seed in reclamation mixes; however, use of native seed has been recommended and preferred over non-native vegetation. Several non-native species have been tried in some areas with mixed results, with prior agency approval.

Objective: The BHBLWG will request that the NRCS area resource conservationist contact the Bridger Plant Materials Center to develop sage-grouse friendly seed mixes from existing plant materials for the Big Horn Basin.

A letter was sent through NRCS to Plant Materials Center, October 2006. USDA Plant Materials Center responded that opportunities for establishing native vegetation from seed are limited in the 5-9 inch precipitation zone. Bridger Plant Materials Center did not have a seed mix available that they could recommend. Test plots for sage-grouse habitats are currently being evaluated in the Pinedale area, which may be useful in the Bighorn Basin.

WRRC, BLM and several mine companies collected native forb seed beginning in 2011. Local seed sources have shown to be more successful at germination and establishment on reclaimed mines. Companies are increasing these efforts to improve reclamation of habitats that may be used by sage-grouse.

Objective: Industry and permitting agencies should attempt to re-establish sagebrush habitat on disturbed sites previously used by sage-grouse by implementing RMPs (pages 65-68).

Several techniques investigated by King and Petty (2008) and King et al. (2009) are successfully being implemented by mining companies to establish sagebrush on mined lands. Germination and survival of sagebrush is very dependent on environmental conditions, unfortunately drought conditions are common in the Big Horn Basin which hamper sagebrush survival.

UW's WRRC evaluated reclaimed bentonite mined lands in the Bighorn Basin to determine if sagebrush communities were becoming established under conventional reclamation techniques (Liesenfeld 2012). Sagebrush plants were not established in adequate densities (compared to Connelly et al [2000a] guidelines) on sites seeded within the past 15 years; however, reclaimed sites older than 15 years were undergoing natural recolonization of sagebrush from adjacent un-mined areas.

Several companies assisted with funding for two projects aimed at improving reclamation of bentonite mined lands. A professor with Michigan Technological University (Dr. Catherine Tarasoff) investigated survival and health of sagebrush seedlings grown in cupric carbonate coated containers – from germination through one year of planting. Dr Tarasoff is also investigating reclamation success in areas with or without cheatgrass control. BHBLWG also supported those two projects with Sage-grouse Conservation Fund grants.

Sub-goal: **Invasive Plants**. Limit the introduction and spread of invasive plants in sage-grouse habitat and promote control and reduction of infestations. All users of sagebrush communities have a stake in seeing that invasive plants do not become established and should work toward elimination of these plants in areas where they have become established.

Objective: The BHBLWG will provide and request publication of two articles in local Conservation District newsletters on the potential effects of invasive plants on sage-grouse by 2008.

This objective has not been addressed, but could still be completed.

Objective: Land managers should monitor and evaluate proposed or implemented vegetation treatments in sage-grouse habitat to determine if invasive plant management is necessary.

BLM monitors past prescribed burns, other treatments and wildfires for establishment of noxious weeds and undesirable plants. Chemical treatment to control for cheatgrass has been done on 5420 acres since 2007. Foreseeing a need to manage invasive species, some sagebrush mowing

projects have included plans to seed native vegetation as part of the original project design.

In addition to cheatgrass control efforts by ACC (mentioned above), another company, M-I Swaco, has also undertaken efforts to control cheatgrass on mined land. 2009 was the final year of treatment of a 20.2-acre cheatgrass test plot. They began treating a 20 acre plot in 2005 (aerial treatment the first year, ground treatments the next three years) using Plateau. There was a reduction in cheatgrass and corresponding increase in native plants; however, two years after treatment cheatgrass returned to the site. They continue to monitor that plot for species cover and diversity. M-I entered into a partnership with the BLM in 2012 towards the chemical treatment of over 200 acres of reclaimed lands and an adjacent 200+ acres BLM land. Treatment will continue for three more years. All sites were, and continue to be, monitored for vegetative species diversity.

Objective: Land managers/owners, working with local Weed and Pest districts, should conduct at least one project to control invasive plants in or near sage-grouse habitat, annually beginning in 2007.

BHBLWG requested project proposals to specifically address invasive species with that portion of the Sage-grouse Conservation Fund allocated to the Big Horn Basin each year since 2008. Land managers and some private land owners are aware of affects that invasive plants could have on sage-grouse habitats and have been proactive in addressing invasive species. Several project proposals were received, funded and (most) completed, including: West Slope juniper removal, Shell Valley salt cedar control, Black Mountain cheatgrass control and sagebrush restoration, ACC cheatgrass control, Crooked Creek and Rome Hill juniper treatments.

Sub-goal: **Conflicting Wildlife Management**. WGFD should consider impacts on sage-grouse when developing population objectives and strategies for big game species. Big game herds in the BHBCA have not been documented to cause any landscape-scale habitat degradation; however, some site-specific impacts have occurred on winter ranges. WGFD recently began conducting browse transects on winter ranges to track if concentrations of big game are impacting habitats, sagebrush in particular. To reduce impacts of big game on sage-grouse habitats, the BHBLWG recommends the following objective:

Objective: WGFD, in cooperation with federal state, local government and private landowners, should monitor vegetation use by big game wildlife in areas identified as important sage-grouse habitat and identify any resulting negative effects to sage-grouse habitat likely being caused by big game species. Areas where specific habitat problems are occurring should be identified and evaluated for corrective management actions.

Neither BLM nor other land management agency has expressed concern with big game populations or densities in regards to sage-grouse habitats. There are three elk herds within the BHBCA that are over WGFD designated

population objectives and efforts are being made to reduce those populations. Mule deer and pronghorn antelope populations in the Basin, which would more typically impact sage-grouse habitat, are at or below population objectives; however, specific sites hold large concentrations of antelope or deer which may be impacting sagebrush production.

WGFD monitors transects throughout the Big Horn Basin (and entire state) to assess browsing of sagebrush by big game species. Those transects were not selected to monitor impacts to sage-grouse habitat and were not purposely located in areas important to sage-grouse (e.g., winter concentration areas, nesting or brood areas), but most transects were located in areas used by sage-grouse to some extent. None of the transects have shown "excessive" browsing by mule deer or pronghorn antelope that would impact sagebrush communities. However, even moderate browsing levels could exacerbate affects of extended or severe drought as seen in 2000-04 and 2012-13.

Sub-goal: **Wild Horse Management**. BLM should assure that feral horse populations are maintained at acceptable carrying capacities and impacts to sage-grouse caused by feral horses are minimized. If populations of feral horses are too high for the range, overgrazing may occur. Overgrazing of habitats by horses, wildlife or livestock can be detrimental to sage-grouse habitats. The BHBLWG will comment on horse populations when it believes they are impacting sage-grouse habitats.

Objective: Request "Interested Party" status for the Big Horn Basin Local Working Group on all actions on the McCullough Peaks and 15-Mile horse herds through the life of the working group.

A letter seeking Interested Party status was written and submitted to both BLM offices within the Big Horn Basin. BHBLWG has assisted a local horse advocacy group (Friends of a Legacy) with projects to improve distribution and grazing of wild horses by increasing available water. BHBLWG members (BLM and WGFD biologists and an agriculture representative) have independently commented on wild horse numbers and management.

Sub-goal: **Farming**. The BHBLWG will promote farming operations that are compatible with maintenance and enhancement of sage-grouse habitat. Converting sagebrush habitat to farmland is no longer a major concern in the BHBCA. Agricultural areas can provide habitat for sage-grouse, especially during summer (brood-rearing).

Objective: Develop and facilitate distribution of a brochure on farming for sage-grouse, coordinated with UW Extension, by December 2007.

Given that the Plan was not completed and formally adopted until August 2007, completing this objective by end of 2007 would have been difficult for the (mostly) volunteer LWG. This objective has not been addressed and is no longer a priority for the LWG.

Sub-goal: **Monitoring**. Facilitate the continued identification and mapping of important sage-grouse habitats in the Big Horn Basin. We concluded that little is known about sage-grouse habitat use in the BHBCA. Knowledge of habitat selection and seasonally important areas is vital for identifying habitat improvement projects, for identifying mitigation and for assessing long-term viability of the species.

Objective: Seek funding to support identification, delineation and mapping of important sage-grouse habitats with initial GIS coverages developed by Dec. 2011.

BHBLWG dedicated funds from the Sage-grouse Conservation Fund to the Big Horn Basin Land Cover Mapping project in 2007-08. This project used satellite imagery and other data to map habitat types across two-thirds of the Big Horn Basin. These data have been used to adjust core area boundaries (version 3), to assess the extent of sagebrush in and around project areas, and in estimating possible project impacts to sage-grouse habitat using Wyoming's Density Disturbance Calculation Tool (DDCT).

Another effort to model and map sage-grouse habitats, state-wide is being undertaken by the US Geological Survey. Data from radio-marked birds were used to model habitat use probabilities and will be further refined to delineate specific seasonal ranges. Until recently there were no radio telemetry data from grouse in the Big Horn Basin available to refine those models and apply the results to the Basin. Two research projects currently underway in BHBCA (see Research Goal, below, for more details) have shared data that will ultimately improve modeling/mapping efforts in the Basin.

Objective: Field personnel with WGFD and BLM should utilize the Wildlife Observation System (WOS) and/or Wyoming Natural Diversity Database (WNDD) to document sage-grouse locations and other relevant data.

A letter was written and sent on 1 April 2006, to BLM and WGFD offices in Big Horn Basin with this recommendation. Data within WOS have been used to identify seasonal ranges and areas that were surveyed to gather more data. BLM and WGFD have made several aerial surveys to delineate winter concentration areas and leks. These data were entered into WOS and/or WNDD and will be used to identify, validate and map seasonal habitats.

Sub-goal: **Water Development**. Provide additional water sources, where suitable, for sage-grouse, other wildlife and livestock. Water can be a scarce, and sometimes limiting, habitat component for sage-grouse in the BHBCA. Development of accessible water can benefit all wildlife and livestock.

Objective: The BLM, WGFD, and NRCS should assure that new water developments in sage-grouse habitats, provide access for sage-grouse and where possible, existing water developments should be retro-fit to provide access to water.

BHBLWG joined with other LWGs to purchase escape ramps for livestock water tanks. Ramps are available to ranchers through local NRCS offices. Several projects were designed to allow over-flow water from stock tanks or

guzzlers to spread across uplands thus creating mesic areas and provide water to wildlife not inclined to get on or into stock tanks.

Objective: Through the life of the BHBLWG, we will help facilitate funding to complete at least one water project per year with specific sage-grouse benefits. Agencies are expected to continue efforts to achieve this objective.

Sage-grouse Conservation Fund money was used to develop reliable flow of water and fence springs at several locations throughout the BHBCA: PW Springs Restoration project, Heart Mountain Ranch, YU Bench, McCullough Peaks horse management area, Martinez Ranch, Gooseberry Ranch, and Cottonwood Creek. We also funded installation of a water guzzler on North Butte, as part of a larger project in which 12 guzzlers were installed across the Basin. Many other water development projects have occurred outside of LWG efforts as part of watershed improvement projects.

Objective: Develop reservoirs, wetlands, or other water sources as part of reclamation of mined lands in areas with limited water.

Individual bentonite mining companies have built wetlands, ponds and/or guzzlers as part of reclamation.

Objective: The BHBLWG will submit a letter to the WDEQ and Region 8 of the Environmental Protection Agency (EPA) stating support for continued historic (pre-1975), conventional oil field surface discharges of water in sage-grouse habitats that meet the needs of wildlife and livestock without bioaccumulation of contaminants at levels that would be hazardous to human health and the environment.

That letter was sent in February 2006. WDEQ subsequently determined that the existing water quality standards established by WDEQ and EPA in 1978 were adequately protective for livestock and wildlife drinking and for irrigation. Proposed, stricter standards for sulfate, sodium, total dissolved solids and barium were not adopted. Had the stricter standards been adopted up to 60% of the conventional discharge waters across Wyoming (most in the Big Horn Basin) would have been re-injected into the ground resulting in a loss of irrigated meadows/alfalfa fields that are currently used by hundreds of sage-grouse as late brood-rearing habitat, particularly along the Cottonwood Creek drainage below Hamilton Dome oil field.

Conservation Goal #2: **MAINTAIN AND ENHANCE SAGE-GROUSE POPULATIONS IN THE BIG HORN BASIN**

Sub-goal: **Population level**. The average number of males per lek should not decline below 24 males/lek during population peaks; below that level, more stringent protections on sage-grouse populations and habitat may be needed. This baseline figure for males/lek was obtained from data collected during 2000. The State-wide Plan used males/lek averages from 2000 to establish baseline levels for the state. Males/lek are

used as an index to population level. No population estimates for the BHBCA or the state have been determined.

Sage-grouse populations are cyclic (Fedy and Doherty 2010). In 2006 and 2007, sage-grouse numbers in the Big Horn Basin peaked at 25 and 24 average males per lek, respectively. Since that time, average males per lek have declined to as low as 9.5 (2013). Both the peak numbers observed in 2006 and the lows in 2012 were within historic parameters. Sage-grouse populations may currently be at a low; however the grouse population in the Big Horn Basin remains viable and relatively stable.

Sub-goal: **Hunting**. The WGFD should recommend hunting regulations that are responsive to fluctuations in sage-grouse population levels. The BHBLWG recommends that hunting seasons continue. Hunting has had minimal impacts on sage-grouse populations in the BHBCA. Hunting seasons (season dates, length, bag limits) should continue to be responsive to sage-grouse population levels.

The Wyoming Game & Fish Commission establishes hunting seasons for sage-grouse. They remain responsive to changes in grouse populations and have expressed concern over impacts from drought, west nile virus, and high density human development. Pressure to close or further restrict sage-grouse hunting season has been increasing; however, there was a significant public criticism of a proposal to close hunting in northeast Wyoming in 2012.

Sub-goal: **Predation**. Where and when scientific studies have demonstrated negative impacts, the BHBLWG endorses the control of predators to reduce their impacts on sage-grouse populations.

Research into impacts of predation was begun in 2011 and is scheduled to continue through 2016.

Sub-goal: **Monitoring**. Beginning with the adoption of this plan, management agencies should improve reliability of data collected on sage –grouse by implementing the following:

1. WGFD, BLM, industry and volunteers will use established protocols for monitoring leks and lek complexes.

2. WGFD and BLM should develop standardized methodology for surveying and documenting sage-grouse broods.

3. State and federal agencies and industry should look for ways to enhance funds to insure adequate personnel to implement protocols for monitoring sage-grouse.

4. WGFD should compile harvest data on sage-grouse that more accurately represents the Big Horn Basin sub-population. Management Area 37 should be split on the Bighorn Mountain divide, with the west portion of that area made into a new management area or combined with Management Area 21.

Lek monitoring has improved across the Big Horn Basin. Between 2007-13, an average of 78% of known leks was surveyed each spring. Standardized protocols for brood surveys have not been established. The number of brood surveys conducted in the Big Horn Basin has been minimal, so that data may not be useful in tracking this grouse population. Monitoring of radio-marked hens has been providing some data on brood survival, but results were not yet available. Harvest data is now compiled for the entire Big Horn Basin, as one hunt area (management area B). Management areas that had been in place since the early 1980s did not correspond to subunits meaningful for sage-grouse management. Those areas were combined in 2011.

Conservation Goal #3: **SUPPORT RESEARCH TO BETTER UNDERSTAND THE DYNAMICS OF SAGE-GROUSE POPULATIONS AND THEIR HABITATS IN THE BIG HORN BASIN**

Objective: The BHBLWG will propose and solicit research on sage-grouse in at least one of the following areas, beginning in 2007:

- Development of a reliable population estimation technique (or validation of techniques currently being developed) for sage-grouse in the Big Horn Basin, to be used in establishing minimum population goals;
- Evaluate the impacts of predators (especially "new" predators) and implement management actions accordingly;
- Evaluate grazing regimes and habitat treatments that have potential to benefit sage-grouse habitats; and/or
- Assess impacts of weather on sage-grouse and their habitats.

In 2007, BHBLWG sought interested parties to conduct research on the above topics through a request for proposals. Several proposals were submitted and the LWG decided to fund research to determine affects of habitat treatments on sage-grouse habitat (Hess 2010, Hess and Beck 2010, and Hess and Beck 2012a).

Although BHBLWG has not been directly involved, two other research projects were initiated in 2011 by outside parties. BHBLWG recently (2012) obligated Sage-grouse Conservation Fund dollars to assist with those research efforts. One project funded and sponsored by ACC in conjunction with UW is monitoring affects of bentonite mining on sage-grouse habitat use and migration patterns on the east side of the Basin (Pratt and Beck 2011).

The other research project sponsored by local Conservation Districts, Predator Management Boards, and Wildlife Services in conjunction with Utah State University is investigating affects of predation on sage-grouse survival and nest success. They will continue the project by experimentally manipulating predator (coyotes and ravens) numbers to determine differences

in nest success and survival among predator control areas and areas with no predator management (Orning and Young 2012). This study will continue through 2016.

Conservation Goal #4: **EDUCATE THE PUBLIC ABOUT SAGE-GROUSE AND CONSERVATION OF THEIR HABITATS**

Objective: In 2007, The BHBLWG will contact coordinators of Project Learning Tree and WILD About OREO (Outdoor Recreation Education Opportunities) to discuss the development of a workshop to introduce teachers and students to the importance of sage-grouse and the sagebrush steppe in Wyoming. This workshop could include coordinating field trips to view sage-grouse leks.

This objective has not been addressed and is no longer a priority for the LWG.

Objective: Present information to the public about potential impacts of subdivisions on sage-grouse. This should be an on-going effort.

In March 2006 and 2007, presentations were given by a BHBLWG member as part of "Living on a Few Acres" program hosted by Cody Conservation District. The Living on a few acres program is not given in every year.

FUTURE DIRECTION

The Big Horn Basin Local Working Group believes our efforts have contributed to improving sagebrush habitats, and in turn, enhanced conditions for sage-grouse. Given our successes, we will continue to concentrate efforts and funding on those goals and objectives stated above. Past requests for proposals have been directed to vegetation management, specifically invasive species. We still believe invasive vegetation is one of the more significant threats in the Big Horn Basin that will continue to require management for many years. Efforts to address other goals and objectives are also still applicable (unless stated otherwise above). We continue to scrutinize relevant scientific findings evaluating their applicability and efficacy for improving sage-grouse habitats and populations in the Big Horn Basin. Where gaps in the knowledge base occur, we will encourage future research to fill those voids.

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Appendix A. Wyoming Sage-Grouse Conservation Fund (S-gCF) Projects in the Big Horn Basin Conservation Area (BHBCA), 2005-14.

Project name	Budget biennium	Project description	Partners	Status	S-gCF $ spent or approved
PW Spring Restoration	2005-06	Spring development and protection.	BLM, Spring Gulch Cattle Co.	Complete	$ 8,150
Heart Mtn SG Habitat Enhancements	2005-06	Spring protection and small mosaic sagebrush treatments with mowing and prescribed fire.	NRCS, TNC, WGFD, Russell Boardman, NW Community College, Park Co. Weed/Pest, Meadowlark Audubon, Buffalo Bill Historical Center.	Complete	$ 32,226
YU Bench SG Habitat Enhancements	2005-06	Mosaic sagebrush mowing and fenced forb seedings.	BLM, Sportsmen for Fish & Wildlife.	Complete	$ 14,493
North Butte Guzzler	2007-08	One of 12 guzzlers to be installed over a period of 5 years	BLM, Water for Wildlife, Mule Deer Foundation, WGF	Complete	$ 11,969
Big Horn Basin Land Cover Mapping	2007-08	Refined land cover/habitat mapping based on Landsat images.	BLM, WGF, RMEF	Complete	$ 30,000
Bentonite Reclamation Trials	2007-08	Experimentally establish portable irrigation systems to reclaim mined areas w/ sagebrush.	Wyo-Ben, M-I, Bentonite Performance Minerals, American Colloid, Black Hills Bentonite	Complete	$ 39,987
Emblem Bench/ Table Mtn Habitat Enhancement	2007-08	Sagebrush mowing and grass/forb seeding.	BLM	Complete	$ 2,498
McCullough Peaks HMA Waters and Healthy Rangelands	2007-08	Develop rangeland water and fenced overflow green strips to improve grazing management and provide sg forage.	FOAL, BLM, Grazing permittee	Complete	$ 8,434

Appendix A. continued

Project name	Budget biennium	Project description	Partners	Status	S-gCF $ spent or approved
Big Horn Basin Habitat Treatment Research	2007-08	Research to quantify and qualify the effects of sagebrush treatments, especially mowing, to sage-grouse habitat	University of Wyoming	Complete	$ 34,000
Westslope Juniper Removal	2007-08	Remove junipers encroaching on sagebrush habitat with chainsaws and/or Gyrotrac machines.	BLM	Complete	$ 6,066
Big Horn Basin Habitat Treatment Research Phase II	2009-10	Continuation of project	University of Wyoming	Complete	$ 59,595
Shell Valley salt cedar & Russian olive control	2009-10	Mechanical and chemical treatment of salt cedar and Russian olive	South Big Horn Conservation Dist.,Big Horn County Weed & Pest, NRCS, WY Wildlife and Natural Resources Trust, BLM	Complete	$ 41,000
Black Mountain Sagebrush Restoration	2009-10	Sagebrush transplants into wildfire area.	Wyoming Wildlife and Natural Resources Trust, WGFD, BLM	Complete	$ 60,000
South highway water project	2009-10	Pipeline, storage and stock tanks to improve grazing management	Wyoming Wildlife and Natural Resources Trust, Washakie County Conservation District, Gooseberry Ranch, Mule Deer Foundation, Water for Wildlife	Complete	$ 20,000

Appendix A continued

Project name	Budget biennium	Project description	Partners	Status	S-gCF $ spent or approved
West Slope Bighorn Mtns Cheatgrass Control	2011-12	Cheatgrass control	BLM - Cody FO	Complete	$ 10,000
ACC Cheatgrass Control	2011-12	Cheatgrass control and effectiveness monitoring	Big Horn Co. Weed & Pest, American Colloid Co.	Complete	$ 17,100
Black Mountain Cheatgrass Control and Sagebrush Restoration	2011-12	Cheatgrass control and sagebrush seedling establishment and planting in wildfire area.	WGFD, BLM, Wildlife and Nat. Res. Trust	On-going	$ 96,000
Crooked Crk and Rome Hill Juniper Treatment	2011-12	Mechanical juniper removal from sage-grouse habitat	BLM - Worland FO	On-going	$ 22,500
Restoration of SG habitat on mined sites	2011-12	Research to test methods to improve sagebrush seedling vigor and survival for mineland reclamation	Michigan Technical University, MI SWACO, American Colloid, BLM	On-going	$ 21,053
Improving SG habitat in the Cottonwood Crk drainage	2011-12	LWG $ to provide spring protection aspect of larger habitat restoration project	The Nature Conservancy, WYDEQ, Wildlife & Nat. Res. Trust, LU Ranch, Hot Springs Weed & Pest, Exxon Mobil, Marathon Oil, WGFD, Spring Gulch Cattle Co.	On-going	$ 30,195
Escape Ramp & spring protection fence materials	2011-12	Water trough escape ramps and spring protection fencing	Niobrara Conservation District	On-going	$ 15,000

Appendix A continued

Project name	Budget biennium	Project description	Partners	Status	S-gCF $ spent or approved
Assisted succession of sagebrush on reclaimed lands	2013-14	Research methods to improve sagebrush establishment on mined lands	Michigan Technical University, MI SWACO	On-going	$ 20,000
Black Mountain (Shell) juniper treatment	2013-14	Remove junipers encroaching on sagebrush habitat with chainsaws and/or Gyrotrac.	BLM-WFO	On-going	$ 34,500
Bentonite research and related aspects	2013-14	Survival and habitat use associated with bentonite mining	American Colloid Corp., Univ. of Wyo	On-going	$ 11,000
Rome Hill juniper treatment	2013-14	Remove junipers encroaching on sagebrush habitat with chainsaws and/or Gyrotrac	BLM-WFO	On-going	$ 34,500
LU and Prospect Ranches juniper treatment	2013-14	Juniper treatments funded as part of larger project including water development, spring protection	The Nature Conservancy, WYDEQ, Wildlife & Nat. Res. Trust, LU Ranch, Hot Springs Weed & Pest, Exxon Mobil, Marathon Oil, WGFD, Spring Gulch Cattle Co.	On-going	$ 20,000
Predation study-monitor movements	2013-14	Monitor movements and habitat use as part of larger predation study	USDA-APHIS Wildlife Serv., local Conserv. Distr.s, local predator management districts, WY-ADMB, Utah St. Univ., Belden Ranch, V Ranch, BHB RCD Council, Legacy Reserves, Fidelity Exploration, Marathon Oil, BreitBurn/Phoenix Production, Park Co. Farm Bureau, Guardians of the Range, NRCS, BLM	On-going	$ 25,000
Total SgCF money spent or obligated in BHBCA					$ 725,266

Appendix B. Table of Accomplishments listing actions taken by agencies, organizations or industry usually independent of Big Horn Basin Local Sage-grouse Working Group involvement, 2007-2013.

Factor	Action	Responsible parties	Funding Sources	Time schedule
Energy/mineral development	Mitigate potential impacts from surface disturbing and disruptive activities to sage-grouse wintering, nesting/brood rearing, and breeding habitats by applying timing limit stipulations, noise limit restrictions, no surface occupancy restrictions, and density disturbance limits.	BLM, mineral/oil/gas companies	no funding required	currently in place on going
Fence modification	Identified 117 miles and inventoried 76 miles of potential hazard fencing within .6 mile of sage-grouse leks; marked 22 miles of hazard fence where strikes or mortalities were documented.	BLM-WFO, WGFD	BLM, WGFD	2010 & 2011
	9 miles of net wire and 7-wire fence were modified to three-wire design in Core Areas in the Cody Field Office. 2 miles of problem fence marked with reflective diverters.	BLM, Audubon Society, Montana Conservation Corp, FOAL	Audubon and FOAL contributed labor	2011
	4 miles of net wire fence converted to 3-strand barbed and smooth bottom wire on the Emblem Bench	BLM, Audubon Society, Montana Conservation Corp, FOAL	Audubon and FOAL contributed labor	2012
	8 miles of net wire and 6-7 wire fence were removed and replaced with 3-wire high tensile electric fence on the Heart Mountain and E&B Landmark ranches	Private landowners	WGFD, RMEF, NRCS, private landowners	2012
	5 miles of net wire fence converted to 3-strand barbed and smooth bottom wire on Wagonhound Bench and within ¼ mile of Wagonhound Cr.1 lek. (Grass Creek Core Area)	BLM	BLM	2013
Habitat management	Sage-grouse habitat assessments completed on 85 allotments within priority sage-grouse habitats	BLM	BLM	2010 - 13 and ongoing
	Bader Draw prescribed fire – burn about 30% of 1200 acre treatment block to thin dense sagebrush stand and improve diversity of herbaceous vegetation	NRCS, private landowner	NRCS, private landowner	fall 2008
	Till/disc 150 acres of blue grama sod and seed with native forbs and grasses to enhance overall watershed condition and improve wildlife habitat.	BLM, WGFD	BLM	2007
	Till/disc 155 acres of blue grama sod and seed with native forbs and grasses to enhance overall watershed condition and improve wildlife habitat.	BLM, WGFD	BLM	2008

Factor	Action	Responsible parties	Funding Sources	Time schedule
Habitat management	West Slope Prescribed Burn – Treated 1,805 acres of Wyoming sagebrush & Utah juniper to improve overall watershed/ecological condition in monotypic sagebrush stands and to promote grass/forb production and allow for a younger age class of sagebrush to re-establish	BLM, grazing permittees, WGFD	BLM, grazing permittees, WGFD, RMEF	2009-2013
	Moss Ranch/Little Mountain Prescribed Burn – Treated 2,560 acres of mountain sagebrush & Utah juniper to improve overall watershed/ ecological condition in monotypic sagebrush stands and to promote grass/forb production and allow for a younger age class of sagebrush to re-establish.	BLM, grazing permittees, WGFD	BLM, grazing permittees, WGFD, RMEF	2009-2013
	Polecat Bench Sagebrush/Grouse Habitat Enhancement – Treated 960 acres of Wyoming sagebrush mechanically to improve overall watershed/ecological condition in monotypic sagebrush stands and to promote grass/forb production and allow for a younger age class of sagebrush to re-establish	BLM, grazing permittee, WGFD	BLM, grazing permittee, WGFD	2009-2012
	Breteche Creek Watershed Enhancement – Treated with prescribed fire and mechanical methods 420 acres of Wyoming & mountain sagebrush, and aspen sites to improve ecological status, diversity and overall watershed health for big game and other sagebrush obligates.	BLM, grazing permittee, WGFD	BLM, grazing permittee, WGFD, RMEF	2009-2013
	North Little Mountain Prescribed Burn – Treated 850 acres of Utah juniper to improve overall watershed/ecological condition in areas with juniper encroachment to promote grass/forb production and allow for a new younger age class of sagebrush to re-establish.	BLM, grazing permittee, WGFD	BLM, grazing permittee, WGFD	2013
	Planted 300 sagebrush seedlings on American Colloid Co. (ACC) property that had been mined.	ACC	ACC, Mich. Tech. Univ.	2011
	Planted 4320 acres of Wyoming Big sagebrush in the 1996 Black Mtn. Wildfire in the upper Nowood Drainage	BLM, WGFD	BLM,WGFD	2009,2011
Habitat management & water development	Installed exclosures around 4 springs (10 acres) to protect and enhance the wetland/riparian area, benefiting fish, wildlife, livestock, and overall watershed health.	BLM	BLM	2010-13
Invasive species management	Treated 2,350 acres of cheatgrass on the West Slope of the Bighorn Mountains, in the Breteche & Slack Creek drainages on the west-side of the basin and in the basin center in sage grouse habitat areas.	BLM, grazing permittee, WGFD, and Weed & Pest Districts	BLM, grazing permittee, WGFD, RMEF	2009-2013

Factor	Action	Responsible parties	Funding Sources	Time schedule
Invasive species management	Treated (Plateau) 950 acres of cheatgrass east of Manderson on property owned by American Colloid Co., resulting in 70% reduction of cheatgrass and increase in native grass and sagebrush seedlings	American Colloid (ACC)	ACC, BHBLWG, Big Horn Co Weed & Pest	2011
	Masticated 480 acres of Utah Juniper encroachment in the Myer Springs Allotment	BLM	BLM,BHBLWG	2009,2010
	Masticated 200 acres of Utah Juniper encroachment around the Black Mtn. Tower lek on Black Mountain, East of Shell Wy..	BLM	BLM,BHBLWG,RMEF,	2011, ongoing
	Masticated 100 acres of Utah Juniper encroachment in Crooked Creek and nearby drainages	BLM	BLM,BHBLWG,RMEF,	2010-12, ongoing
	Masticated 615 acres of Utah Juniper encroachment in the Rome Hill Allotment	BLM	BLM, Marathon Oil	2008-112 & ongoing
	Masticated 1120 acres of Utah Juniper encroachment in the Enos Creek Drainage	BLM	BLM,WNRT, NRCS,LU Ranch, WGFD	2009,2010, 2011
	Masticated 200 acres of Utah Juniper encroachment in both riparian and upland habitats within ¼ mile of Lefthand lek and in the Lefthand Creek area, a tributary of the Gooseberry drainage	BLM	BLM,BHBLWG,TNC,	2012 and 2013
	Treated 2600 acres of cheatgrass in the upper Nowood Drainage	BLM	BLM,WGFD	2009,2011
	Treated approximately 5002 acres of noxious weed infestations within sage grouse habitats with herbicides	BLM	BLM	2009-11
	Treated approximately 50 acres of cheatgrass on mine reclamation site near Red Hole (Thermopolis)	Wyo-Ben Inc.	Wyo-Ben Inc.	2010
	Planted 4320 acres of Wyoming Big sagebrush in the 1996 Black Mtn. Wildfire in the upper Nowood Drainage	BLM, WGFD	BLM,WGFD	2009,2011
	Treated 2420 acres of cheatgrass on the Renner Habitat Management Unit	BLM	BLM,WGFD	2009-10
	Treated 401 acres of cheatgrass in the Paint Rock Creek Watershed (Hyattville Core Area)	BLM, WGFD	BLM, WGFD	2011
	Treated 974 acres of cheatgrass in the Core area situated in the Bighorn River/Coal Draw watershed/Zimmerman Butte Wildfire Emergency Stabilization	BLM	BLM	2012
	Treated 3356 acres of cheatgrass in the Core area situated in the Nowater Creek watershed	BLM	BLM	2012

Factor	Action	Responsible parties	Funding Sources	Time schedule
Livestock Management	Reduction in growing season use and/or AUMs, and/or designed rotational grazing strategies on 46 allotments encompassing approximately 187,600 acres of rangelands to improve ecological status and insure that adequate residual forage remains on the watershed. These positive shifts in vegetative composition translate to increases in desirable species, herbaceous cover values, height and diversity of vegetation and decreased soil erosion.	BLM	BLM	2008-13
	Constructed 26,000 feet of fence to facilitate management of livestock grazing to prioritize sage-grouse habitat on American Colloid Company (ACC) private land.	ACC	ACC	2010
Monitoring	Aerial flights and ground surveys to delineate sage grouse winter concentration areas and remote lek monitoring	WGFD, BLM	BLM, WGFD	2005-13 & on-going
	Monitor movements, nest success, and habitat use of sage-grouse near bentonite mines on the east side of the Big Horn Basin using radio marked birds.	ACC, Univ Wyo.	ACC, Univ Wyo, BHBLWG	2010-14
	Monitor movements, nest success, predation rates and habitat use of sage-grouse near bentonite mines on the west side of the Big Horn Basin using radio marked birds.	Utah St. Univ., local predator boards, USDA APHIS	Utah St. Univ., local predator boards, USDA APHIS, Conserv. Distr.'s, BHBLWG, landowners, many others	2010-13 & on-going
Recreation – travel managemen	Little Mountain Travel Management Plan 69,000 public acres – reduced roads per square mile in sage grouse habitat (seasonal closure, 12/1 thru 4/30 restricted vehicle access in sage grouse core area.	BLM	BLM	2010,2011
Water development	Installation of a 8 wildlife guzzlers within sage grouse breeding, nesting and brood rearing habitat in the Worland Field Office	BLM	BLM, WGFD, Water for Wildlife	2008,09,10

Sage-grouse Conservation Plan

for the Big Horn Basin, Wyoming

August 31, 2007

Prepared by:
The Big Horn Basin Sage-grouse Local Working Group

PREFACE

The purpose of this plan is to provide direction for conserving sage-grouse populations and habitats in Wyoming's Bighorn Basin, while including socio-economic and human use of sage-grouse habitat. The Big Horn Basin Local Working Group will implement portions of this plan and are depending on landowners, land managers, users of the sagebrush system and the public to do likewise. Our intent is to work with everyone that has a stake in the sagebrush ecosystem of the Big Horn Basin to conserve sage-grouse.

Our plan provides recommendations and options for managing sagebrush systems and potential financial options for accomplishing goals. It lists agencies and groups also needed for achieving those goals. It does not authorize rules, enforce restrictions or regulate activities.

This Conservation Plan was developed with input and participation from the public and was not an agency-generated document. The Local Working Group consisted of eleven members, of which only four work for various government agencies (federal, state and county). All meetings were open to the public and included time for guests to add comments or ask questions. A previous draft of the plan was available for review by constituents of the working group members. The public at-large had an opportunity to comment on the draft plan for approximately five weeks during summer 2007. Only four comments were received, some of which resulted in revision to the plan. Two public meetings were held during the comment period (July 18 in Cody and July 19 in Worland) to discuss the plan with interested parties. Six people (non-working group members) attended the meeting in Cody and two people were at the Worland meeting. Participation from members of the public helped to maintain this plan as a user-friendly document. We hope the public, and agencies, will use it.

Scientific names and literature citations were intentionally omitted from the text of this plan, but are provided in appendices at the end of the plan. A glossary of words/terms and acronyms is also provided.

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EXECUTIVE SUMMARY

The Big Horn Basin Sage-grouse Working Group was established in September 2004 to develop and facilitate implementation of a local conservation plan for the benefit of sage-grouse and, whenever feasible, other species that use sagebrush habitats. The Working Group includes 11 members representing government agencies, industry, agriculture and wildlife stakeholders.

Our organizational mission statement is: ***"Through the efforts of local concerned citizens, recommend management actions, that are based on the best science, to enhance sagebrush habitats and ultimately sage-grouse populations within the Big Horn Basin."*** This conservation plan will identify practical management techniques to improve sage-grouse populations and habitats to preclude the need for listing this species under the Endangered Species Act, while including socio-economic and human uses of sagebrush habitats.

Conservation Assessment. Sage-grouse are found throughout the sagebrush grassland habitats of north-central Wyoming. In montane foothills, sagebrush habitats are fairly uniform with the exception of riparian areas and agricultural lands. In the interior of the Basin saltbush dominates with scattered stringers of sage. The sage-grouse population in the Basin appears stable with natural fluctuations occurring on approximately a 10-year cycle. Most occupied sage-grouse habitat is on public land. Approximately 69% of known leks are found on BLM managed lands and 24% are found on private land; remaining leks are on state or other federally managed lands.

Sagebrush habitat is essential for sage-grouse survival. Suitable habitat consists of plant communities dominated by sagebrush and a diverse native grass and forb 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. Both quantity and quality of the sagebrush environment determines suitability for, and productivity of sage-grouse.

Providing for all habitat needs on a scale suitable for sage-grouse may be the most challenging element of managing landscapes in the context of other land uses. Structure and cover components of vegetation communities are also important. These challenges are greatest in pre-nesting, nesting and early brood-rearing habitats. Winter range is increasingly being recognized as a critical component of sage-grouse habitat.

The Working Group identified several factors that may influence sage-grouse populations in the Big Horn Basin. A brief description of each factor and impacts to grouse or their habitats are discussed. Impacts of each factor are addressed in the Conservation Strategy section of the plan.

Conservation Strategy. This conservation plan identifies strategies and commitments designed to improve sage-grouse habitats and populations in the Big Horn Basin. Specific actions, recommended management practices, and commitments to achieve goals and objectives are presented. Actions are based on the general biology of sage-grouse, their seasonal habitat requirements, and the potential and documented affects of each factor on sage-grouse or habitats. Our goals are to:

1. **Maintain, enhance, and/or restore quality habitat for sage-grouse,**
2. **Maintain and enhance sage-grouse populations in the Big Horn Basin,**
3. **Support research to better understand the dynamics of sage-grouse populations and their habitats in the Big Horn Basin, and**
4. **Educate the public about sage-grouse and conservation of their habitats.**

The strategy for sage-grouse conservation in the Big Horn Basin is to meet the goals and sub-goals through the development and implementation of objectives. Objectives are the actions designed to improve sage-grouse habitats and populations. This Working Group will implement some of these objectives; other objectives rely on implementation by cooperating government agencies and other groups. Objectives may be implemented using a variety of management actions and practices. We recommend some management practices designed to improve sage-grouse populations and sagebrush habitats.

The dynamic nature and variability of vegetation communities in the Big Horn Basin necessitates using adaptive management. We recommend use of ecological site descriptions and state-and-transition models for interpreting rangeland health. Determining existing and potential plant communities for a site is the foundation for selecting practices to manage a site toward the desired plant community. Implementation of management actions must be followed with monitoring of that site. Management for sage-grouse may need to be continually adjusted as man-caused and natural forces continue to influence grouse habitats. Therefore, the BHBLWG will meet periodically in the future to evaluate plan implementation, adjust recommendations to new situations, and allocate future legislative appropriations.

Big Horn Basin sage-grouse working group members

Bill Alldredge, (no affiliation) representing conservation/environmental interests

Marvin Blakesley, Advanced Health, Environment, and Safety Professional, Marathon Oil Corp., representing oil and gas exploration/development interests

Matt Call, Environmental Supervisor, WyoBen Inc., representing mining (bentonite)

Lee Campbell, Hot Springs County Planner, representing local government

Tom Easterly, Wildlife Biologist, Wyoming Game & Fish Department, representing state wildlife management agency, primary author

Keith Hamilton, Owner, Hamilton Ranch, representing agricultural interests

Kathleen Jachowski, Executive Director, Guardians of the Range, representing agricultural interests, chairperson

Rory Karhu, District Conservationist, Natural Resources Conservation Service, representing natural resources conservation on private lands (Rory replaced Jim Mischke, district conservationist, approximately half-way through this planning process.)

Carl Meyer, (no affiliation), member-at-large

Chris Pfister, (no affiliation) representing conservation/environmental interests

Tim Stephens, Wildlife Biologist, Worland Field Office Bureau of Land Management, representing federal land management agencies

Dennie Hammer, Regional I&E Specialist, Wyoming Game & Fish Department, facilitator and note taker

CONSERVATION ASSESSMENT

Introduction

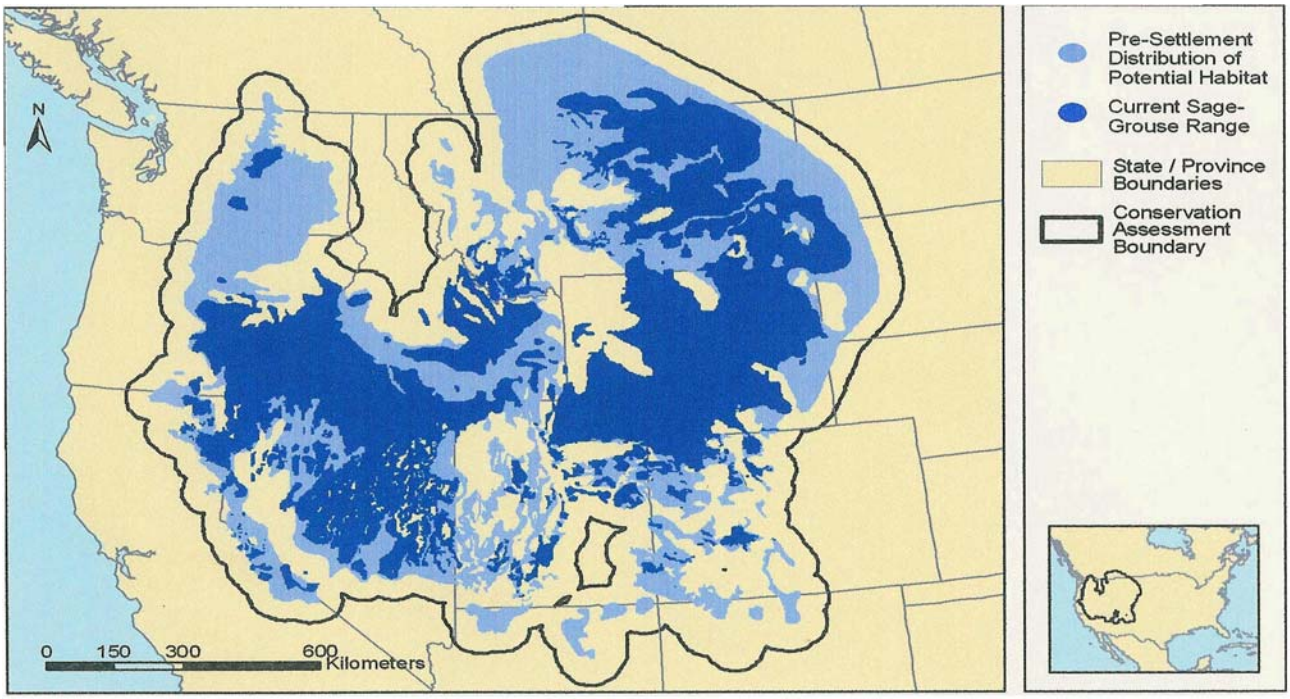
In the second half of the 20th century, numbers of greater sage-grouse declined throughout their historic range in western North America (Fig. 1). In response to this decline, several petitions were filed to list sage-grouse for protection under the Endangered Species Act. In July 2000, the Wyoming Game & Fish Commission (Commission) assembled the Wyoming Sage-grouse Working Group (WSWG) to develop a statewide strategy for conservation of sage-grouse in Wyoming. WSWG consisted of 18 citizens from diverse backgrounds including agriculture, industry, government, environmental, hunting, and Native American tribal interests. Other western states convened similar groups to address sage-grouse concerns in their respective states. WSWG drafted the Wyoming Greater Sage-Grouse Conservation Plan (State-wide Plan), which was approved by the Commission in May 2003. The State-wide Plan recommended practices aimed at improving sage-grouse populations and called for creation of local working groups to address issues affecting sage-grouse at the local level. In December 2005, the U.S. Fish and Wildlife Service determined that the greater sage-grouse was not warranted for listing under the Endangered Species Act, at that time.

The purpose of local working groups is: to develop local conservation plans, to design projects that benefit sage-grouse and other sagebrush obligate species, and to implement on-the-ground habitat and population related projects for the species. Local plans are to identify management practices for the purpose of halting long-term sage-grouse population declines and to identify financial and personnel resources needed to implement those practices.

The Big Horn Basin Sage-grouse Local Working Group (BHBLWG) was established in September 2004 by the Wyoming Game and Fish Department, as called for in the State-wide Plan. The BHBLWG includes 11 members representing major interests within the Big Horn Basin Conservation Area (BHBCA): Wyoming Game and Fish Department (WGFD), the Bureau of Land Management (BLM), the U.S.D.A. Natural Resources Conservation Service (NRCS), local (county) government, agriculture, bentonite mining, oil and gas industry, conservation interests, and citizens at-large. Working Group members represent their particular interests and provide liaison to the groups they represent.

Our organizational mission statement is: ***"Through the efforts of local concerned citizens, recommend management actions, that are based on the best science, to enhance sagebrush habitats and ultimately sage-grouse populations within the Big Horn Basin."*** Our conservation plan will identify practical management practices to improve sage-grouse numbers and habitat to preclude the need for listing this species under the Endangered Species Act, while including socio-economic and human uses of sagebrush habitats. This plan strives to utilize mechanisms to benefit sage-grouse that do not adversely affect local economies.

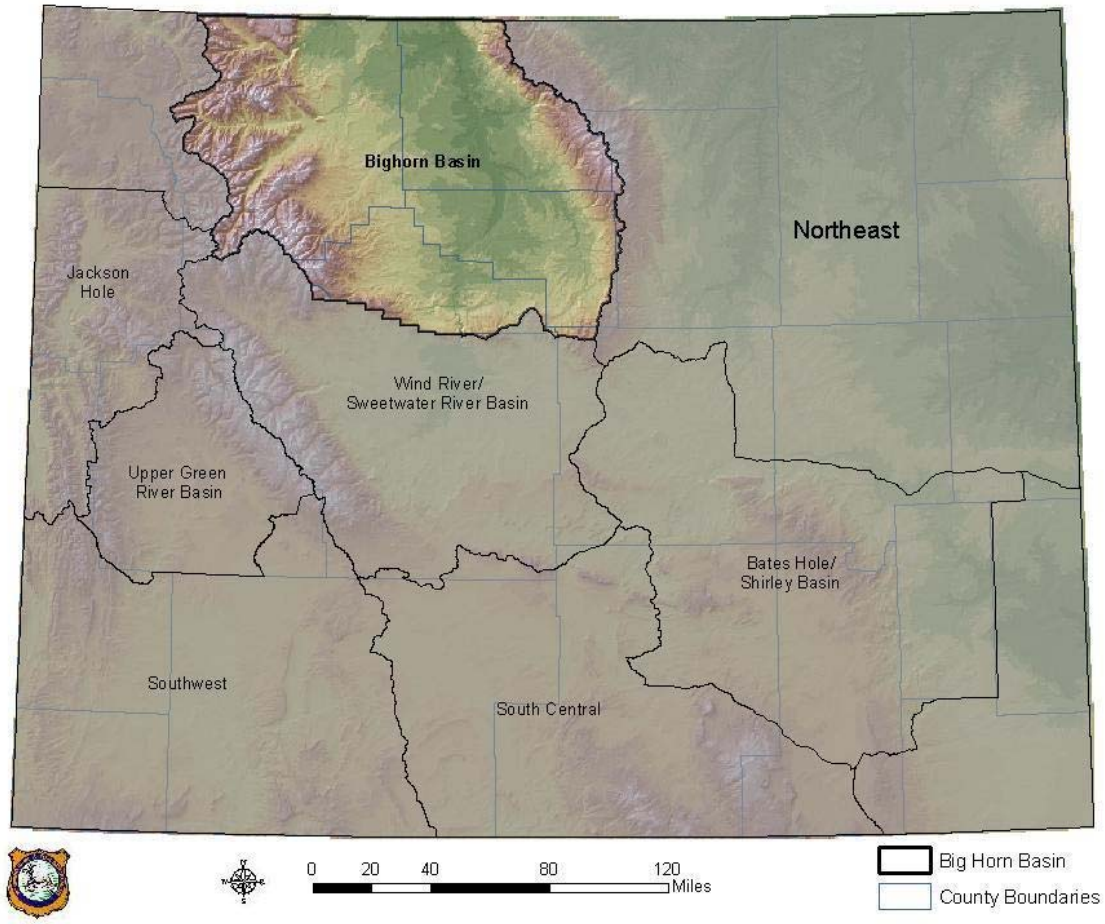
Figure 1. Current distribution of sage-grouse and pre-settlement distribution of potential habitat in North America.



Conservation Plan Area

The Big Horn Basin Conservation Area consists of the geographically isolated Bighorn River drainage in Wyoming (Fig. 2) and is bounded by the Bighorn Mountains on the east, Bighorn Mountains, Bridger Mountains and Owl Creek Mountains on the south, Absaroka Mountains on the west, and Beartooth Mountains and Pryor Mountains on the north. The Wyoming-Montana state line represents the northern boundary for the BHBCA.

Figure 2. Map of Big Horn Basin Sage-grouse Conservation Area and other planning areas across Wyoming.



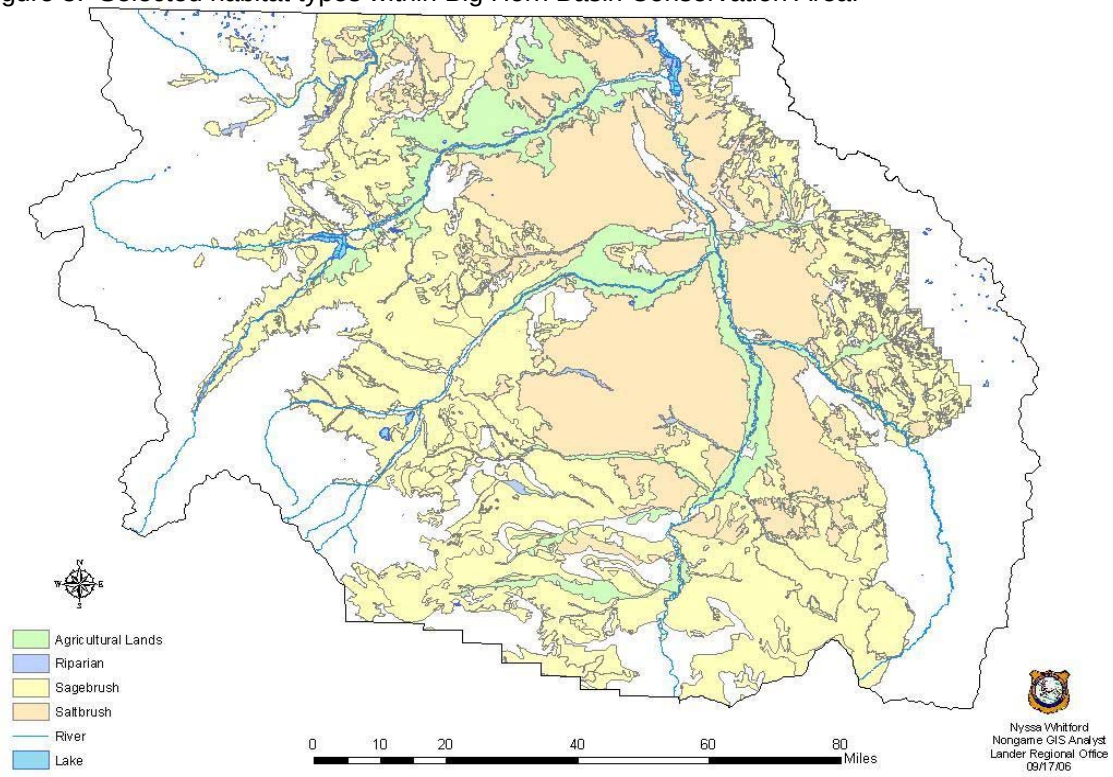
The Bighorn Basin (Basin) is essentially a desert, receiving little moisture and extreme temperatures. Lower elevations of the Basin are the driest part of Wyoming. Mean annual precipitation ranges from less than 5 inches to more than 40 inches at higher elevations of mountain ranges. Snow is very light with annual averages from 15 to 20 inches on the lower elevations and 3-4+ feet at 5,000-6,000 feet. Significant snowfall events at lower elevations in the Basin are limited, with less than three days annually receiving five or more inches. The warmest parts of Wyoming are the lower elevations of the central, northeast and the eastern portions of the Bighorn Basin. Mean annual temperature across potential sage-grouse habitat in BHBCA ranges from 30-

50^{o}F, but extreme temperature fluctuations are common. Parts of the Basin can experience up to 50 days per year with temperatures $\geq$90^{o}. Some of these same areas may often have temperatures of $\leq$32^{o} on as many as 230 days per year.

Habitats within the BHBCA are diverse and vary depending upon such factors as soil type, annual precipitation, and elevation. Major habitat types within the plan area include: sagebrush/grassland, salt desert shrub, agricultural crop and pasture lands, mixed mountain shrub, mixed conifer and aspen forests at higher elevations, cottonwood-riparian corridors, and urban areas. Primary land uses in Basin include: livestock grazing, wildlife habitat, dry-land and irrigated crop production, oil and gas development, bentonite mining, recreation and urban/suburban developments.

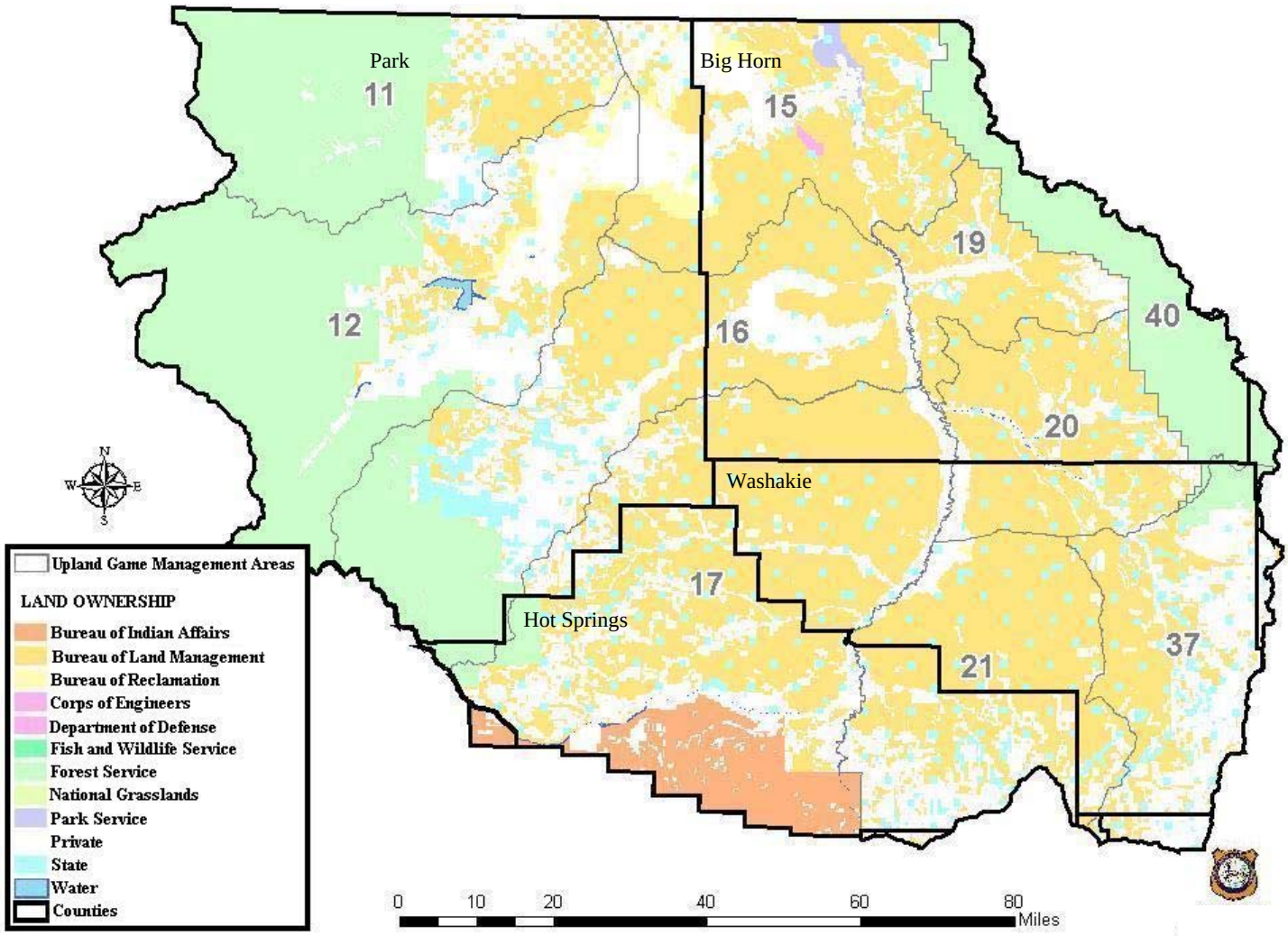
Habitats that may be most important to sage-grouse are presented in Figure 3 from the Wyoming GAP Analysis Land Cover Map (GAP). Figure 3 depicts sagebrush of 5% or greater canopy cover in sagebrush/grassland habitat. GAP data used to construct this habitat map were often incorrect, based upon experience of landowners and managers familiar with the Basin. For example, the southeast corner of the Basin actually does contain considerable sagebrush not shown on Figure 3. Also, there are sagebrush habitats interspersed with conifer forests on mountain ranges (often used by sage-grouse) that were not detected. No formal state-wide validation of the Wyoming GAP has been done, however, resource specialists from BLM, WGFD, FS, and NRCS reviewed and edited GAP cover types using maps and aerial photos (Fig. 12). BLM and WGFD has contracted the Wyoming Geographic Information Science Center at the University of Wyoming to inventory habitat types and refine vegetation cover maps beginning in 2007.

Figure 3. Selected habitat types within Big Horn Basin Conservation Area.



The BHBCA has been subdivided into various political jurisdictions and ownership patterns (Fig. 4). Counties within BHBCA include Big Horn, Hot Springs, Park, and Washakie. The BHBCA encompasses WGFD's Small/Upland Game Management Areas 11, 12, 15, 16, 17, 19, 20, 21, and a portion of 37 and 40. Management Areas do not correspond to sage-grouse sub-population boundaries; they are used for general data collection and reporting for all small and upland game species. BHBCA is mostly public land managed by the BLM (40%), Forest Service (25%), state (5%) or other federal agencies (>1%; Bureau of Reclamation, National Park Service, Department of Defense). Private land represents 25% of the BHBCA. There have been land sales and exchanges between federal agencies and private interests that are not reflected on Figure 4 (i.e., Little Mountain). Less than 3% of BHBCA lies within the Wind River Indian Reservation.

Figure 4. Big Horn Basin Sage-grouse Conservation Area showing counties, WGFD Small and Upland Game Management Areas and land ownership.



Economic Conditions

Social and economic data concerning the four counties within the BHBCA indicate distressed conditions in three of the four counties (Big Horn, Hot Springs and Washakie). Socio-economic factors influencing the distressed conditions of the counties include: (1) a persistent drought greatly affecting agriculture, (2) steadily declining oil and gas production caused by aging oil and gas fields, (3) lack of diversity in the local economies, (4) inability to retain young, high school graduates, (5) mean average ages significantly higher than the state average (aging in place), (6) a disabled population higher than the state average, and (7) assessed valuations in the lower range of the state's assessed valuations. State-wide assessed valuation for Wyoming indicates that three of the counties (Big Horn, Washakie and Hot Springs) are among the lower ranking counties in the state.

Due to the remoteness of the Big Horn Basin (no interstate highways cross or access the Basin and access into the Basin is through restrictive "passes"), it seems unlikely that economic growth will occur in the manufacturing sector. Some resurgence in the oil and gas industry is expected; however, any new production will most likely fall short of replacing production declines already incurred. Much of the Basin has high speed, fiber optic phone lines which could create opportunities for Internet based companies and tele-commuting. The extent and impacts (both positive and negative) of this "new" economy is unknown at this time.

Some human migration from highly populated areas, (e.g., "baby boomer" retirees) to the BHBCA has occurred and will continue. The effect of migrants on the economy and the effects on sage-grouse habitat and populations are unknown.

The purpose of this plan is to provide direction for conserving sage-grouse populations and habitats in the Bighorn Basin. However, we recognize the socio-economic need to continue human uses of sagebrush ecosystem. We believe ideas presented in this plan, if implemented, will reduce the odds that sage-grouse populations in the BHBCA fall below levels needing protections under the Endangered Species Act, while not hindering economic development of the Big Horn Basin.

General Sage–Grouse Biology And Habitats

Research has not been conducted on the basic ecology, life history, or habitat use/requirements of sage-grouse in the Bighorn Basin. Sage-grouse in the BHBCA may have similar biology and interact with their habitats similarly to sage-grouse in other parts of their range. The following information on sage-grouse biology and habitat use was adapted from the State-wide Plan.

Sagebrush is essential for survival of sage-grouse. Suitable habitat consists of plant communities dominated by sagebrush and a diverse understory of native grasses and forbs. The sagebrush species most important to sage-grouse found in BHBCA are Wyoming big sagebrush at lower elevations and mountain big sagebrush at higher elevations. The composition of shrubs, grasses and forbs varies with the subspecies of sagebrush, ecological condition of habitat and range site potential. Both quantity and quality of the sagebrush environment determines suitability for and productivity of sage-grouse.

Water may be important to sage-grouse and its availability could affect summer distribution. Grouse have been observed in large flocks near water during the autumn migration, watering from 10 to 30 minutes daily. Movements to agricultural lands or high elevation summer ranges, however, are probably in response to lack of succulent forbs in an area rather than a lack of free water. It has been suggested that grouse do not commonly use water developments even during relatively dry years, but instead obtain moisture from consuming succulent vegetation. Evidence (feathers, tracks, droppings) of sage-grouse, however, can be found at guzzlers and stock tanks throughout the BHBCA.

Winter Habitat – December-February

During winter, sage-grouse feed almost exclusively on sagebrush leaves and buds, thus suitable winter habitat has sagebrush available above snow. Sage-grouse tend to select wintering sites with canopy cover of 10-30% and heights of at least 10-14 inches, regardless of snow cover (Fig. 5). Sage-grouse generally return to traditional wintering areas before heavy snowfall. Distances to wintering areas vary widely, ranging from a few miles to over 50 miles, depending on the area and population. Sage-grouse tend to roost in open, low sagebrush sites. Foraging areas tend to be gentle southwest facing slopes and windswept ridges. Sage-grouse will move considerable distances (>5 miles) and elevations (>1,000 feet) between winter feeding sites and suitable snow roosting sites.

Figure 5. Typical winter habitat in the Big Horn Basin Conservation Area.

During winter storms and in severe winters (extended cold and/or deep snow accumulation), the amount of available habitat can be greatly reduced. Sage-grouse will seek taller shrubs with greater canopy cover to conserve energy. Sage-grouse may burrow deep into snow. Taller, denser sagebrush may be essential and used to a great extent during severe winters. Such habitats should be provided to ensure sage-grouse survival through severe winters and blizzards.

Winter habitat is increasingly recognized for its importance to sage-grouse. Identifying winter habitat at the landscape scale has been difficult. Spatial analysis of sage-grouse locations during winter has been used to assess critical components of winter habitat in the Powder River Basin. Three factors were identified to contribute to suitable winter habitat: sagebrush, lack of conifer cover and terrain. Sage-grouse select large, flat areas of non-forested sagebrush habitat in winter. Currently, few sage-grouse wintering areas have been formally delineated within the BHBCA.

Breeding Habitat and Leks – March-May

Breeding occurs on traditional strutting grounds (leks; Appendix A) during late March through mid May. Leks are often located on the same site each year. Leks are generally situated on sites with low density of shrubs and lower herbaceous height, such as broad ridge tops, grassy openings, and disturbed sites (Fig. 6). Leks are generally near nesting habitat. Sage-grouse hens exhibit fidelity to a lek and nesting area. Males also return to the same lek if they have achieved stature in the breeding hierarchy. As populations decrease, leks can be abandoned; conversely, as populations increase, leks can become active again. “Satellite leks” often appear at high population levels. Satellite leks are small groups of males, usually subordinate males, strutting away from the main lek site.

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.

Figure 6. Sage-grouse often select areas with little or no sagebrush for breeding display sites (leks).

Although the lek site can be comprised of no or low density sagebrush, stands of sagebrush surrounding leks are essential. Sagebrush is used extensively by sage-grouse for foraging, loafing and protection from weather and predators when they are not engaged in breeding behavior. A small-grained mosaic of early-to-late seral stages of sagebrush communities is desired. Pre-nesting habitats should contain areas with relatively open sagebrush canopies and a robust, leafy forb understory. Preferred breeding habitats consist of 15-25% canopy cover of sagebrush, perennial herbaceous cover averaging $\geq$7 inches in height, $\geq$15% canopy cover of grasses and a diversity of forbs providing $\geq$10% canopy cover.

During the breeding season and throughout early spring, herbaceous plants are essential habitat components that contribute to nesting success. At green-up, forbs are more nutritious than sagebrush. Sage-grouse hens need foods rich in protein, calcium and phosphorus to support nest initiation, increase clutch size, improve hatch success and increase early chick survival. Commonly identified important plant species include: common dandelion, curlycup gumweed, western salsify, western yarrow, prickly lettuce, cudweed, fleabane, sweetclover, milkvetch, alfalfa, winterfat and fringed sagewort. When plants are young and succulent, sage-grouse will eat most forb species.

Nesting Habitat – April-June

Approximately two-thirds of hens nest within three miles of the lek where they were bred. The remainder of the birds usually nest within 15 miles of the lek. In one instance, a collared bird in western Wyoming nested 60 miles from the lek at which she was bred.

Sage-grouse typically nest under sagebrush, but may use other large shrubs. Sage-grouse select mid-height, denser sagebrush stands for nesting. Nesting habitats should also have sagebrush of varying heights. Studies conducted in Wyoming indicated sagebrush heights ranged between 8 to 32 inches at sage-grouse nests. Sagebrush canopy cover at nesting sites ranged between 6% and 40%. Research studies conducted in Wyoming indicated that sage-grouse chose nest sites with greater canopy cover of total shrubs and dead sagebrush cover when compared to surrounding vegetation. Although dead sagebrush canopy cover has been shown to be statistically significant in nest selection, it represented only 12-21% of the overall canopy cover in the stand. Dead sagebrush may provide screening cover while allowing for increased amounts of herbaceous understory.

Areas between the sagebrush should have good residual grass and some current-year's grass and forb growth under the sagebrush canopy (Fig. 7). Herbaceous cover provides visual screening to protect nests from predators and weather. Live grass heights measured immediately after hatch ranged between 4 and 9 inches with residual grass heights of 2 to 6 inches. Herbaceous cover was variable and ranged between 1% and 85%. In general, dense residual grasses (at least as tall as the bottom of the canopy on mid-height sagebrush plants) at nesting sites appear to positively influence hatching success. Areas that support a diverse forb understory should be in close proximity to nesting sites for feeding during incubation and early brood rearing. Hatching success appears to improve with increased forb cover. The vegetation composition of an area depends upon site potential, seral stage and range management.

Figure 7. Sage-grouse nesting habitat in the Big Horn Basin Conservation Area.

Early Brood-Rearing Habitat – late May to mid-July

Early brood-rearing habitats are used during the brood's first month of life. 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 occurring in Wyoming) occurs during this period. At about ten days post-hatch, hens with broods may move five or more miles from the nest site.

A highly diverse vegetation mosaic is essential to early brood survival. Early brood-rearing habitat is more open than nesting habitat (10-15% sagebrush canopy cover) with more herbaceous cover and similar sagebrush height. Brood survival is tied to an abundance of insects and green vegetation, primarily forbs, in close proximity to sagebrush cover (Fig. 8). Sagebrush density must provide 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, especially forbs, increases insect diversity. Insects are crucial during the first ten days post-hatch. Studies suggested that insects can make up to 75% of chick diets and remain an important source of protein throughout the summer.

Figure 8. Sagebrush, grasses and abundant forbs used by sage-grouse during early brood rearing in the Big Horn Basin Conservation Area.

Late Brood-Rearing Habitat – July to mid-September

As summer progresses and food plants mature and dry, sage-grouse move to areas still supporting succulent herbaceous vegetation. From mid to late summer, wet meadows, springs, riparian areas and irrigated fields are the primary sites of forb and insect production necessary for juvenile birds (Fig. 9). In years with above-normal summer precipitation, sage-grouse may find succulent forbs on upland sites all summer. In more arid areas and low precipitation years, riparian meadows and irrigated fields become important to survival of broods in the late summer. In general, the drier the summer, the more sage-grouse are attracted to remaining green areas. They continue

to rely on adjacent sagebrush for roosting, loafing and protection from weather and predators.

Figure 9. Riparian areas and wet meadows near sagebrush create late brood rearing habitat in the Big Horn Basin Conservation Area.

Delayed maturation of forbs has a noticeable effect on bird movements. Where uplands lack green vegetation, sage-grouse hens with broods may move to lower elevation native or irrigated meadows. Some sage-grouse may migrate to higher elevations, seeking habitats where succulent forbs are still available in sagebrush habitats, riparian areas or moist upland meadows.

Fall Habitat – mid-September to first major snow

The amount of 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 may occur. As meadows dry and frost kills forbs, sagebrush consumption increases. Fall movements to winter ranges are slow and meandering from late August to December. With significant snowfall accumulation, sage-grouse move onto winter range more quickly.

Landscape Context

Seasonal habitats, as described above, must occur in a patchwork or mosaic across a landscape to satisfy the habitat needs of a sage-grouse population. Important habitat components have to be in proximity to one another and constitute a small-grained mosaic of seral stages with adequate vegetation structure (height and cover). The amount of each seasonal habitat, the vegetative condition and spatial arrangement of those habitats determine the landscape's potential for sage-grouse.

If upland vegetation is managed to provide a variety of early, mid, and late seral stages at the landscape scale, it is assumed the area will provide sage-grouse with the variety of habitats required on an annual basis. Issues relating to landscape-scale needs of sage-grouse must consider amounts of all seasonal habitats (pre-nesting, nesting, early brood-rearing, late brood-rearing, fall and winter), juxtaposition of those habitats, seral stages of vegetation, site potential, vegetative structure and past and future management. The ideal or required percentages of each seasonal habitat and the juxtaposition of these habitats on the landscape are not well understood. "Landscape-scale" can be highly variable. Sage-grouse populations may contain birds that are migratory, non-migratory or both, further complicating the concept of landscape-scale.

Providing for all habitat needs on the scale required by sage-grouse has been the most challenging element of managing sagebrush habitat for sage-grouse. There is debate about how sagebrush communities should be managed to maximize benefits to sage-grouse. 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; conversely, managing for early-seral sagebrush habitats on a large scale often fails to provide adequate nesting and security cover for sage-grouse. The value of the various successional stages of sagebrush communities to sage-grouse may not be completely understood, although some generalizations may be made (Table 1).

It has been suggested landscape scale habitat assessment focus on nesting and early brood-rearing habitat associated with leks. Leks have been shown to be reliable indicators of nesting habitat. Nesting and early brood-rearing periods are the most critical period to grouse survival. Sage-grouse chicks have limited mobility during the first two weeks post-hatch. Habitat management of breeding (pre-nesting, nesting and early brood-rearing) habitats has been most challenging.

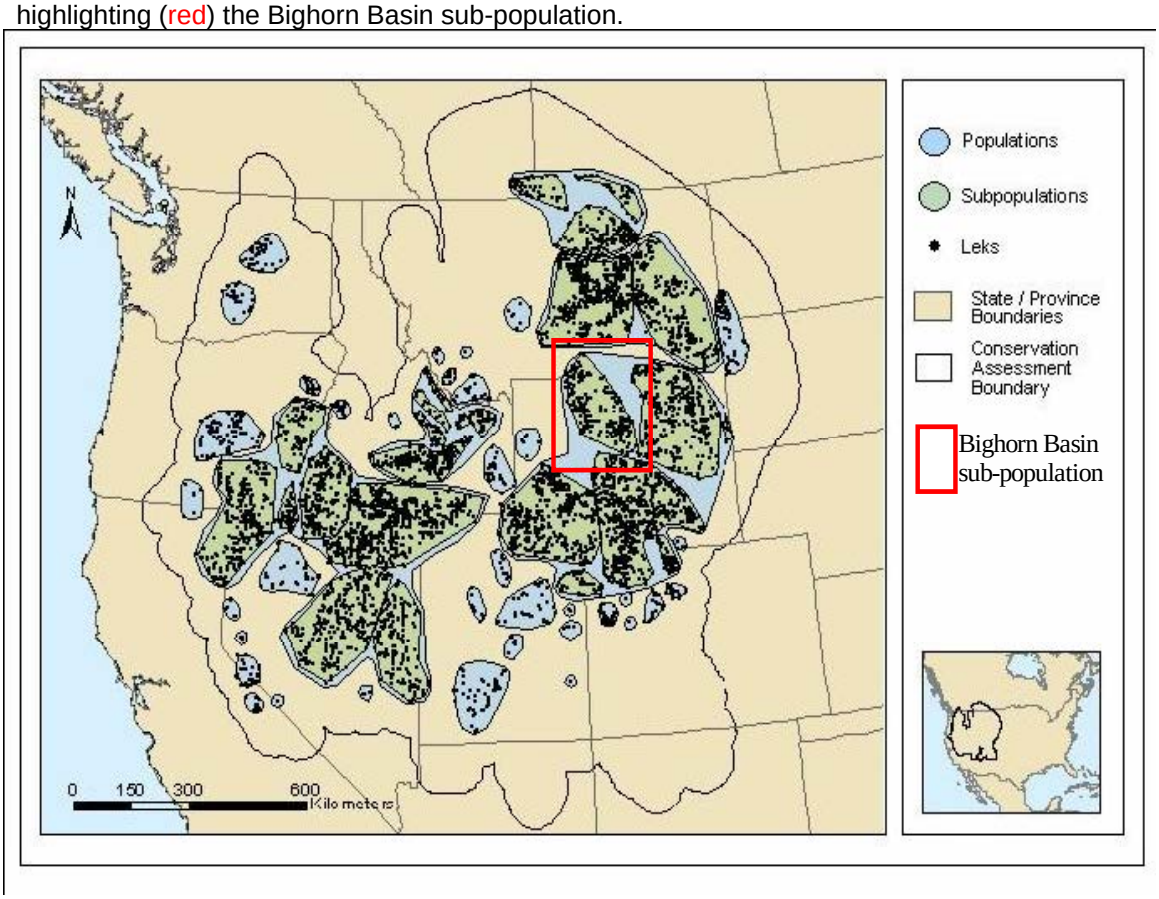
Table 1. Habitat check sheet for sage-grouse seasonal habitat requirements (Roath, in prep: *modified by BHBLWG*).

Sage-grouse physiologic phase or state	Approx. dates	Relative requirement	Vegetation to meet requirements	Appropriate Seral phase/state	Desired vegetation structure
Wintering	Nov. - March	low	mature sagebrush	late seral	tall basin big sagebrush
Nesting	April-June	moderate	residual and new grass growth	mid-seral	sagebrush overstory w/ dense grasses
Early Brood Rearing	late May - mid July	high	lush grasses, young forbs and insects	mid-seral	open stands of sagebrush w/ good understory
Late Brood Rearing	July - mid Sept.	moderate	lush grasses, forbs and insects	early to mid-seral	riparian with forbs adjacent to sagebrush
Fall	Sept. - Nov.	moderate	riparian meadows, forbs	mid-seral	riparian with forbs and grasses adjacent to sagebrush

Sage-grouse in the Big Horn Basin Conservation Area

Sage-grouse in the Bighorn Basin represent a nearly isolated population. These sage-grouse have been recognized as a distinct sub-population (Fig 10). Mountain ranges to the east and west restrict most sage-grouse movement due to unsuitable habitat types. Grouse movements in the north and southeast portions of the Basin have not been well documented. There are several leks on both sides of the Wyoming-Montana state line and movement between states is suspected. Suitable habitat on Copper Mountain, Owl Creek Mountains and southern Bighorn Mountains may serve as travel corridors to other areas where sage grouse populations occur (e.g., South Fork of the Powder River drainage).

Figure 10. Discrete populations and subpopulations of sage-grouse in western North America, highlighting (red) the Bighorn Basin sub-population.



As of 2006, there were 248 known, occupied sage-grouse leks in the BHBCA (Fig. 11). There are probably several leks within the BHBCA that have not been documented. Sage-grouse leks in BHBCA occur in sagebrush habitats (Fig. 12) and most occur in 8-10 inch annual precipitation zone (Fig 13). Leks within BHBCA occur most frequently (69%) on BLM managed land (Table 2). Leks in the BHBCA occasionally move to new sites for unknown reasons. Maps and databases are being updated to reflect leks that have moved, but new sites are not shown in attached figures.

Twenty-nine additional lek sites are classified as unoccupied or historical; three of which were abandoned due to destruction of habitat at the lek site. Several leks have not been active in recent years, but have not been surveyed adequately to categorize as "unoccupied". (Refer to Appendix A for definitions of lek terms.) There probably have been leks that were abandoned or destroyed before they could be discovered.

Figure 11. Distribution of known sage-grouse leks across the Big Horn Basin in reference to land ownership, 2006.

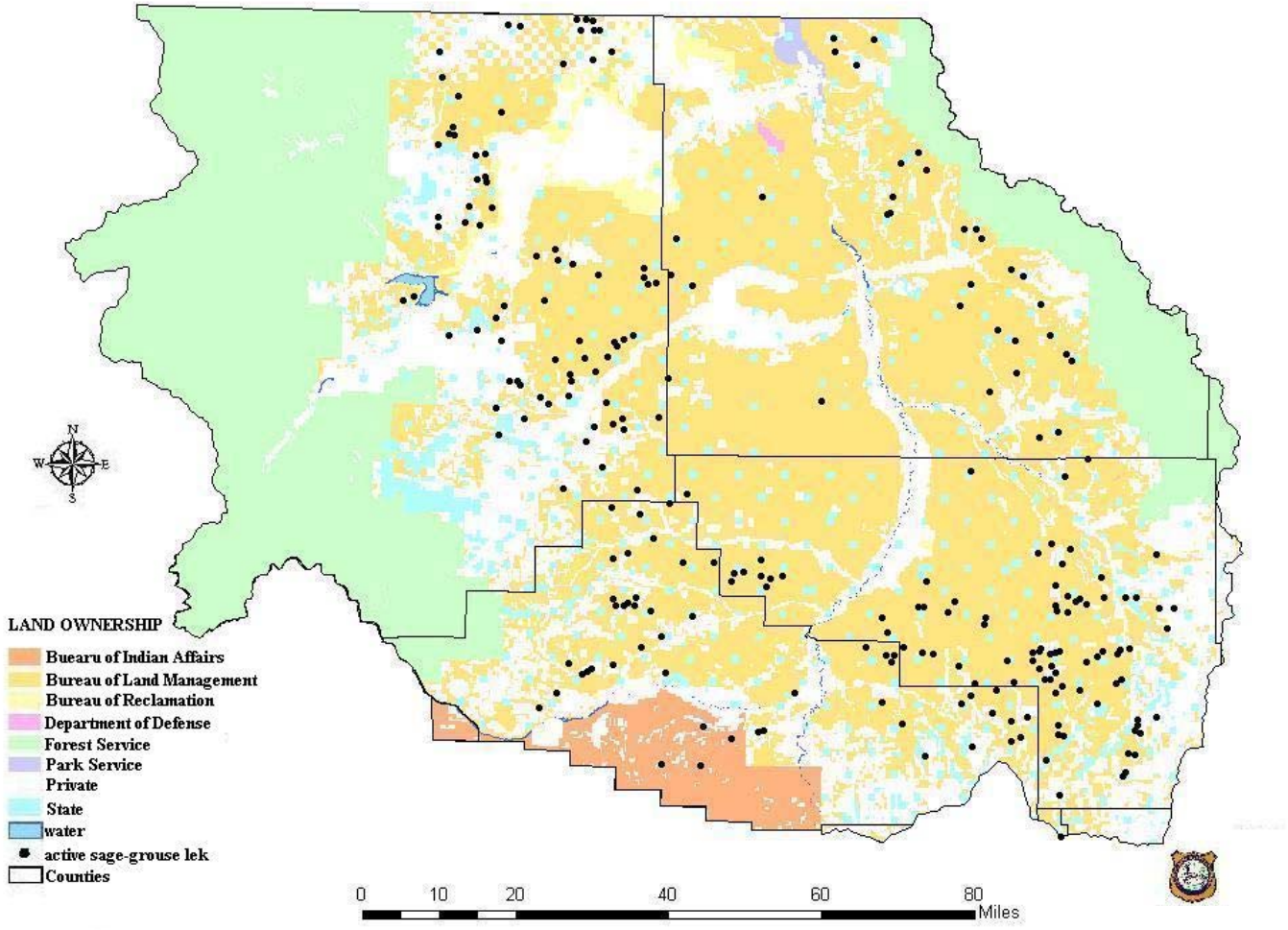


Figure 12. Sage-grouse leks in the Big Horn Basin Conservation Area in relation to sagebrush distribution, 2006.

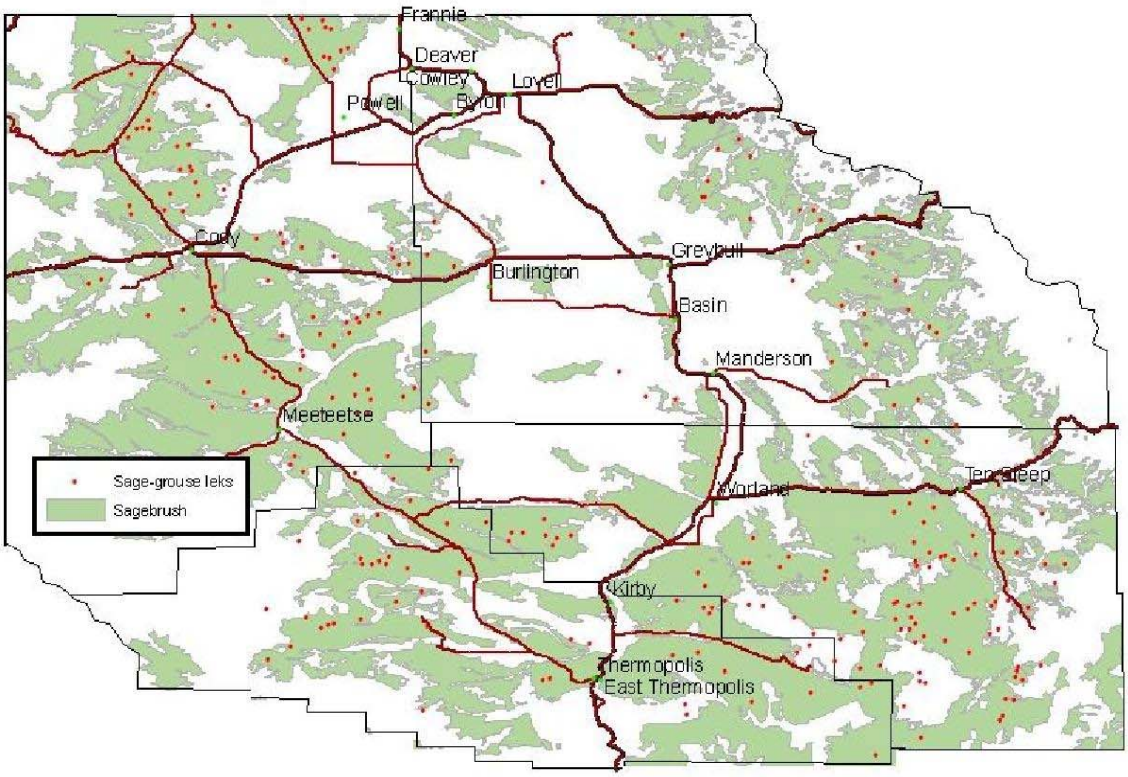


Figure 13. Sage-grouse leks in the Big Horn Basin Conservation Area in relation to average annual precipitation (inches).

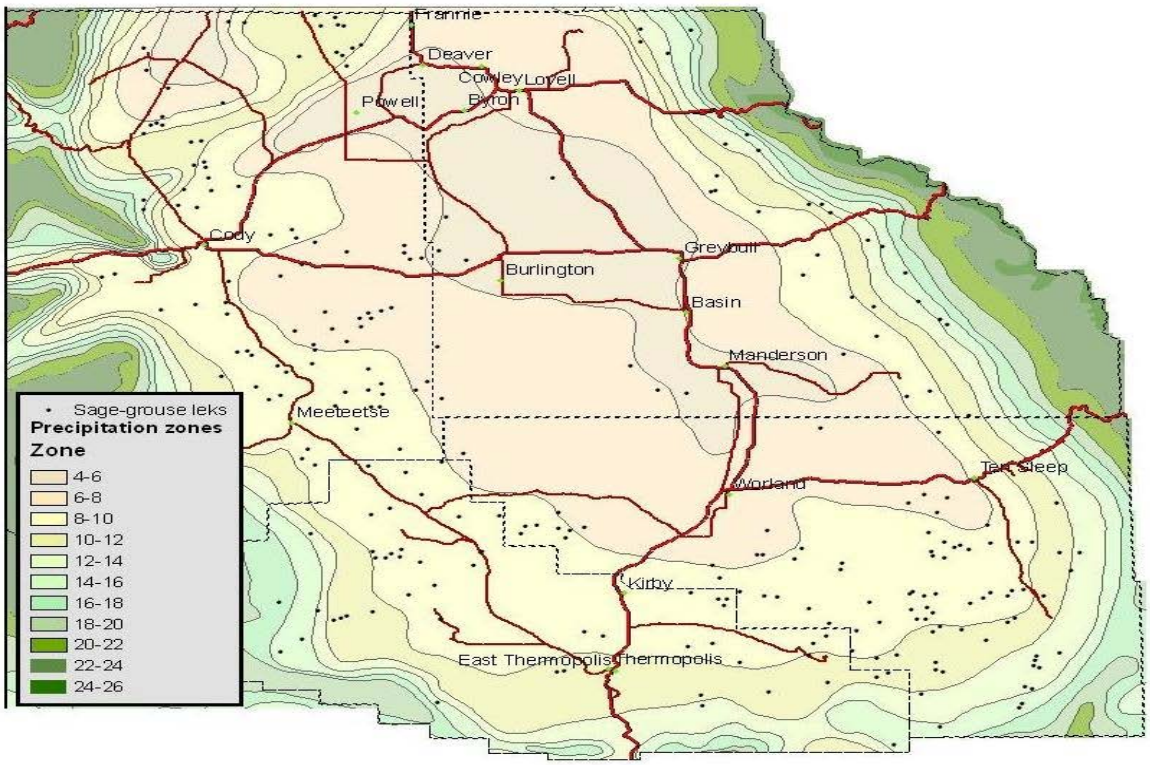


Table 2. Distribution of the 277 sage-grouse leks (active and unoccupied) within the Bighorn Basin based on various geopolitical subdivisions, 2006.

County	Number	Percent
Bighorn	40	14.4%
Hot Springs	48	17.3%
Park	94	33.9%
Washakie	95	34.3%

Land Status	Number	Percent
BLM	191	69.0%
BOR	1	0.4%
Private	66	23.8%
State	19	6.9%

WGFD Biologist District	Number	Percent
Cody	79	28.5%
Greybull	38	13.7%
Thermopolis	160	57.8%

BLM Office	Number	Percent
Cody	98	35.4%
Worland	179	64.6%

WGFD Game Warden district	Number	Percent
Greybull	25	9.0%
Lovell	17	6.1%
Meeteetse	36	13.0%
North Cody	22	7.9%
Powell	13	4.7%
South Cody	18	6.5%
Ten Sleep	46	16.6%
Thermopolis	41	14.8%
Worland	59	21.3%

WGFD Management Area	Number	Percent
11	13	4.7%
12	25	9.0%
15	17	6.1%
16	37	13.4%
17	59	21.3%
19	16	5.8%
20	12	4.3%
21	48	17.3%
37	50	18.1%

A lek “complex” is defined as a group of leks where sage-grouse intermingle during the breeding season (Appendix A). An example of a complex may be one large lek and one or several smaller satellite leks or 2 (or more) leks in close proximity. Leks in the BHBCA have been grouped into 144 complexes; however, there has been no research to document movements of grouse in the Basin. Identification of lek complexes without specific information on movements of birds is subjective and may not be accurate. Recent research in the Pinedale and Jackson areas found that some males and females move greater distances than formerly thought (>1-2 miles) and attend several leks during one breeding season. Complexes in BHBCA have not been re-evaluated in light of these findings. Distribution and movement data is needed to refine complexes to a more meaningful level.

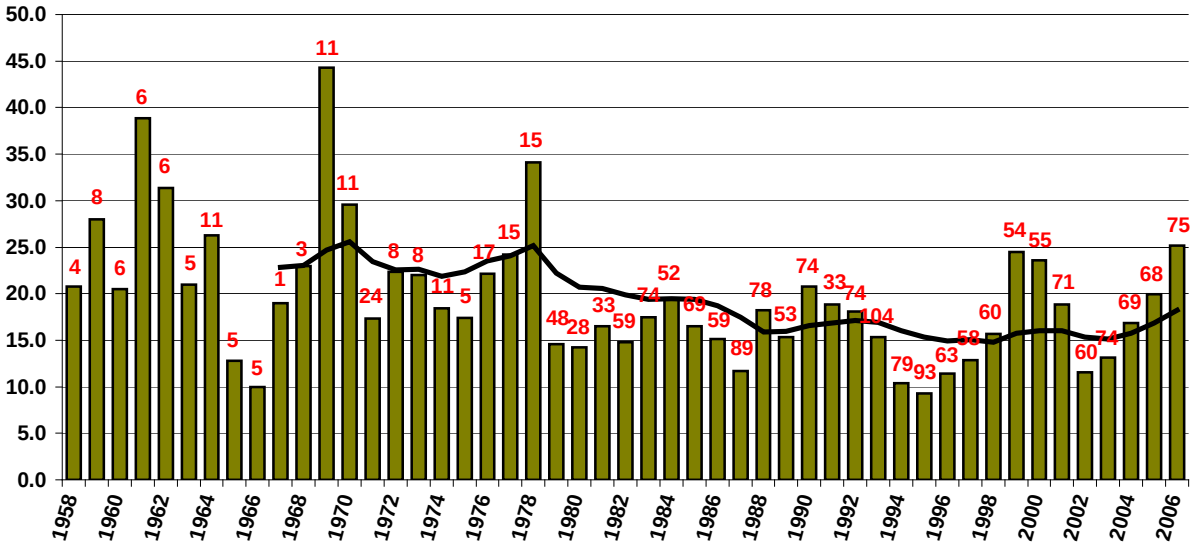
Population Trends

No reliable method for estimating sage-grouse populations exists at this time. The number of males observed on leks (standardized to average males/lek) may indicate a trend of a population over time; however, collection of accurate and consistent data has been problematic. The number of leks in an area and the number of males and females attending leks must be quantified in order to estimate a population. Fairly continuous habitats may make it difficult to define a "population" or "sub-population". All leks within a complex have not been checked on the same mornings to account for day-to-day dispersal of birds across an area. Not all leks used by a "population" have been located. Survey effort and number of leks surveyed has varied over time. The same leks have not been surveyed in every year. Lek sites have moved over time, thus some leks were not surveyed. Population parameters (survival and reproduction) specific to the BHBCA are not known, but may be similar to areas where sage-grouse research has documented those parameters.

Leks. Since the late 1990's, data on numbers of sage-grouse attending leks have been collected in two ways: lek surveys and lek counts (Appendix A). Lek **surveys** were defined as at least one visit to a lek during the breeding season (mid March-mid May) to determine if the lek was active. Lek **counts** consisted of three or more visits to a lek (separated by about 7-10 days) during the peak of strutting activity (early April-early May) to obtain the maximum number of males in attendance. Peak male attendance usually occurs after peak breeding and female attendance. The procedure for conducting more intensive lek counts was established in 1998 and, until recently, few leks had been monitored enough to qualify as "counted". The majority of the data collected were lek surveys. Lek survey data has been collected in the BHBCA since 1958.

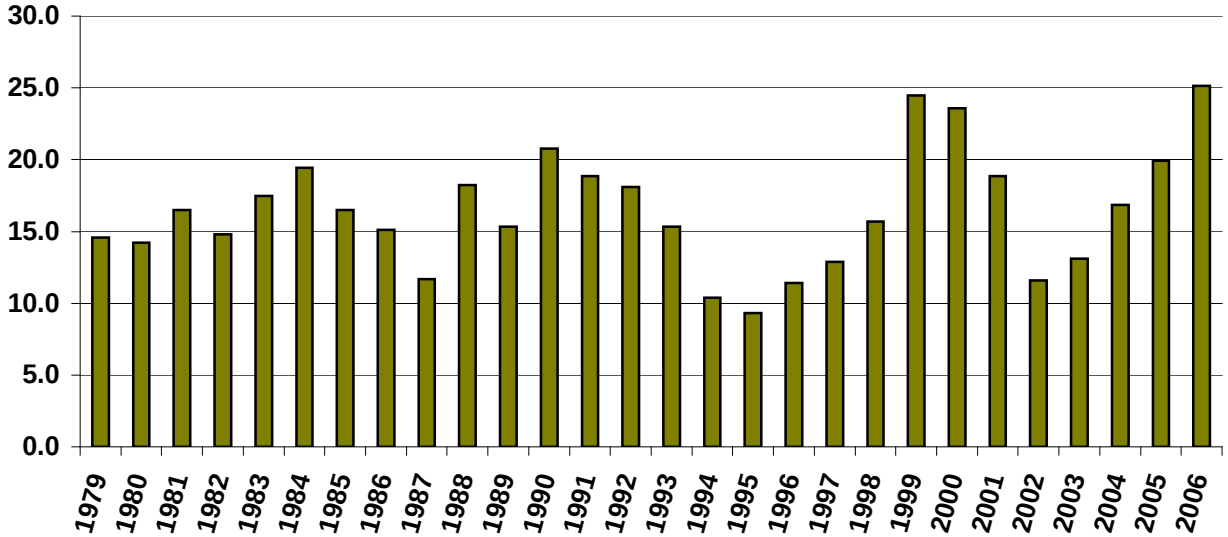
Average male attendance at leks has fluctuated since 1958 with a slight downward trend (Fig. 14). Average male attendance was calculated using only those leks where one or more males were present (active leks). If a lek was visited more than once during a year, only the maximum number of males observed at that lek was used to calculate annual averages. Sage-grouse in the BHBCA appear to follow cyclic population fluctuations about every ten years. Low number of males typically occurred during the middle of a decade (1965-66, 1974-75, 1994-97). Drought during the early part of the current decade (2000) may have resulted in population lows earlier than "normal" (2002-03) and slight recovery from drought beginning in 2004 has allowed grouse numbers to rebound.

Figure 14. Average maximum number of males per active lek, number of leks used to calculate the average in each year (red), and 10-year running average trend line for sage-grouse in the Big Horn Basin Conservation Area, 1958-2006.



Using only males/lek data calculated from more than 25 leks (after 1979), it may not be possible to detect trends in sage-grouse numbers in the BHBCA (Fig. 15). Data on males/lek are insufficient to adequately evaluate trends. Problems with data collection, mentioned above, also complicate reliable data analysis.

Figure 15. Average maximum number of males per active lek for sage-grouse in the Big Horn Basin Conservation Area, 1979-2006.



Broods. Brood surveys and seasonal distribution surveys were conducted sporadically during July and August between 1962-2006 (Table 4). Since 2000, brood surveys have been included on work schedules for WGFD (Cody region) personnel, resulting in more effort to locate sage-grouse during this period. Brood surveys usually consisted of a person (with or without dogs) walking or driving in areas thought to be occupied by sage-grouse, however, no consistent methodology was established. Incidental observations of sage-grouse broods were also included in the analysis. Data on the number of chicks, adult hens, and adult males were collected. Locations and habitat type were also recorded to help delineate brood rearing areas.

On average, there were 3.5 chicks per hen and 4.3 chicks per brood observed (Table 3) in the BHBCA. Most brood data were based on small samples (<25 groups) and may not be an accurate representation of actual conditions. Classifying grouse to sex and age class is often difficult in dense cover or when birds are flying away. Few broods were observed in any one management area; so all observations for the entire Bighorn Basin were combined in calculations of brood size. When evaluated by date, no trend was apparent in chick mortality over summer (e.g., larger brood size early in summer and small broods late in summer), so all observations over a summer were

Table 3. Sage-grouse brood survey data collected in the Bighorn Basin, 1962-1999.

Year	Location	Young	Adult hens	Broods	Young /hen	Young /brood
1962	Basin-wide	36	10		3.6	
1963	Basin-wide	127	32		4.0	
1964	Basin-wide	165	39		4.2	
1965	Basin-wide	138	31		4.5	
1966	Basin-wide				5.2	
1968	Basin-wide	63	11		5.7	
1970	Basin-wide	77	17		4.5	
1976	Washakie and Hot Springs	39		10		3.9
1977	Washakie and Hot Springs	36		10		3.6
1978	Washakie and Hot Springs	34		12		2.8
1979	north Big Horn Co.			10		4.3
1979	Thermopolis					2.9
1980	Little Mtn and Medicine Lodge			13		3.3
1980	Thermopolis					4.0
1981	Thermopolis			14		6.2
1981	Little Mountain			15		4.4
1996	Basin-wide	44	12	8	3.7	6.3
1997	Basin-wide	52	10	8	5.2	6.3
1998	Basin-wide	15	5	3	3.0	5.0
1999	Basin-wide	83	48	19	1.7	4.4
2000	Basin-wide	85	32	25	2.7	4.3
2001	Basin-wide	51	24	14	2.1	3.6
2002	Basin-wide	35	16	10	2.2	3.5
2003	Basin-wide	103	30	24	3.4	4.3
2004	Basin-wide	71	73	17	1.0	4.2
2005	Basin-wide	123	41	23	3.0	5.3
Average					3.5	4.3

combined to calculate annual values. The raw data before 1996 were not always available in the same format, so it was not always possible to calculate chicks/hen or chicks/brood.

Most broods were observed in sagebrush or agricultural lands. Alfalfa was the most frequently used crop. These habitats contain abundant forbs and insects. Sagebrush should be retained near fields for escape and thermal cover.

Harvest. Data on harvest levels are probably the most reliable, long-term data available on sage-grouse in the BHBCA (Appendix B). Harvest information (number of hunters, number of birds harvested and number of days spent hunting sage-grouse) was obtained through a mail questionnaire of bird hunters. Prior to 1982, harvest data was compiled by county, and after 1982, by Upland Game Management Areas. Management Areas completely within the BHBCA include Areas 11, 12, 15, 16, 17, 19, 20, and 21. Only portions of Management Areas 37 and 40 are within the Bighorn Basin. Few sage-grouse are harvested from the east side of Area 37 or the west side of Area 40. Harvest data for Areas 37 and 40 have been included in the Northeast LWG Conservation Plan and are not included here. Harvest levels within the BHBCA are not complete without including number of birds harvested from that portion of Area 37 in the BHBCA.

Hunter numbers and effort generally reflect population levels. When grouse are plentiful, more people hunt for sage-grouse and spend more time hunting. However, due to varied hunting season regulations (i.e., season dates, length of season), a direct relationship between hunter numbers and grouse populations cannot be determined. Average (10-year) sage-grouse harvest in the BHBCA has steadily declined since the early 1980s (Fig. 16). Over the last fifty years, sage-grouse harvest has ranged from a high of 8,535 birds in 1977 to a low of 365 birds in 2003. Hunting seasons have recently changed (Appendix B), which may have had a greater influence on hunter participation than grouse population levels. When more conservative season dates and bag/possession limits were enacted in 1995, harvest, hunter participation (Fig. 17) and time spent hunting (Fig. 18) dramatically declined. Figure 10 indicated that average males/lek recently increased in 1999-00, which corresponded to an increase in harvest and hunter participation. Similarly, males/lek again increased in 2005 and ‘06. Both number of grouse harvested and hunter numbers also increased in 2005.

Figure 16. Number of sage-grouse harvested in the Big Horn Basin Conservation Area, 1956-2006.

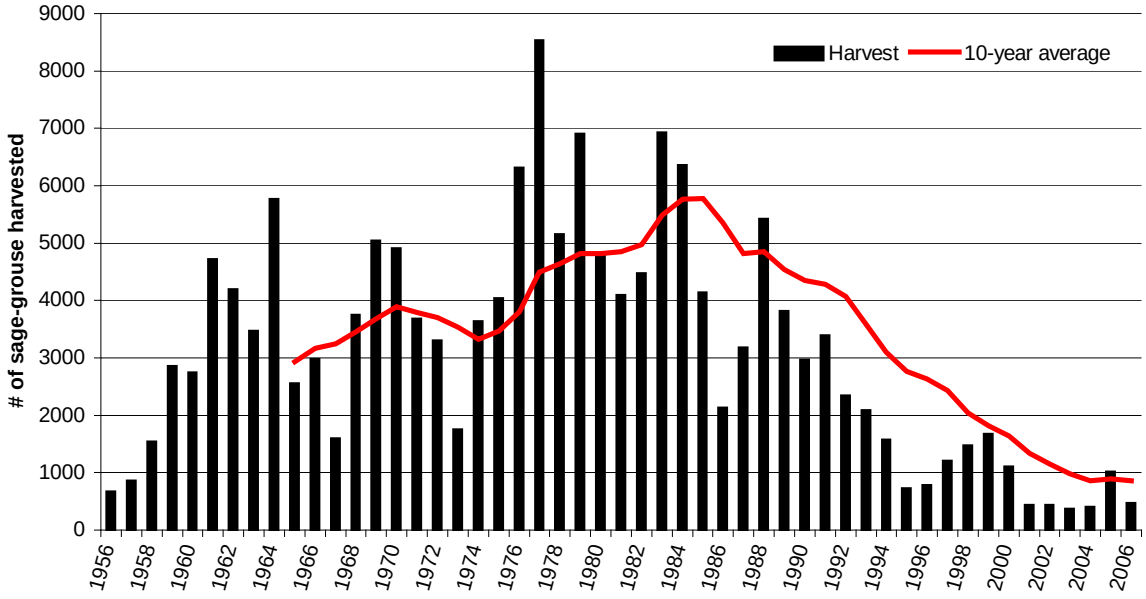


Figure 17. Number of sage-grouse hunters in the Big Horn Basin Conservation Area, 1966-2006.

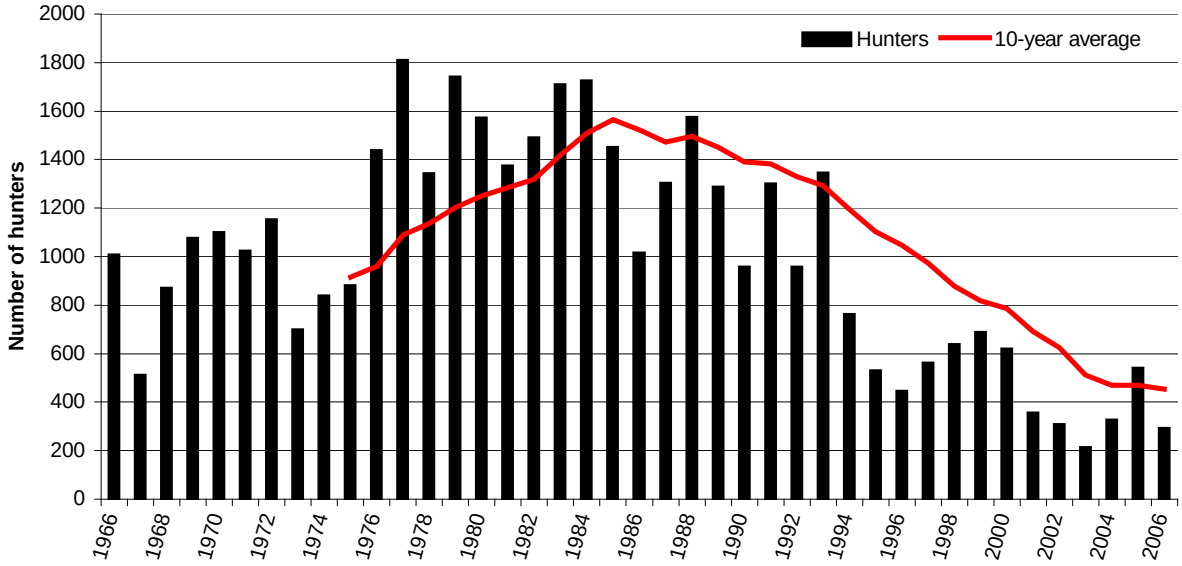
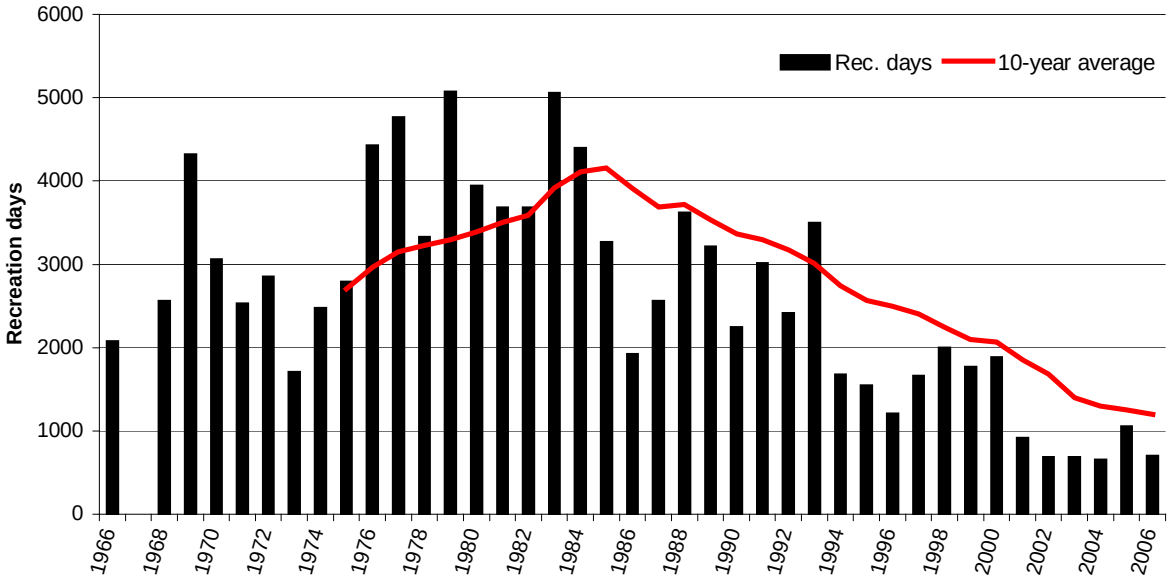
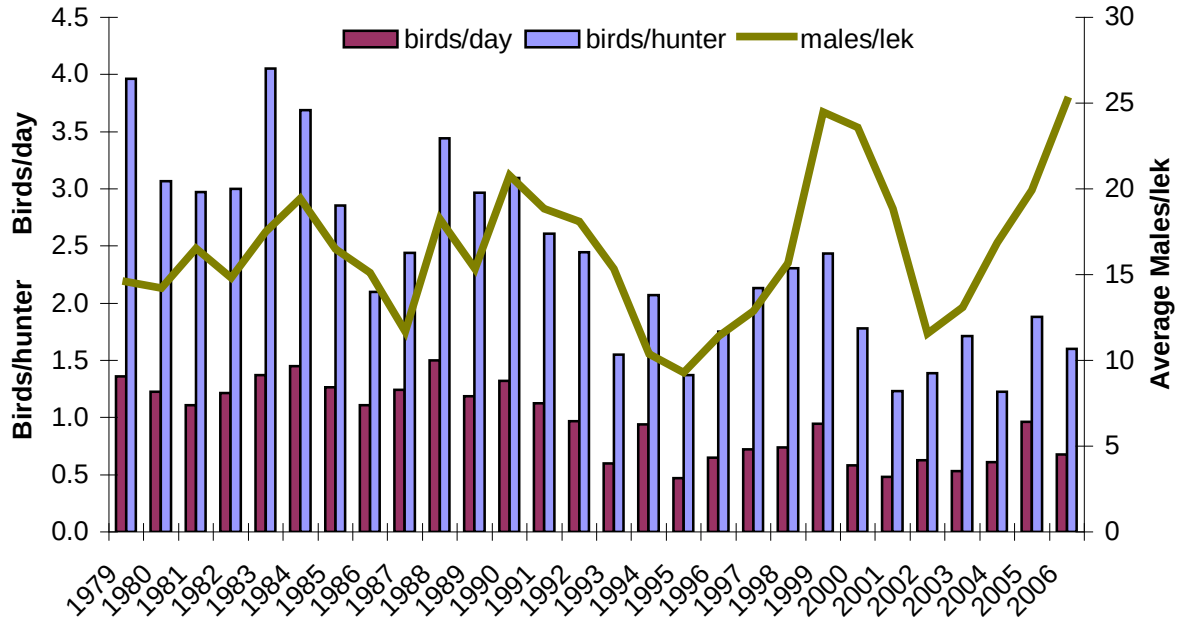


Figure 18. Recreation days spent hunting for sage-grouse in the Big Horn Basin Conservation Area, 1966-2006.



Relationships between birds/day, birds/hunter and average males/lek may indicate short-term trends in sage-grouse populations (Fig.19). Those values indicate a possible decline in sage-grouse populations in the BHBCA from 1990-95; a slight population recovery from 1995 to 2000; followed by another decline between 2001 and 2004. All indices suggest increasing populations since 2004.

Figure 19. Sage-grouse harvest data and average males per lek for the Big Horn Basin Conservation Area, 1966-2006.



Population trend summary

The sage-grouse population in the BHBCA appears fairly stable over the past 30 years. During that period, there have been human activities and natural forces that have affected this population. The degree to which sage-grouse populations were affected by these factors has varied. Sage-grouse evolved with natural factors (e.g., weather), with populations fluctuating as conditions fluctuated. Human activities may have supplanted, fragmented, degraded, and/or enhanced sage-grouse habitat within the BHBCA. The amount of habitat alteration cannot be quantified, except, possibly by those activities that have occurred within the past 50 or so years. Specific impacts to the sage-grouse population caused by past human activities may never be quantified.

Factors Affecting Sage-grouse Populations and Habitats

The WSWG identified factors that could potentially affect sage-grouse populations and habitats. Those factors included: conflicting wildlife and wild horse management, farming, hunting, invasive plants, livestock grazing, mineral development, parasites and diseases, pesticides, predation, recreation, residential development, vegetation management and weather. Sage-grouse may be influenced by several of these factors, both individually and cumulatively. These factors were presented and described in the State-wide Plan.

The BHBLWG reviewed these potential factors in the State-wide Plan to determine which may be most relevant to sage-grouse populations and habitats in the Big Horn Basin. After thorough discussion of factors affecting sage-grouse populations in the Basin, the BHBLWG ranked those factors to establish priorities. Since no research or in-depth monitoring has been done to determine limiting factors in the Basin, the initial ranking of factors was subjective, based on the personal and professional observations of individual working group members. BHBLWG felt that sage-grouse populations could be most affected by (in order of initial ranking): predation, weather, livestock grazing, vegetation management, mineral development, invasive plants, parasites and diseases, residential development, recreation, conflicting wildlife management goals, conflicting wild horse management, farming and hunting. Descriptions of these factors, adapted from the State-wide Plan, are discussed below with additional information specific to the BHBCA. These factors, regardless of initial ranking, led to formulation of goals and objectives, which were ranked independently of factor rankings.

Predation

Impacts of predation are greatest during nesting and early brood rearing. Research projects in Wyoming have identified several predators of sage-grouse nests including badgers, red foxes, ravens and ground squirrels. In addition, golden eagles, coyotes, various hawks, bobcats, feral cats, striped skunks, raccoons and weasels may prey on sage-grouse throughout the year.

The predator-prey relationships that evolved between sage-grouse and native predators have been influenced by human activities. These activities have led to a change in the number, distribution, and type of predators that prey on sage-grouse. “Newcomer” predators, such as red fox, raccoons and feral cats, have expanded their range into sage-grouse habitats and may represent an additive source of predation where they were not previously a factor. As habitats are altered, and/or where predators have increased, in number or in type, impacts of predation may be magnified.

In some areas, newcomer and traditional sage-grouse predators have increased in numbers due to human activities. When prey species are difficult to find/capture, predators turn to scavenging. Landfills, dumpsters and litter along roadways provide supplemental foods. Better highways lead to higher vehicle speeds and increased

numbers of road-killed animals, which may also supplement a predator's diet. Expanding rural subdivisions often bring domestic cats and dogs into sage-grouse habitat. Powerlines and buildings, associated with subdivisions and energy developments, may serve as raptor perches where none previously existed.

In some circumstances, predators may be a major cause of sage-grouse mortality. Where predation is demonstrated to be of significant concern, site-specific predator management may be warranted. In 2006, the WGF Commission formally adopted the "Predatory Animal and Predacious Bird Management Recommendations for the Benefit of Wildlife". These recommendations direct the WGFD to consider lethal take of predatory animals to increase recruitment and/or survival of sage-grouse if male lek attendance within the area of interest is declining. For other upland game bird species, it must be determined (through literature review, monitoring or specific studies) that predator populations are having a significant impact on prey species. For sage-grouse and other upland game birds, predator control efforts are to be focused on red fox, skunk, and raccoon. Large-scale predator removal was not included as a statewide or local objective.

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. Lethal predator control to increase production and recruitment of game bird populations has only been shown to be effective on small, intensively managed areas with long-term control efforts. Most predator control efforts do not remove all predators, especially non-target predators such as snakes, ravens, and ground squirrels. Predator control can also create vacant habitat for new predators (both target and non-target species) to move in. It is also important to identify potential unintended consequences of predator control as it relates to sage-grouse. For example, removing coyotes may allow red fox numbers to increase. Fox are a more efficient predator of sage-grouse than coyotes. As with many issues surrounding sage-grouse management, predator-prey relationships are complex and difficult to quantify.

Sage-grouse in the Big Horn Basin potentially face predation pressures from many sources. Large numbers of hawks and eagles migrate to the Basin during winter. Raven and crow populations have been increasing. Even though red fox and raccoon had not occurred in the Basin historically, populations of these newcomer species are now well established. Human populations, and associated developments, have also been increasing. Predator populations in the Basin are probably increasing due to those human activities mentioned above.

Mortality rates of sage-grouse in the Basin due to predation are not known. It should be assumed that if those predator species are present, they are potentially preying upon sage-grouse. It is not known if predation is suppressing any sage-grouse sub-populations across the Basin. If adequate quantities of quality habitat are provided, predators should have minimal impacts on sage-grouse populations, therefore habitat management received our primary emphasis.

Weather

Long-term climate, multi-year weather trends, annual weather patterns and daily weather events can all influence sage-grouse populations by physically stressing them and by modifying their habitats. Climatic cycles affect growing season length, plant succession and the quantity and quality of herbaceous vegetation. Long-term or extreme drought can cause changes in vegetation communities that decrease the effectiveness of sage-grouse habitats for long periods. Conversely, above normal precipitation can enhance cover and forage used by sage-grouse. Climatic cycles occur on large geographic scale and may influence sage-grouse populations at a regional level. Sage-grouse evolved with variable weather and long-term climatic change and have survived multiple ice ages and droughts. Drought has been the most recent climatic factor potentially affecting sage-grouse.

Annual variations in weather can affect annual sage-grouse production. Precipitation and temperature can be the most important influences on sage-grouse populations. Timing of precipitation events can also have a significant influence on sage-grouse populations and habitats. Cold, wet weather during early brood rearing can physically stress and kill chicks. Insect populations can also be adversely affected by cool, wet weather. Wet springs, however, are advantageous for promoting herbaceous growth, especially forbs. Extremely hot, dry conditions during the early summer concentrate sage-grouse on the few riparian areas that remain wet. In general, wet years are good for sage-grouse production and dry years can inhibit production.

Although sage-grouse have evolved with climatic fluctuations, weather remains a significant factor in determining the status and well being of the population. Weather can have positive or negative affects on sage-grouse populations. Wildlife managers must understand these effects in order to correctly assess the extent to which weather is limiting a population or contributing to a decline. Effects of long-term climate and short-term weather variations on sage-grouse populations must be considered when management practices for sage-grouse are selected.

The large area and geographical variability of the BHBCA produce considerable variation in climatic conditions. Day-to-day weather events may occur in one part of the Basin and completely miss other parts. Temperature inversions during winter can leave the eastern portion of the Basin at -30^{o} while Chinook winds on the western sections push temperatures above freezing. Daily temperature across the Basin can also vary by 20^{o} or more due to differences in elevation. Rain and snow showers are usually isolated, often dropping more moisture in some areas and none in others.

Mortality rates of sage-grouse in the Basin due to weather are not known. It is not known if short-term weather events have suppressed sage-grouse across the Basin, however, hard winters (e.g., 1978-79) and extended drought (2000-06) are believed to have decreased grouse numbers. There is little that can be done to change the weather. Providing sufficient quantities and quality of habitats should lessen impacts of weather on grouse populations.

Livestock Grazing Management

The sagebrush ecosystem evolved with grazing by a variety of wildlife species. The timing, duration, location, and intensity of that grazing are not known. Domestic livestock were added to the mix of migrating, free-ranging wildlife species in the mid and late 1800's. Since that time, there have been changes in terms of class of livestock, season of use, duration, numbers of herbivores (large and small, domestic and wild) and grazing management systems.

A healthy sagebrush community provides diverse age and vegetation seral stage classes necessary to sustain and increase sage-grouse populations and also provide for other wildlife and multiple uses, including livestock grazing. Grazing 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. Ecosystems that do not provide this diversity need long-term management strategies to allow recovery.

Positive and negative affects of livestock on sage-grouse habitats can vary with grazing management systems. Water developed in arid areas provides water to sage-grouse and other wildlife, and also allows for dispersal of grazing animals over a larger area. However, water developments allow for grazing of forage during a season when, historically, an area would not have been occupied by large ungulates. Short-duration grazing in late spring and early summer may improve both quantity and quality of summer forage (forbs) for sage-grouse. Conversely, long-term continuous use by livestock, and/or wild ungulates, may not leave suitable residual cover for nesting. Continuous grazing pressure may also affect the site potential of riparian areas. Improper grazing may cause a reduction of forb diversity and forb-associated insects. Conversion of sagebrush to grasslands for grazing has also had detrimental effects on sage-grouse populations. There is little direct experimental evidence, however, to assess affects of specific livestock grazing practices on sage-grouse populations.

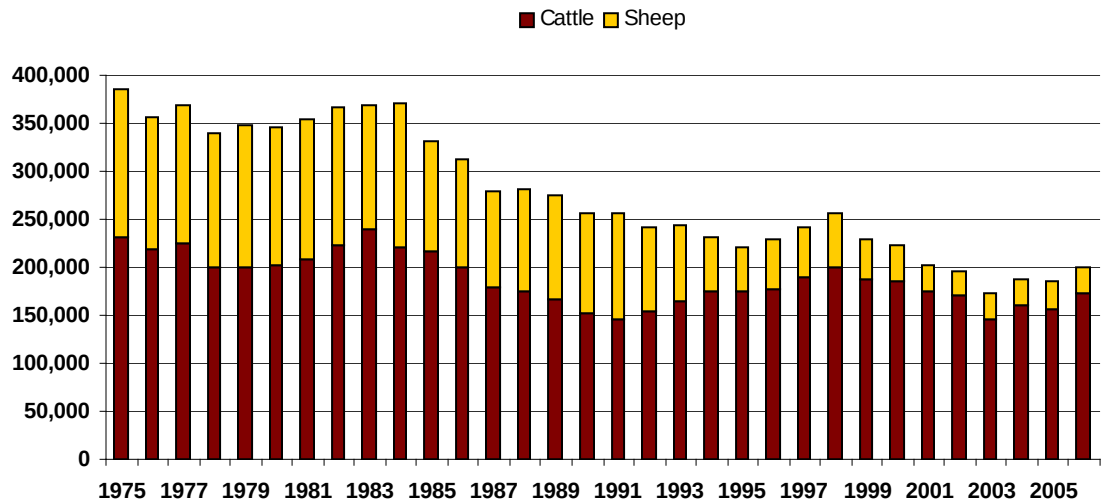
Research has shown that residual forage remaining from the prior year's growing season contributes to sage-grouse nest success. In general, dense residual grasses (at least as tall as the bottom of the canopy on mid-height sagebrush plants) at nesting sites appear to positively influence hatching success. Spring precipitation and grazing determine the amount of forage remaining available for nest concealment.

Past approaches to grazing management included broad-scale prescriptions to achieve combined (wildlife and livestock) growing season grazing of 30-50% of current year's herbaceous growth, or dormant season grazing of up to 60%. Monitoring of grazing was done in established key use areas. Grazing at levels described above was designed to result in adequate residual vegetation for other ecological needs (i.e., watershed, plant health and wildlife). Adaptive management of livestock grazing currently provides more appropriate and flexible prescriptions than strictly using percentage-based guidelines.

Adaptive management methods may provide for more appropriate prescriptions based upon site-specific goals and potentials. The Field Office Technical Guide (FOTG), published by the NRCS, can be used to assess the Ecological Site Description (ESD) for an area. Range surveys are generally needed to assess the current ecological condition of the area. State-and-Transition Models, within FOTG, list potential plant communities for an area and provide possible management options (transitions) on how to move an area from current conditions to a desired plant community. Management options can then be implemented using a variety of recommended management practices (RMPs) to achieve optimal habitat conditions for various life-stages of sage-grouse. Livestock management is one tool that can be used to achieve a desired plant community. Many RMPs for livestock grazing are, or soon will be, available to assist managers in transitioning an area from current condition to the desired plant community. The Adaptive Management section (page 58) provides a more detailed use of the FOTG to achieve a desired plant community.

Cattle and sheep are the primary livestock species in the BHBCA. Most ranching operations include federal and/or state grazing leases. Privately owned mountain pastures or National Forest grazing allotments are typically used during summer months while private and BLM lands at lower elevations serve as winter and spring ranges. Wintering herds forage on native range or hay fields, and most are supplemented with hay. There has been a decrease in overall number of livestock in the Basin since the mid-1970s (Fig. 20). Cattle numbers have declined approximately 23% over the past 30 years. Numbers of domestic sheep have gone from over 150,000 to less than 30,000 due to increasing costs of raising sheep and decreasing markets for wool. Agricultural economics, including commitments to lending institutions, are a contributing factor that ranchers consider when formulating stocking rates and grazing programs.

Figure 20. Livestock numbers in the Big Horn Basin, 1975-2006



Vegetation Management

Sage-grouse are sagebrush obligates, meaning that they rely on sagebrush to exist. Sage-grouse evolved with dynamic and diverse sagebrush landscapes. Historic sagebrush communities occurred in tracts occupying hundreds or thousands of acres. Evidence suggests that these sagebrush communities were a mosaic of successional age-classes with forb and grass understories.

Patchy fires appear to have been the norm in most sagebrush communities. Larger fires at lower frequencies occurred in some areas. Fire cycles ranged in frequency from 25 to over 100 years depending on the ecological site, climate, topography and plant composition. With European settlement of western North America came fire suppression. Fire suppression has simplified community diversity and allowed stands of sagebrush to become dense with old-aged plants and reduced herbaceous understories. Dense, monotypic sagebrush communities do not provide all of the habitat components needed by sage-grouse. Juniper and other conifer species have also invaded sagebrush communities due to fire suppression.

Old, dense stands of sagebrush and juniper/conifer areas may need some type of management to improve sage-grouse habitats. Sage-grouse benefit from a mixed landscape with sagebrush of different ages and structures. Vegetation treatments promote forb growth and also influence the abundance and diversity of insects in sagebrush habitats. Use of vegetative treatments requires planning and understanding of the sagebrush ecosystem so that sufficient stands of desirable sagebrush remain. Vegetation responses to treatments in sagebrush communities depend upon sagebrush species; type, amount and condition of vegetation present pre-treatment; type, size and timing of treatment; weather conditions before and after treatment; and post-treatment management of grazing animals. Habitat conditions must be monitored and treatments should only be proposed if warranted by range condition.

Vegetation management can be achieved through biological, mechanical, or chemical treatments. Biological treatments include prescribed fire, managed domestic livestock grazing and insect pathogens. Chemical treatments to manipulate, control, enhance or remove sagebrush include a variety of herbicides and fertilizer. Mechanical brush control treatments in sagebrush systems include mowing, roto-beating, chaining, disking, roller harrowing, railing, and blading. Reseeding and planting grasses and shrubs are also common practices. Burning and mowing are currently used more than other methods of sagebrush management. Generally, the treatment selected should be that which is least disruptive to the vegetation community and has the most rapid recovery time. This selection should not solely be based on economics.

The FOTG, published by the NRCS, can be used to determine if vegetation management may be required in an area. FOTG can provide the ESD for an area. Range surveys are also needed to assess the current ecological condition of the area. State-and-Transition Models, within FOTG, list potential plant communities for an area and provide possible management options (transitions) on how to move an area from

current conditions to a desired plant community. Management options can then be implemented using a variety of RMPs to achieve optimal habitat conditions for various life-stages of sage-grouse. Different vegetation treatments can result in different desired plant communities and/or different seral stages. The section on Adaptive Management (page 58) provides a more detailed use of the FOTG to achieve a desired plant community. Some RMPs for vegetation treatments are also provided (page 64).

"Management" of sagebrush communities does not include complete eradication of sagebrush and conversion to grassland or cultivated crops, as has occurred across much of the sage-grouse's former range. Removal of large tracts of sagebrush is detrimental to sage-grouse populations. Areas of extensive treatment can no longer support sage-grouse until sagebrush returns to the site. Some birds may be able to adjust by moving to adjacent sagebrush stands. However, sage-grouse hens show fidelity for nesting in the same general area. If brush is completely removed from that area, nests will probably not be successful. Research in Wyoming and Utah found that sage-grouse will avoid areas further than 200 feet of an edge separating burned and unburned areas. Treatments should result in a mosaic of various habitats across a landscape and not large blocks void of sagebrush.

Catastrophic wild fires have resulted in the loss of thousands of acres of sagebrush. To address wild fire on a national level, the National Fire Plan mandated reductions in hazardous fuels to decrease the likelihood of large fires. Fuels reduction projects could contribute to the fragmentation of sagebrush habitats. However, loss of habitat due to wild fire could be more devastating. Fire suppression should continue in fragmented sagebrush habitats. Large areas burned by wild fire should be evaluated to determine if rehabilitation (e.g., seeding, weed control) is necessary. Fuels reduction projects should be designed to enhance and restore habitats for sage-grouse.

Sage-grouse in the BHBCA are dependent upon sagebrush and the close association between sage-grouse and sagebrush is reflected by locations of leks in the Basin (Fig. 12). Sagebrush treatments have occurred in the BHBCA to improve herbaceous forage for livestock and/or elk. Many of these treatments may not have been beneficial to sage-grouse, but no monitoring was conducted following treatments. Recently, more treatments have been proposed and conducted to rejuvenate sagebrush specifically for sage-grouse. Unfortunately, there is no centralized database to document location, acreage, type, or results of treatments in the BHBCA. Additionally, there is no monitoring to determine how habitat treatments affected sage-grouse populations or habitats. Without this information, cumulative impacts of vegetation treatments (past and future) on sage-grouse cannot be assessed.

Energy and Mineral Development

The discovery and development of natural gas, oil, coal bed methane gas, coal, uranium, trona, bentonite, gypsum and construction materials throughout the western United States has impacted sagebrush 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. For example, according to the American Gas Association, natural gas consumption in the U.S. is expected to increase at least 40% by the year 2015, therefore impacts from these operations are expected to continue.

Impacts of mining and drilling/production operations on sage-grouse have not been quantified in the BHBCA. Construction of mines, well pads, roads and pipelines may cause direct loss and fragmentation of habitat. Indirect loss of habitat may result from increased human activity and increased noise, which will cause animals to avoid the area. The potential effects of noise on sage-grouse include masking sounds that influence courtship, mate selection, grouping and escape behavior. Roads built to accommodate exploration and development activities often result in the establishment of permanent travel routes, improved public access, increased long-term traffic, noise impacts and direct mortality. Research on the Pinedale Anticline suggested that road-related disturbances during the breeding season caused sage-grouse leks to become inactive over time, increased the distance hens moved from a disturbed lek to nesting habitat and reduced nest initiation by hens bred on disturbed leks. Dust from roads and other surface disturbances can adversely affect plants and animals. Disturbed lands are susceptible to weed infestations, such as cheatgrass. Transmission and power lines do not cause significant direct habitat loss, but sage-grouse tend to avoid areas near these lines (because they provide potential raptor perch sites), thus resulting in an indirect loss of habitat in the vicinity of overhead lines. Research into these subjects is continuing.

Some mining and drilling activities have less impacts, or even positive affects, on sage-grouse habitat. Installation of pipelines can occur in a relatively short time and could be installed during a non-critical period of the year. Pipelines and old roads or well pads can be seeded with beneficial species to increase habitat diversity. A by-product of some oil and gas production is water. Water of suitable quality can be put into a reservoir or streambed for access by grouse and other wildlife. Mining can create depressions in the ground to form wetlands or ponds. Other impacts may be long-term (30 years or more) and rehabilitation of impacted habitats may take many years to complete.

The various types of energy and mineral 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. The Wyoming Department of Environmental Quality-Land Quality Division (WDEQ/LQD) issues permits for most mines, quarries, and gravel pits. For federal minerals, such operations are also subject to BLM stipulations. For mining of private minerals, operations are subject to WDEQ/LQD regulations. Oil/gas drilling and production are regulated under BLM, WDEQ, and Wyoming Oil and Gas Conservation Commission jurisdiction, depending on mineral ownership and permits required for specific activities (e.g., discharge of produced water).

Mitigation of impacts caused by mining and drilling are required by state and federal regulations. Other impacts can be minimized through planning, off-site mitigation and/or reclamation for sage-grouse needs. In some situations, seasonal or timing restrictions may provide adequate protections for grouse. In other situations, no surface occupancy restrictions should be enforced. No single set of recommendations will work for all forms of mineral development, therefore, flexibility and a familiarity with the applicable and appropriate controlling regulations are necessary. The selection and implementation of RMPs to mitigate affects of mining or drilling on sage-grouse habitat may need to be approved by the surface management agency and/or state regulatory agency.

Oil and gas. Recently completed research in areas of intense drilling activity and high density of wells (Pinedale Anticline and Powder River Basin in Wyoming) documented negative impacts to sage-grouse populations from conventional and coalbed natural gas (CBNG) development. These studies showed that even minimal levels of development within two miles of leks negatively effected breeding behavior. Lek attendance was directly influenced by distance to wells, densities of wells, associated traffic volume, and distance to roads. Areas with active leks had one-third the density of wells, one-half the density of powerlines, and generally had fewer wells and powerlines within two miles of leks than inactive leks. Research suggested that gas field-related noise may have had negative impacts on breeding birds up to three miles down wind. Young females searching for nesting sites avoided gas fields with high well densities, as did brooding females. Researchers concluded existing stipulations were inadequate to maintain pre-disturbance sage-grouse breeding populations and suggested management of adjacent habitats to increase carrying capacity for grouse dispersing from nearby gas fields.

The Big Horn Basin has not experienced recent increases in exploration or production of oil, gas or CBNG as has occurred in northeast and southwest Wyoming. Well densities and drilling activity are much lower than in the Pinedale Anticline or Powder River Basin. Most of the oil and gas activity in the Basin has been within mature fields that were established in the early 1900s through the 1940s. Active fields already occur on most of the areas that are estimated to have high potential for production (Fig. 21). There are 95 producing oil and gas fields (2,787 wells) and ten non-producing fields in BHBCA. These fields account for approximately 28% of Wyoming's annual oil production and 1% annual gas production (based on 2005 production figures). Active wells and sites of high potential do not overlap greatly with current distribution of sage-grouse leks (Fig. 22). Future impacts of oil and gas development on sage-grouse in the Basin may be minimal unless technical advances in oil/gas recovery make production of marginal reserves more profitable.

Water is a by-product of oil extraction from many fields within the BHBCA. This "produced" water is discharged on the surface, extending the life of many intermittent streams. Produced water from oil field discharges provide a perennial water source for sage-grouse and other wildlife, particularly in the arid interior of the Basin where natural water sources are scarce. Sage-grouse have been observed using produced water

from oil fields. Produced water discharge creates riparian habitats and is also used to irrigate alfalfa fields. Grouse in the Hamilton Dome and Cottonwood Creek drainages rely on these areas for brood rearing habitats.

Figure 21. Producing oil and gas wells in the Big Horn Basin Conservation Area and future potential.

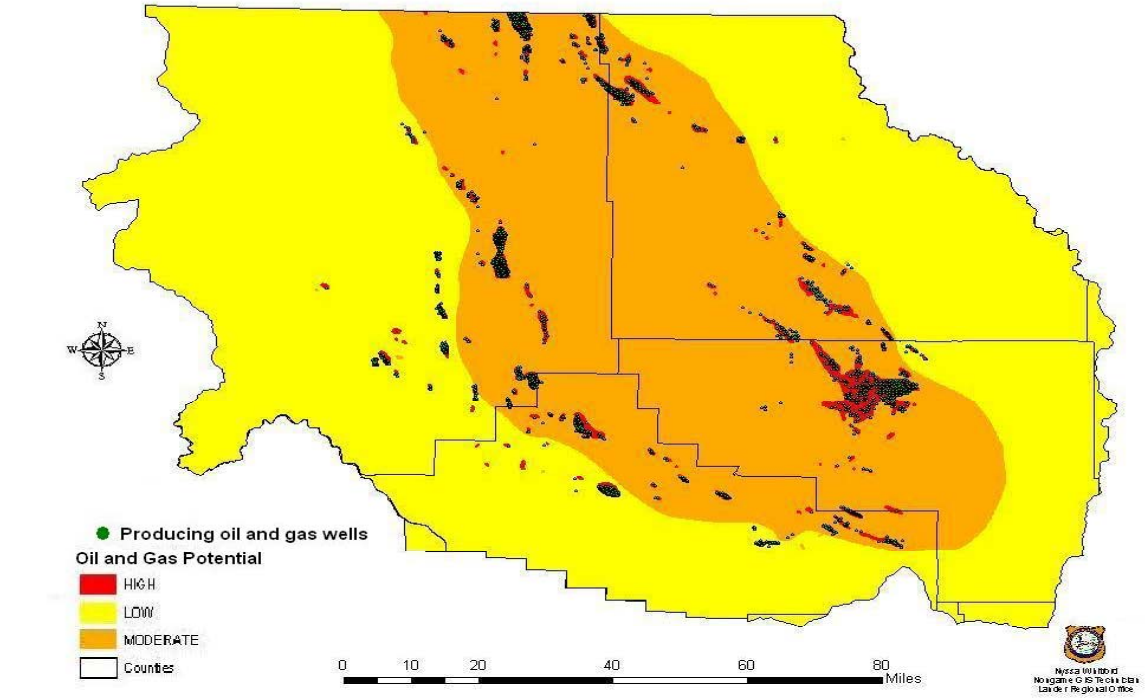
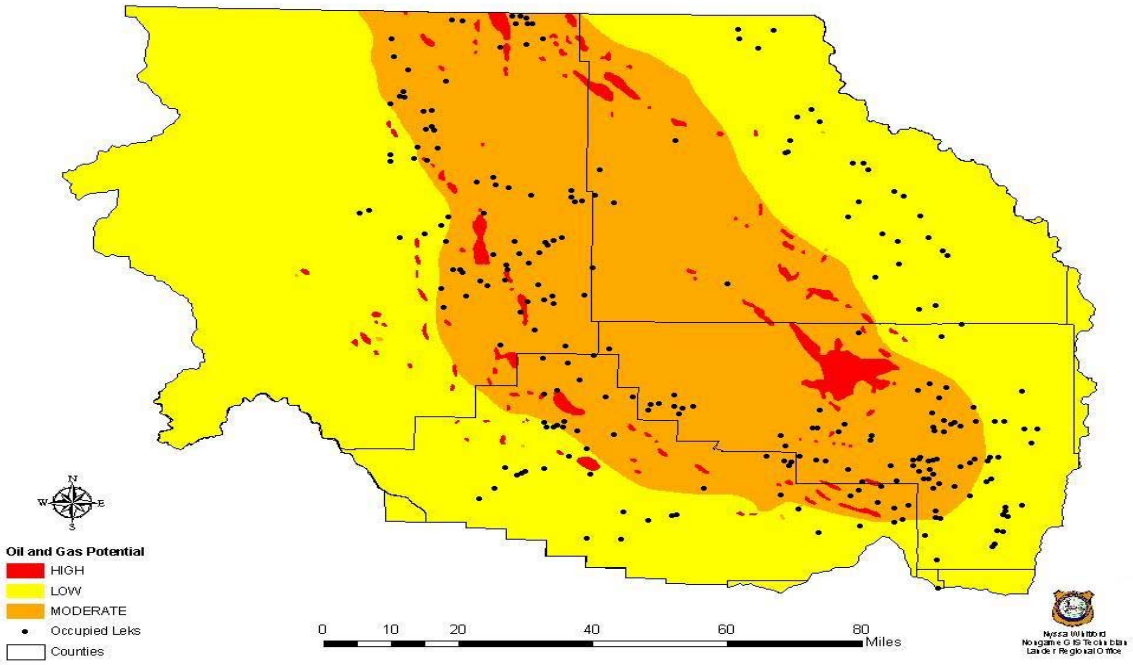


Figure 22. Sage-grouse leks and oil and gas potential within the Big Horn Basin Conservation area.



Wind power generation. There is little potential for wind power development in the BHBCA. Those few sites with most desirable wind conditions are not in sage-grouse habitat. Little research has been conducted to assess impacts of wind power generation on sage-grouse. Construction of wind turbines can result in direct loss and fragmentation of habitat and indirect loss of habitat since grouse avoid of tall structures (e.g., turbine, power poles). Noise from wind turbines could disrupt breeding behavior.

Mining. No research has been conducted to determine impacts of mining on sage-grouse in the BHBCA. Methods of mining may vary, but surface mining generally involves removal of all vegetation. Habitat loss and fragmentation can impact sage-grouse if large areas are impacted. Noise from heavy equipment and haul trucks probably has similar affects as described for oil/gas drilling. Disturbance levels vary by the size and duration of the mining activity, which depends on the quantity and quality of the mineral reserve. The duration of the mining process can vary from a few months to many years.

Long-term impacts to sage-grouse populations depend upon success of reclamation of disturbed sagebrush habitats. Sagebrush, however, may be difficult to grow even on undisturbed soils. Sagebrush establishment, in nature, is cyclic, and even under favorable conditions, success can be anticipated in only 1 of 5 years. Soils that did not previously contain sagebrush should not be expected to grow sagebrush after mining.

BHBCA contains deposits of coal, limestone (sand and gravel), uranium and bentonite that may be profitable to mine (Figs 23-24). There is an active coalmine near Grass Creek, northwest of Thermopolis. Other coal resources within the BHBCA have limited to no development potential due to depth and/or poor quality. Significant limestone deposits within the BHBCA are not typically located in sage-grouse habitat, however, some conflict between gravel extraction and grouse lekking has occurred. Uranium deposits in the BHBCA are small and if developed would probably have little impact to sage-grouse populations in the Basin. Sites with only moderate potential of these minerals are not worth mining with current technology. As economic conditions change, the development potential for these lower priority resources may increase.

Bentonite mining on a large scale in the Big Horn Basin began in the early 1950's and is a major economic industry in the Basin. Bentonite is mainly used for oil/gas drilling and cat litter, but is used in many other products. From the 1950's until the early 1970's bentonite mining occurred without oversight by governmental regulations ("pre-law mining"). In 1969 the Open Cut Land Reclamation Act was passed, which gave the State Land Commissioner rudimentary oversight of mining operations in the state. In 1973, the Wyoming Legislature enacted the Environmental Quality Act. Shortly after, the WDEQ was formed and given authority to oversee all mining in the state.

Figure 23. Coal development potential and sage-grouse leks within the Big Horn Basin Conservation Area.

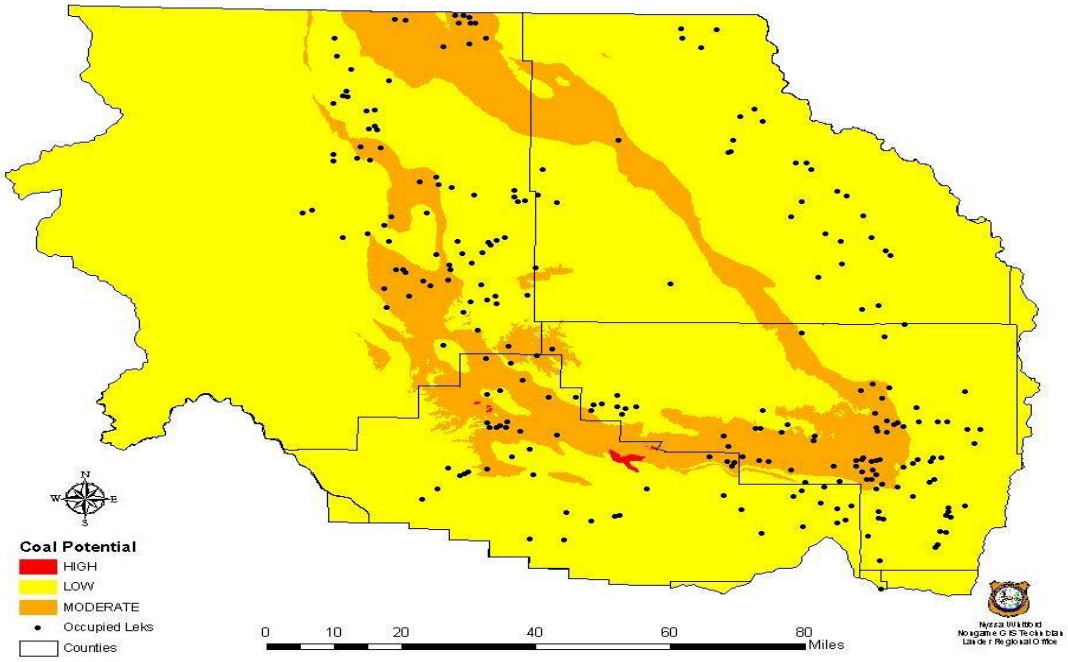
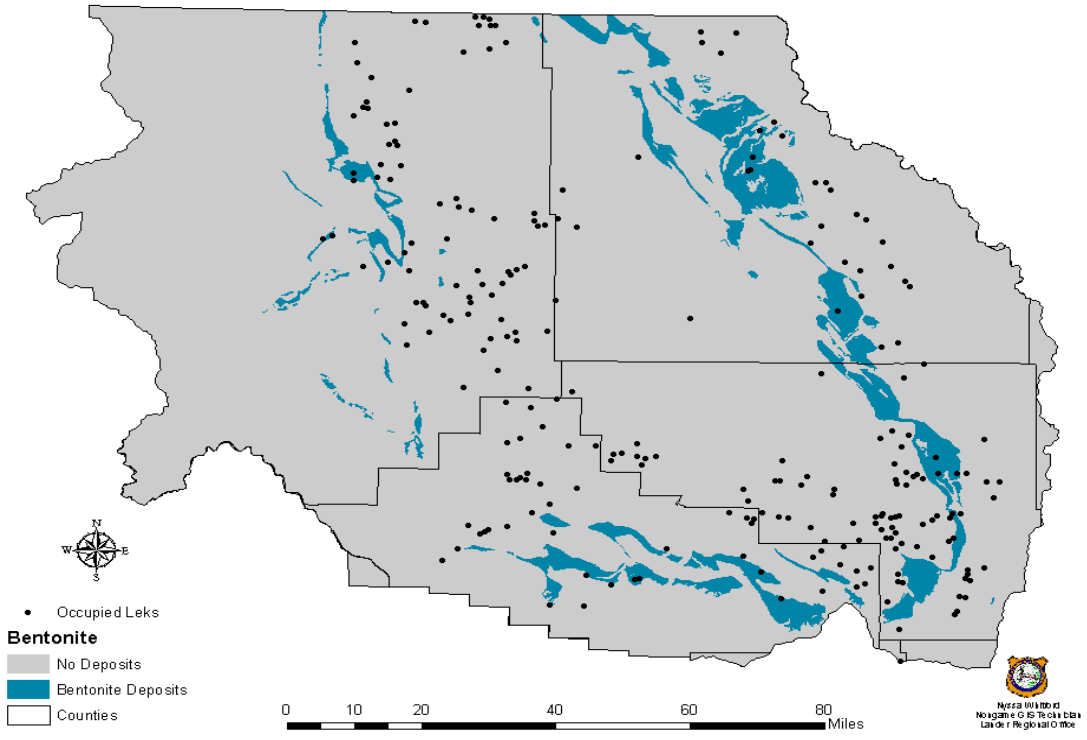


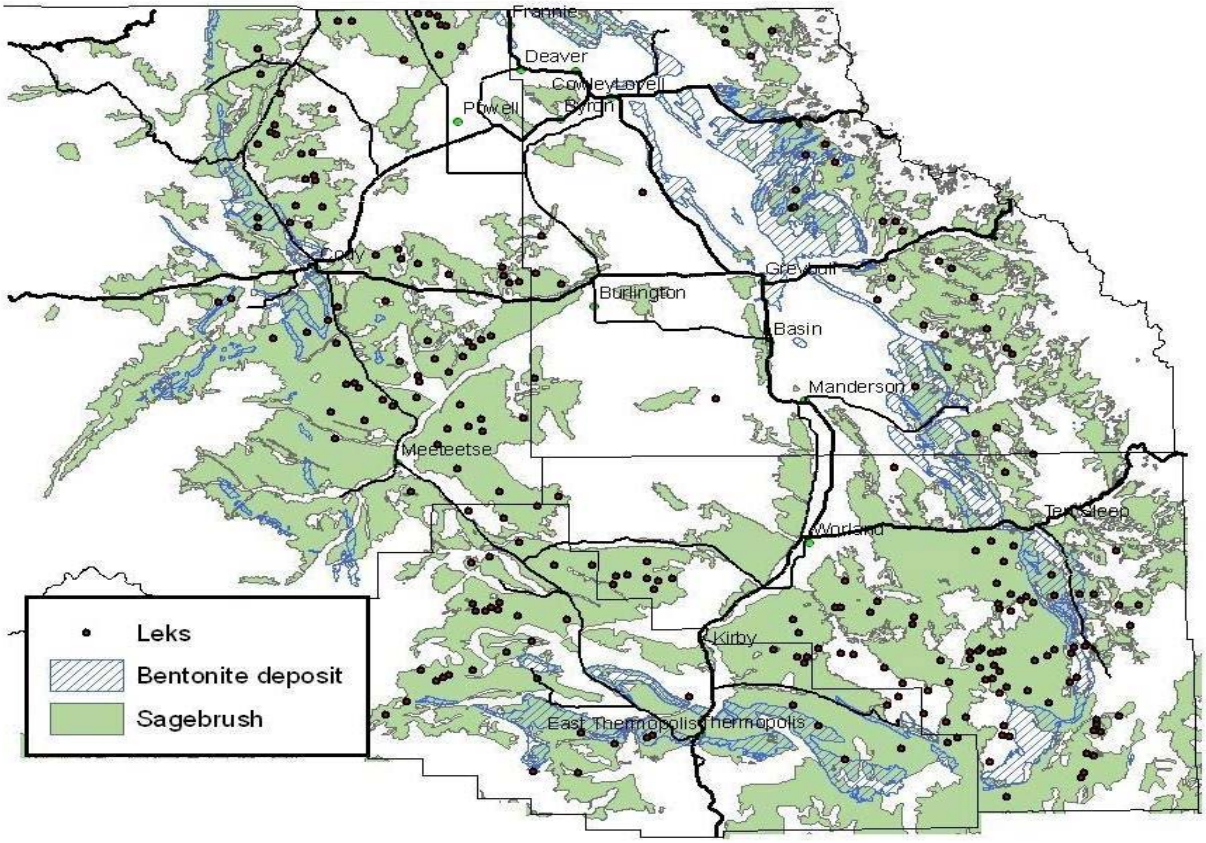
Figure 24. Bentonite deposits and sage-grouse leks within the Big Horn Basin Conservation Area.



Today, five companies mine bentonite in the Basin on federal, state, and private lands with governmental oversight by both the BLM and WDEQ-LQD. Based on annual reports from those companies to the WDEQ, beginning in 1969 to late 2005-early 2006, there has been a total of almost 16,000 acres disturbed by bentonite mining, with an average of 432 acres mined annually. Of that disturbance, approximately 10,800 acres were reclaimed through seeding, with varying levels of success. It would be difficult to determine a true total disturbance when pre-law mining is taken into consideration, as those disturbances were not reported.

Areas with bentonite generally feature sparse vegetation because of the physical characteristics of the soil. However, some bentonite deposits on the east and south sides of the BHBCA are covered with sagebrush habitats and are occupied by sage-grouse (Fig 25). Present and future bentonite mining could affect approximately 3,570 acres of sagebrush habitat in the BHBCA. Since bentonite mining occurs exclusively by strip-mining procedures, all habitats are temporarily removed. It is critical that companies use mining practices that produce the lowest amount of impact possible and reclamation techniques that produce the highest success possible, especially when mining near sage-grouse habitat. BHBLWG has compiled several Recommended Management Practices that may improve reclamation of mined areas (page 65).

Figure 25. Bentonite deposits, sagebrush habitat and sage-grouse leks within the Big Horn Basin Conservation Area.



Invasive Plants

Little information exists on the effects invasive plants have on sage-grouse populations. As more terrain is disturbed by human activities (e.g., mineral and energy exploration and development, housing subdivisions, uncontrolled pioneering of roads) and natural events (e.g., wildfires, erosion) the potential for significant negative impacts from invasive plants increases. Invasive plants from disturbed areas can spread to surrounding rangelands and riparian areas, replacing native vegetation in sagebrush communities.

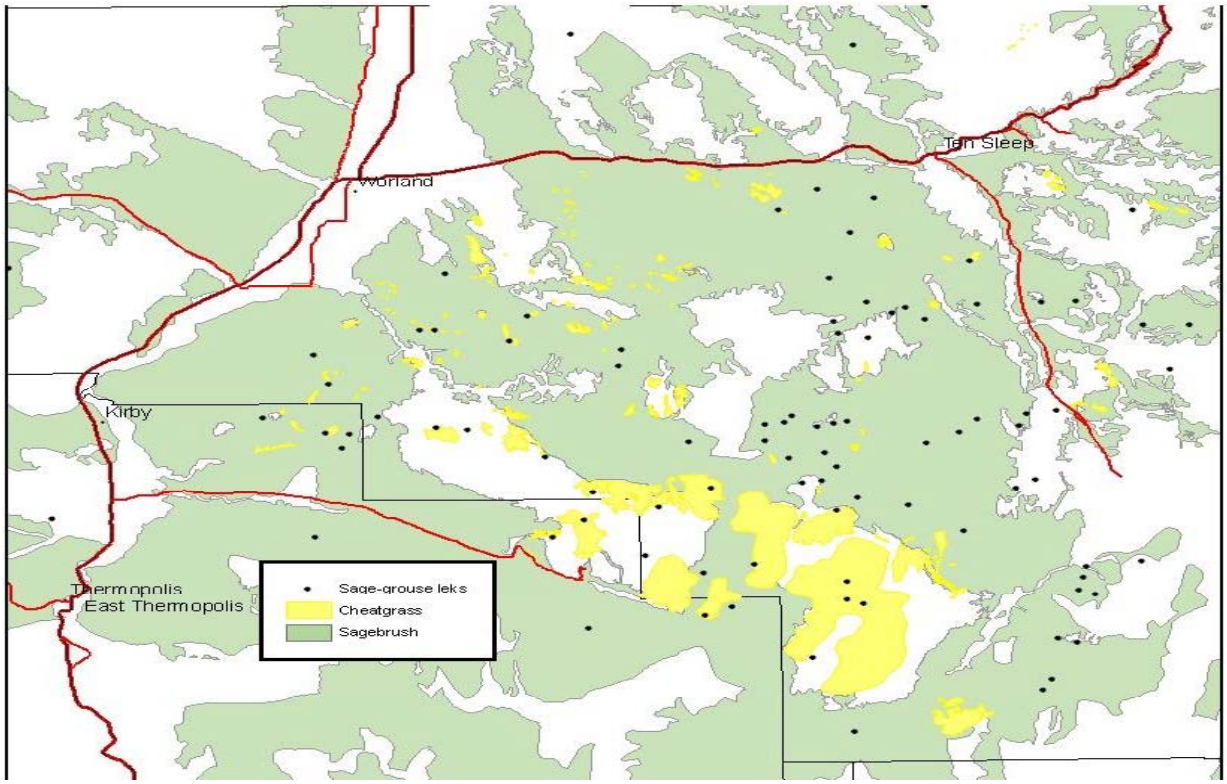
Preventing introduction of invasive species, treatment of pioneering plants, and reclamation practices favoring native plants are necessary to control the proliferation of undesirable plants. Simple steps such as washing of equipment before transportation or using certified weed-free hay and/or straw mulch can help minimize the spread of undesirable plants. Proper grazing can decrease the likelihood of invasive species becoming established. Mechanical, chemical, and biological treatments may be applied to control the spread of invasive plants and noxious weeds. Mechanical treatments such as repeated mowing or pulling can remove weeds from native rangelands. Chemical spot treatments can effectively control and prevent the spread of weeds. Chemical treatments should be conducted with caution to ensure the appropriate invasive plants are targeted while mortality of desired plants is minimized. There are specific insect predators that target specific plant species, however, this form of biological control is rarely 100% effective in controlling invasive plants. Managed grazing by particular classes of livestock and during periods of active weed growth can be used to control larger infestations. Regardless of treatment methods, education and cooperation among landowners, grazing permittees, and outdoor recreationists is essential to curb future proliferation of invasive species in native vegetative communities.

County Weed and Pest Districts have determined which species are most pervasive and possible methods of control. Various Coordinated Resource Management (CRM) groups have been formed within the Basin to identify areas for control of noxious weeds. Unfortunately, there is no region-wide comprehensive mapping effort to track occurrence and rates of spread. Most often, inadequate budgets limit a range-wide strategic approach to control invasive plants.

Primary species of concern in sage-grouse habitats are cheatgrass, Japanese brome, leafy spurge, hoary cress (whitetop), various knapweed species, toadflax, Canada thistle, burdock, Russian olive and salt cedar. Approximately 100,000 acres of sagebrush communities southeast of Worland that burned by wildfire have been infested with cheatgrass, thus replacing native forbs and grasses, and drastically accelerating the natural fire interval. Smaller cheatgrass infestations scattered throughout the BHBCA have the potential to spread and reduce sage-grouse habitats if not aggressively managed (Fig. 26). Dalmatian toadflax can be found along the South Fork Shoshone River. Salt cedar in riparian areas can increase soil salinity and outcompete native species for water. Salt cedar and Russian olive have replaced

cottonwood and willow along streams and reservoirs. Knapweeds and hoary cress outcompete many native riparian species. The degree to which invasive plants have affected sage-grouse in BHBCA are unknown. Inventory and mapping of cheatgrass and other invasive plants in the BHBCA was not complete as of 2006.

Figure 26. Current, known distribution of cheatgrass, sagebrush and sage-grouse leks in the southeast corner of the Big Horn Basin Conservation Area. Cheatgrass mapping was incomplete as of 2006. (Only large blocks of cheatgrass show up at this scale.)



Parasites and Diseases

Sage-grouse are known to harbor a number of parasites and diseases. Sage-grouse have evolved with most of those diseases and parasites, and most are not a serious threat unless birds are stressed. Diseases and parasites that affect sage-grouse include various bacteria, protozoa, worms, and ecto-parasites. Many of the common parasites and diseases carried by sage-grouse appear to be non-pathogenic, but may increase the vulnerability of infected birds to predation, starvation or other forms of mortality. Implications of diseases and parasites with respect to sage-grouse populations at a range-wide level are unknown. If sage-grouse come into contact with captive-raised birds released into the wild, there is also potential for diseases and parasites to become an issue.

Coccidiosis may cause mortality in sage-grouse, but is probably not a threat to populations. Coccidiosis is caused by a protozoan infection in the intestines of mainly young grouse. Birds that survive coccidiosis are immune to serious infection by the same species of protozoa in the future.

Effects of the newly emergent West Nile Virus (WNV) on sage-grouse are not fully understood at this time. WNV has been identified as a cause of significant mortality at a local scale. Mosquitoes are the primary vectors for WNV transmission. In 2003, WNV contributed to a 25% decline in the survival of marked sage-grouse across three study sites. Some evidence of survival by sage-grouse exposed to WNV was found in 2005. The full impact of this disease has yet to be understood and more research is needed to monitor grouse exposure and survival, identify species that serve as intermediate hosts, and identify options to mitigate the effects of the disease.

Urban Expansion and Residential Development

Little or no research is available directly addressing the effects of residential development on sage-grouse, although some effects may be predictable. Residential development can cause direct loss of lek sites and fragmentation of habitats. Unlike impacts from energy and mineral development, most impacts from residential development are permanent and will not be reclaimed. Careful consideration should be given to ways these effects can be managed and mitigated. County governments should recognize and address problems with unregulated housing developments. Developers must be willing to design subdivisions to mitigate impacts to wildlife habitats.

Research on other impacts to sage-grouse suggests possible effects of residential developments. Increased roads, fences, powerlines, human activity, landfills, and density of cats and dogs are additional factors that may impact sage-grouse populations. 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 increase the distance from the lek that hens move to selected nesting sites. People that move to the country usually commute to towns for work. Five different highway segments in the Basin ranked in the top 20 statewide (3 in top 10) for the number of vehicle-ungulate collisions (1983-2003). Increased road-kill deer provide supplemental foods for predators such as crows. Direct mortality of sage-grouse by vehicles has also been documented. Dust from roads and other surface disturbances can adversely affect plants and animals. Overhead powerlines can result in indirect habitat loss since sage-grouse avoid areas near these lines. Human-generated noises possibly mask sage-grouse vocalizations important to courtship, mate selection, grouping and escape behaviors. Intense herbivory from domestic livestock associated with ranchette developments, especially with horse properties, is a concern since native vegetation is often over-grazed, thus increasing potential establishment of invasive weed species.

Sage-grouse habitat in the BHBCA has not been severely compromised by housing developments, but future growth remains uncertain. BHBCA is mainly public land managed by state or federal agencies; therefore, the vast majority of sage-grouse habitat may only be minimally impacted by future residential development and urban expansion. Only privately owned lands (25% of BHBCA) could be open to subdivision and development. There has been an influx of people to Wyoming from more populated states and an out-migration of people from towns to rural ranchettes. Much of the urban sprawl occurs because people desire to live outside of town, to distance themselves from neighbors and/or to have property for animals. The other contributing factor is a shortage of building lots within town limits, which encourages buyers to purchase lots in rural areas.

The biggest threat to sage-grouse habitat from residential development in the BHBCA is sale of family farms and ranches to developers. Most of the larger ranches are still in private ownership committed to family ranching, but that trend is beginning to change. Subdividing has occurred mainly along the rivers and streams and other irrigatable uplands. Much of the sagebrush and riparian communities along streams were converted long ago to farming and pastureland. Irrigated crops have proven beneficial to sage-grouse, especially during late brood rearing. Conversion of cropland to even low density housing may be detrimental to the sage-grouse that have used those lands.

Cody, Powell, and Worland are the primary population centers within the BHBCA. These towns are experiencing residential development outside of city limits. Even smaller communities such as Burlington, Thermopolis, and Willwood are experiencing outward growth. Powell and Worland have been successful in implementing “planned growth” adjacent to city limits thereby reducing rural subdividing.

Hot Springs County anticipates future growth in the area immediately south of Thermopolis, throughout the Owl Creek drainage, and continuing along the Big Horn River bottom. Hot Springs County appears on the verge of reversing a long-term population loss incurred as a result of the oil/gas “bust” of the mid-1980s. In addition, proposed extension of water pipelines into the primary rural areas is expected to increase development as water becomes available. Insignificant development has occurred away from the existing population centers, which preserves habitat for sage-grouse and other wildlife.

Washakie County has experienced migration from within the limits of Worland to small subdivisions within five miles of town. These subdivisions have been primarily on agricultural land along the route of the Washakie Rural Improvement Service District water line. At the same time, the two subdivisions with the largest number of lots (approximately 200 lots total) have been developed as additions to the City of Worland. Washakie County contains the most leks of any county within the BHBCA, and fortunately, they are mostly concentrated in southeast Washakie County within areas of high federal land ownership and away from residential development. Therefore, sage-grouse habitat in Washakie County, has not been severely compromised and should not be compromised by anticipated growth.

In Big Horn County, loss of sage-grouse habitat to urban development is not expected to be significant. Big Horn County has the least number of leks of the four counties within the BHBCA and is also mostly public land. There has, however, been stable growth of rural housing, approximately 2-5% annually, over the past decade. House construction has mainly been along river and stream corridors near agricultural land where rural water lines occur. There are 90 miles of rural water pipelines and 70 plated subdivisions in the county, so urbanization of some rural areas may be imminent.

Park County has almost as many leks as Washakie County. Park County has the largest human population of the four counties and the highest percent of federal land ownership (82%). Sage-grouse occur mostly on BLM administered lands. Park County's human population is concentrated in the towns of Cody and Powell, along the Highway 14A corridor between Cody and Powell, subdivisions along North Fork and South Fork (Shoshone River) corridors and in the area around Clark. Park County has the potential to increase in population over the next several years as retirees increasingly move to the scenic area. Currently, it is estimated that about 2,200 acres in Park County could be developed into housing subdivisions within five to seven years.

None of the counties within the BHBCA have strict zoning to regulate housing development in unincorporated portions of the counties. Large tracts of agricultural land have not been designated "agricultural use only", with residential subdividing prohibited. Adoption of strict zoning resolutions by counties has the potential to protect large expanses of sage-grouse habitat from residential subdividing. Currently, however, strict zoning is politically doubtful. Only one county in Wyoming, Teton County, has adopted wildlife protection measures applicable to private land in the unincorporated parts of the county. As the demographics of other counties change, especially through migration from populated states, they may begin to consider zoning provisions. Wyoming's subdivision law does not regulate subdivisions with tracts of land greater than 35 acres.

Recreation

Some recreational activities that may impact sage-grouse include ATV riding/"4-wheeling", lek viewing, hunting for other species, dog training, antler hunting, and sightseeing. Impacts of hunting sage-grouse will be discussed separately. Recreational impacts to grouse include disturbing birds during already stressful periods (i.e., breeding, nesting and winter) and habitat fragmentation due to creation and use of roads in sagebrush habitats. Recreational viewing of leks can cause disruption of breeding activities, especially when it is done too close and/or too often. 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 may increase the distance hens move to selected nesting sites. Dust from roads and other surface disturbances can adversely affect plants and animals. Increased use of off-road vehicles may result in disturbance of sage-grouse and degradation of habitats (i.e., fragmentation, weeds).

Impacts from all recreational activities are more likely to occur to leks adjacent to public roads or on public lands than on private land. The Big Horn Basin is largely public land with almost 75% of all leks on public land. Accessible public lands receive considerable recreation activity, especially during big game hunting seasons in the fall. Fragmentation of habitat due to illegal creation of new roads can be curtailed by effective travel management plans and enforcement. Travel management plans should strive to lessen disturbances near sage-grouse leks.

There has been research to assess impacts of recreation on several big game species, but little has been done to document recreational disturbances to sage-grouse. Impacts may be less with the lower human population in the Big Horn Basin. However, due to the amount of public land, the Basin attracts recreationists from the Billings (Montana), Casper, Sheridan and Gillette areas.

Conflicting Wildlife Management

Habitat management for other wildlife species utilizing sagebrush ecosystems can conflict with management goals for sage-grouse. Managing sagebrush for all wildlife species that may inhabit sagebrush communities is impractical because practices that benefit some species can be detrimental to others. Conversely, managing sagebrush communities for a single species is not ecologically sound. Approximately 100 bird species, 70 mammal species and several reptiles are found in sagebrush habitats including many sagebrush obligates or near-obligates. Numerous sensitive wildlife species are dependent upon or inhabit the sagebrush ecosystem including the black-tailed prairie dog, Brewer's sparrow, ferruginous hawk, mountain plover, and swift fox. Each has specific habitat requirements that may conflict with the seasonal habitat requirements of sage-grouse. On a landscape scale, with a mosaic of seral stages and vegetation types, the specific seasonal habitat requirements of the various wildlife species that inhabit sagebrush ecosystems can be accommodated.

Wild ungulates in Wyoming are managed to achieve a desired population objective. Mule deer, elk and pronghorn are the primary wild ungulates that occur within occupied sage-grouse habitat. 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. Annual heavy sagebrush browsing by large concentrations of ungulates, such as some crucial winter ranges, may impact sage-grouse habitats. As with livestock, these grazing/browsing effects may be positive, negative or neutral depending on site-specific conditions. Wild ungulate populations should not be allowed to increase to a point where they may negatively impact sagebrush habitats.

Habitat management for other wildlife species may not result in the best sage-grouse habitat. Large-scale prescribed burns have been conducted in the Basin to promote herbaceous vegetation to increase elk habitat. Federal and state laws, rules and regulations have also been enacted that limit management options for various

wildlife and plants. Some threatened, endangered or candidate species have habitat requirements or other needs that directly conflict with sage-grouse habitat requirements or preferences. For example, in recent years, increased emphasis has been placed on the black-tailed prairie dog. Although prairie dog towns adjacent to sagebrush habitats are often used as lek sites, the lack of cover and forage provides little value to sage-grouse during the remainder of the year. High intensity grazing to promote barren landscapes to meet mountain plover habitat needs can decrease available sage-grouse habitat. Sagebrush and residual grass cover are important components of sage-grouse seasonal habitat requirements.

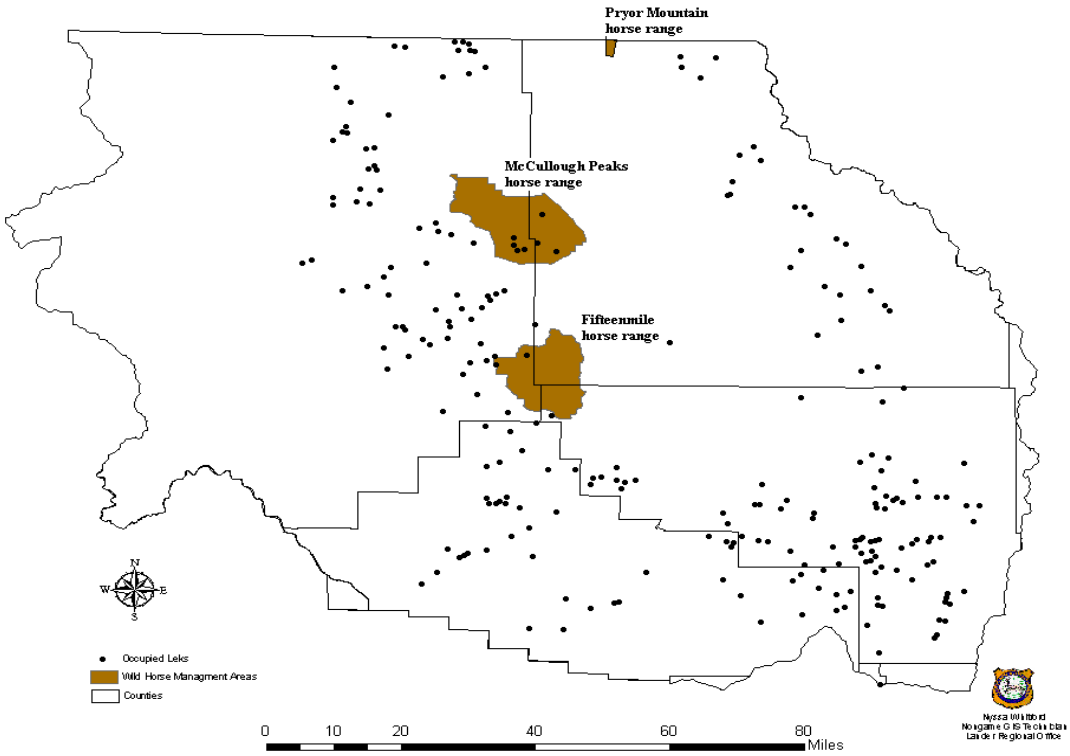
Wild (feral) Horse Management

In 1971, Congress passed legislation to protect, manage, and control wild horses and burros on the public lands. The Wild Horse and Burro Act declared these animals to be "living symbols of the historic and pioneer spirit of the West." Congress further declared that "wild free-roaming horses and burros shall be protected from capture, branding, harassment, or death..." and that they are "...an integral part of the natural system of the public lands." Furthermore, BLM regulation requires that wild horses and burros be considered comparable with other resource values within the area. The BLM maintains and manages wild horses or burros in herd management areas (HMA).

Horse numbers in excess of the appropriate management level could impact the herbaceous component of sagebrush communities. Affects of overgrazing on sage-grouse were discussed in the livestock grazing section.

There are three wild horse management areas in the BHBCA: Fifteenmile, McCullough Peaks and Pryor Mountain (Fig 27). Pryor Mountain horse area, located approximately 12 miles northeast of Lovell, is mainly in Montana. Sage-grouse are not known to occur in that portion of the Pryor Mountain horse area in Wyoming. The Fifteenmile herd management area is located approximately 30 miles northwest of Worland and encompasses over 83,000 acres of mostly public land. The Fifteenmile area is managed for between 100-230 horses. In 2006, there are approximately 125 horses in the HMA. The McCullough Peaks wild horse area is located east of Cody and encompasses 109,814 acres of mostly BLM land. The management objective for this area is to maintain a population of 100 adult horses; however, the area had as many as 450 animals prior to a roundup in 2004. High horse use and drought may have impacted habitats in the McCullough Peaks area, but no analysis was conducted. Approximately 140 horses currently occupy the area. Roundups to manage these three populations occur approximately every 5 years.

Figure 27. Wild horse management areas and active sage-grouse leks within the Big Horn Basin Conservation Area.



Farming

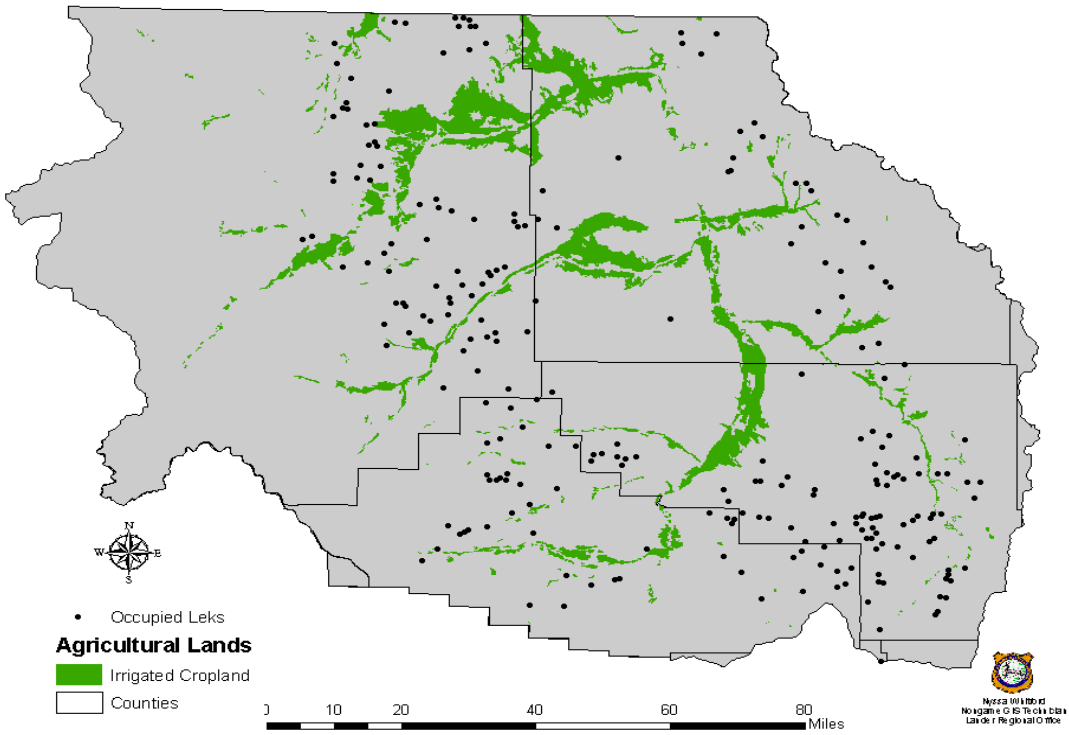
During the homesteading era, sagebrush habitats with the best soils were often converted to farmland. Habitat loss and fragmentation occurred as a result of farming and associated infrastructure. Some leks were abandoned after the site was plowed for farming. Extensive irrigation canals were built to provide water to cultivated ground. Rerouting natural water flows may have eliminated historic riparian areas, but created many additional riparian areas along canals and ditches.

In the past, federal farm programs associated with dry land crops led to some conversion of sagebrush habitats to farmland. Since the inception of the 1985 Farm Bill, federal farm programs are written to ensure that producers cannot benefit by converting native land to farmland. There is little conversion of native rangeland to farmland today. In fact, emphasis of recent Farm Bills has been placed on programs to restore native species on previously farmed lands.

Ecological and economic constraints limit the amount of land in the Basin that could be converted to farmland. Irrigated farming areas constitute only a small percentage of

the landscape within the BHBCA (Figure 28). There are 1,075 active farms in the Big Horn Basin with an average size of 2,349 acres. There have been situations where sage-grouse have caused damage to crops by eating flowers and buds of beans and alfalfa.

Figure 28. Cropland and sage-grouse leks in the Big Horn Basin Conservation Area.



The continued existence of privately owned farm operations should be recognized for the value of habitat and open space provided for sage-grouse. The most beneficial crops grown in BHBCA are alfalfa and beans. Alfalfa hay fields provide a food resource for hens in the form of succulent leaves. Chicks benefit greatly by feeding on the insects that thrive in fields. Between 1995 and 2005, acreage planted to alfalfa hay in Park, Hot Springs, Washakie, and Big Horn Counties fluctuated between 76,000 acres in 2004 to a high of 94,000 in 1998, with an 11-year average of 87,681 acres. Alfalfa grown for seed remains uncut providing food and cover throughout the summer. University of Montana research found that some birds move considerable distances to utilize alfalfa fields. Bean crops and associated insects provide food value for sage-grouse in areas where sagebrush habitat is adjacent to crops. Annual bean production between 1995 and 2005 has ranged between 11,400 and 20,200 acres with a mean of 15,500 acres. Other small grains, and the insects they attract, also provide a food source for grouse. Irrigated pasturelands provide forbs and water. In general, smaller fields scattered across the landscape with adjacent sagebrush cover provide valuable habitat and are favored by sage-grouse.

There is little potential for future conversion of sage-grouse habitats to farmland in the BHBCA. Federal legislation passed in 2000, requires that 16,500 acres of BLM-managed land northwest of Worland be available for agricultural production. The West Side Irrigation Project was projected to show an economic gain of over $16 million annually for Washakie and Big Horn Counties. Sale of the land to a local irrigation company, and subsequently to private ownership, is still pending waiting for completion of environmental analysis and mitigation of impacts. Few sage-grouse have been documented using habitats in the West Side area. The West Side Project has the potential to attract late brood-rearing use but decrease winter use of the area.

Hunting

Sage-grouse hunting provides recreational, cultural and economic values. The harvested birds provide biological data, via harvest surveys and wing collections, which may serve as important indicators of population status. In addition, hunting creates a constituency of advocates who are interested in sage-grouse and their habitats.

Hunter harvest of adult hens may have a detrimental impact on a population. Sage-grouse are relatively long-lived, with lower reproductive rates and lower annual turnover than other game birds. Adult female grouse are more successful hatching clutches and raising chicks than are yearling hens. Thus, maintaining a higher proportion of adult hens in the population allows the population to grow faster under favorable habitat conditions. Adult hens are more susceptible to harvest during late summer and early fall because hens with chicks are concentrated on late brood-rearing habitats and near water. By late September, chicks are more independent of hens and cooler, wetter weather results in dispersal of family groups. This dispersal makes adult hens less vulnerable to harvest since they are more scattered across their habitat and mixed with barren hens and males.

Regulated hunting of sage-grouse has occurred in Wyoming since 1948. Hunting seasons traditionally opened in late August or early September. The WGF Commission has altered sage-grouse hunting seasons in response to population levels. Because of concern over low populations, the hunting of sage-grouse was prohibited in Wyoming from 1937 to 1947. More recently, concern with decreasing sage-grouse populations and the impact of harvesting too many adult hens initiated changes to more conservative hunting seasons (Appendix B). In 1995, the Commission enacted shorter seasons and lower bag limits. The opening date was moved to the third Saturday in September with hunting seasons lasting 14-17 days. Bag and possession limits were 3 birds per day and 6 birds in possession. More conservative hunting seasons were again enacted in 2002, when the opening day was moved to the fourth Saturday in September and the closing date to the first Sunday in October, resulting in a 9 day season. The bag and possession limits were reduced to 2 and 4 birds, respectively. Although concern has again been expressed about the impacts of recreational hunting

on sage-grouse populations, studies have not shown that hunting alone causes sage-grouse population declines.

Complete closure of sage-grouse hunting seasons has not resulted in subsequent increases in breeding populations. Two areas in Wyoming have been closed to hunting, southeast Wyoming and northwest Wyoming. Sage-grouse habitat and numbers are limited in these areas and while Wyoming has chosen a conservative approach to hunting in these areas, it is not anticipated the closures will result in population increases. Research to document the impact of closing hunting seasons on local bird populations was recently conducted in Idaho. Results suggested hunting seasons as currently structured in Wyoming are conservative and do not harm sage-grouse populations, nor prevent their ability to increase under favorable conditions.

Sustainable harvest rates can vary by geographical area and population depending on habitat quality and productivity of a population. A healthy sage-grouse population should be able to withstand harvest rates of less than 10% of the fall population. It has been recommended that hunting seasons be closed if the breeding (adult) population is less than 300 birds. The sage-grouse population in the BHBCA cannot be estimated due to insufficient data, however, more than 300 adult grouse are counted annually on all leks. We do not know if there are isolated sub-populations below recommended levels or if any might be limited by human harvest.

Conservation Assessment Summary

The sage-grouse population in the BHBCA appears fairly stable over the past 30 years. Limiting factors for this population have not been researched. Many of the factors that have greatly reduced sage-grouse populations throughout western North America, have not had as great of an impact on the Big Horn Basin population. Present levels of human activity, over the past 30 years, do not appear to have put this sage-grouse population at risk. As technology improves and as demand increases, it may become economical to mine or drill for resources that are currently unfeasible to retrieve. Conversion of agricultural areas and open spaces to housing has been minimal, but will continue. All factors mentioned above will continue to add to the cumulative impacts on sage-grouse and sagebrush habitats unless mitigating measures are practiced.

CONSERVATION STRATEGY

This section of the Big Horn Basin Sage-grouse Conservation Plan provides specific goals, objectives and actions designed to improve sagebrush habitats and sage-grouse populations. We also offer recommended management practices (RMPs) to address or mitigate possible limiting factors. Agency and industry sector commitments, outside the scope of the BHBLWG, are also provided to demonstrate other efforts that are being undertaken to assure sage-grouse populations in the BHBCA remain viable (page 81).

After thorough discussion of factors affecting sage-grouse populations in the Big Horn Basin, the BHBLWG ranked those factors to establish priorities. Our initial ranking of factors affecting grouse (page 26) was used as a baseline for expanded discussion on how best to address these factors. Personal experience, review of existing scientific literature and appreciation for limited site-specific information lead to a prioritizing of goals and objectives that differed from our initial ranking of factors. Through this process, we developed four major goals to fulfill our mission "…*to enhance sagebrush habitats and ultimately sage-grouse populations within the Big Horn Basin*." Several of these goals have sub-goals to address specific factors that may affect sage-grouse. Goals address habitat, populations, research and education:

1. **MAINTAIN, ENHANCE, AND/OR RESTORE QUALITY HABITAT FOR SAGE-GROUSE,**

2. **MAINTAIN AND ENHANCE SAGE-GROUSE POPULATIONS IN THE BIG HORN BASIN,**

3. **SUPPORT RESEARCH TO BETTER UNDERSTAND THE DYNAMICS OF SAGE-GROUSE POPULATIONS AND THEIR HABITATS IN THE BIG HORN BASIN,**

4. **EDUCATE THE PUBLIC ABOUT SAGE-GROUSE AND CONSERVATION OF THEIR HABITATS.**

The strategy for sage-grouse conservation in the BHBCA is to meet the goals and sub-goals through the development and implementation of objectives. Objectives are the actions designed to improve sage-grouse habitats and populations in the Big Horn Basin. Objectives were ranked by the BHBLWG to assist in prioritizing projects and funding. Ranking criteria included: 1) urgency, 2) feasibility and likelihood of success, 3) benefits to multiple species, 4) importance to sage-grouse populations and 5) importance to sagebrush habitats.

Some of these objectives will be implemented by the BHBLWG, but others rely on implementation by cooperating agencies and other groups. Although the BHBLWG does not have authority to enforce implementation of objectives, agencies and groups should agree to work toward implementation of these objectives. Objectives may be

implemented using a variety of management actions and practices. Where we felt it necessary, we provide more details on how to implement objectives. In other instances, we allow for maximum flexibility on how objectives are to be implemented.

Recommended management practices are included to assist with implementation of some of our objectives (pages 63-70). RMPs are techniques that should be implemented, voluntarily, to mitigate for possible impacts on sage-grouse habitats. RMPs may be appropriate under some circumstances but not under others. The user must determine relevance and appropriateness of each RMP, which may require modification to meet site-specific conditions. They are not implied regulations although some are based on current regulations or policies. If deemed appropriate, some may become future policy via established agency procedures, outside the authority of the BHBLWG.

Conservation Goal #1: **MAINTAIN, ENHANCE, AND/OR RESTORE QUALITY HABITAT FOR SAGE-GROUSE**

Sub-goal: Livestock Grazing. **Promote grazing practices that maintain suitable sage-grouse habitats on federal, state, and private land in the Big Horn Basin.** Managers and owners of the land and livestock should be aware of and address potential impacts of livestock grazing on sage-grouse populations and habitats.

Objective: **The BHBLWG will conduct/host two workshops/field tours in the Big Horn Basin by the end of 2008 to demonstrate livestock management practices that can be beneficial to sage-grouse habitat.**

Objective: **Within one year of plan adoption, the BHBLWG will identify and work with willing landowner(s), BLM and NRCS to apply the Ecological Site Description/Adaptive Management process to manage at least one project area for improved sage-grouse habitat.**

Objective: **Land managers should use the Adaptive Management process (described below) to evaluate habitat conditions for sage-grouse, identify desired vegetation communities best suited for the site and obtain a list of RMPs to use for management of the site when grazing plans are revised.**

Sub-goal: Vegetation Management. **Endorse habitat treatments that are beneficial to sage-grouse and provide a mix of early, mid and late seral vegetation stages on a landscape scale.** Sagebrush communities evolved with disturbance, but the frequency of disturbance has been debated. Habitat treatments (e.g., mowing, burning, spraying) should be used to reduce sagebrush density and increase herbaceous vegetation.

Treatments should promote a mosaic of early, mid and late seral stages of plant succession on a landscape. We provide RMPs to be considered in project planning (page 64).

Objective: **Beginning with the adoption of this plan, vegetation treatments on public lands or on private land with public funds should be designed to maintain or enhance sage-grouse habitat on a landscape scale, while considering ecological, economic and cumulative impacts.**

Objective: **The BHBLWG will initiate efforts to create a GIS data layer that encompasses all of the available habitat treatments that have taken place Basin-wide for use in assessing cumulative impacts and guidance on future habitat treatments by 2008.**

Sub-goal: Mineral Development. **Minimize negative impacts of exploration and/or development of mineral resources on sage-grouse habitat and encourage reclamation that restores or improves sage-grouse habitats.** The BLM, WDEQ/LQD, mining companies and oil/gas exploration and development companies should be aware of potential impacts to sage-grouse and work to lessen those impacts.

Objective: **By 2008, conduct at least one workshop/field tour to present successful low impact exploration, production, and/or reclamation techniques that could be used throughout the Basin.**

Objective: **Where and when loss of sage-grouse habitat is unavoidable, industry should use off-site mitigation to produce similar habitat values, effective upon adoption of this plan.**

Objective: **The BHBLWG will write a letter in 2007 requesting that permitting agencies allow use of appropriate, non-native vegetation species to aid in reclamation of difficult areas.**

Objective: **The BHBLWG will request that the NRCS area resource conservationist contact the Bridger Plant Materials Center to develop sage-grouse friendly seed mixes from existing plant materials for the Big Horn Basin.** – *Completed*. Letter sent through NRCS to Plant Materials Center, October 2006. USDA Plant Materials Center responded that opportunities for establishing native vegetation from seed are limited in the 5-9 inch precipitation zone. Bridger Plant Materials Center did not have a seed mix available that they could recommend. Test plots for sage-grouse habitats are currently being evaluated in the Pinedale area, which may be useful in the Bighorn Basin.

Objective: **Industry and permitting agencies should attempt to re-establish sagebrush habitat on disturbed sites previously used by sage-grouse by implementing RMPs** (pages 65-68)**.**

Sub-goal: Invasive Plants. **Limit the introduction and spread of invasive plants in sage-grouse habitat and promote control and reduction of infestations.** All users of sagebrush communities have a stake in seeing that invasive plants do not become established and should work toward elimination of these plants in areas where they have become established.

Objective: **The BHBLWG will provide and request publication of two articles in local Conservation District newsletters on the potential effects of invasive plants on sage-grouse by 2008.**

Objective: **Land managers should monitor and evaluate proposed or implemented vegetation treatments in sage-grouse habitat to determine if invasive plant management is necessary.**

Objective: **Land managers/owners, working with local Weed and Pest districts, should conduct at least one project to control invasive plants in or near sage-grouse habitat, annually beginning in 2007.**

Sub-goal: Conflicting Wildlife Management. **WGFD should consider impacts on sage-grouse when developing population objectives and strategies for big game species.** Big game herds in the BHBCA have not been documented to cause any landscape-scale habitat degradation; however, some site-specific impacts have occurred on winter ranges. WGFD recently began conducting browse transects on winter ranges to track if concentrations of big game are impacting habitats, sagebrush in particular. To reduce impacts of big game on sage-grouse habitats, the BHBLWG recommends the following objective:

Objective: **WGFD, in cooperation with federal state, local government and private landowners, should monitor vegetation use by big game wildlife in areas identified as important sage-grouse habitat and identify any resulting negative effects to sage-grouse habitat likely being caused by big game species. Areas where specific habitat problems are occurring should be identified and evaluated for corrective management actions.**

Sub-goal: Wild Horse Management. **BLM should assure that feral horse populations are maintained at acceptable carrying capacities and impacts to sage-grouse caused by feral horses are minimized.** If populations of feral horses are too high for the range, overgrazing may occur. Overgrazing of habitats by horses, wildlife or

livestock can be detrimental to sage-grouse habitats. The BHBLWG will comment on horse populations when it believes they are impacting sage-grouse habitats.

Objective: **Request "Interested Party" status for the Big Horn Basin Local Working Group on all actions on the McCullough Peaks and 15-Mile horse herds through the life of the working group.**

Sub-goal: Farming. **The BHBLWG will promote farming operations that are compatible with maintenance and enhancement of sage-grouse habitat.** Converting sagebrush habitat to farmland is no longer a major concern in the BHBCA. Agricultural areas can provide habitat for sage-grouse, especially during summer (brood-rearing).

Objective: **Develop and facilitate distribution of a brochure on farming for sage-grouse, coordinated with UW Extension, by December 2007.**

Sub-goal: Monitoring. **Facilitate the continued identification and mapping of important sage-grouse habitats in the Big Horn Basin.** We concluded that little is known about sage-grouse habitat use in the BHBCA. Knowledge of habitat selection and seasonally important areas is vital for identifying habitat improvement projects, for identifying mitigation and for assessing long-term viability of the species.

Objective: **Seek funding to support identification, delineation and mapping of important sage-grouse habitats with initial GIS coverages developed by Dec. 2011.**

Objective: **Field personnel with WGFD and BLM should utilize the Wildlife Observation System (WOS) and/or Wyoming Natural Diversity Database to document sage-grouse locations and other relevant data.** – *Completed.* Letter was written to BLM and WGFD offices in Bighorn Basin with this recommendation, April 1, 2006.

Sub-goal: Water Development. **Provide additional water sources, where suitable, for sage-grouse, other wildlife and livestock.** Water can be a scarce, and sometimes limiting, habitat component for sage-grouse in the BHBCA. Development of accessible water can benefit all wildlife and livestock.

Objective: **The BLM, WGFD, and NRCS should assure that new water developments in sage-grouse habitats, provide access for sage-grouse and where possible, existing water developments should be retro-fit to provide access to water.**

Objective: **Through the life of the BHBLWG, we will help facilitate funding to complete at least one water project per year with specific sage-grouse benefits. Agencies are expected to continue efforts to achieve this objective.**

Objective: **Develop reservoirs, wetlands, or other water sources as part of reclamation of mined lands in areas with limited water.**

Objective: **The BHBLWG will submit a letter to the WDEQ & Region 8, EPA stating support for continued historic (pre-1975), conventional oil field surface discharges of water in sage-grouse habitats that meet the needs of wildlife and livestock without bioaccumulation of contaminants at levels that would be hazardous to human health and the environment.** – *Completed*. Letter was sent February 2006.

Conservation Goal #2: **MAINTAIN AND ENHANCE SAGE-GROUSE POPULATIONS IN THE BIG HORN BASIN**

Sub-goal: Population level. **The average number of males per lek should not decline below 24 males/lek during population peaks; below that level, more stringent protections on sage-grouse populations and habitat may be needed.** This baseline figure for males/lek was obtained from data collected during 2000. The State-wide Plan used males/lek averages from 2000 to establish baseline levels for the state. Males/lek are used as an index to population level. No population estimates for the BHBCA or the state have been determined.

Sub-goal: Hunting. **The WGFD should recommend hunting regulations that are responsive to fluctuations in sage-grouse population levels.** The BHBLWG recommends that hunting seasons continue. Hunting has had minimal impacts on sage-grouse populations in the BHBCA. Hunting seasons (season dates, length, bag limits) should continue to be responsive to sage-grouse population levels.

Sub-goal: Predation. **Where and when scientific studies have demonstrated negative impacts, the BHBLWG endorses the control of predators to reduce their impacts on sage-grouse populations.**

Sub-goal: Monitoring. **Beginning with the adoption of this plan, management agencies should improve reliability of data collected on sage –grouse by implementing the following:**

1. WGFD, BLM, industry and volunteers will use established protocols for monitoring leks and lek complexes.
2. WGFD and BLM should develop standardized methodology for surveying and documenting sage-grouse broods.
3. State and federal agencies and industry should look for ways to enhance funds to insure adequate personnel to implement protocols for monitoring sage-grouse.
4. WGFD should compile harvest data on sage-grouse that more accurately represents the Big Horn Basin sub-population. Management Area 37 should be split on the Bighorn Mountain divide, with the west portion of that area made into a new management area or combined with Management Area 21.

Conservation Goal #3: **SUPPORT RESEARCH TO BETTER UNDERSTAND THE DYNAMICS OF SAGE-GROUSE POPULATIONS AND THEIR HABITATS IN THE BIG HORN BASIN**

Research Objective: **The BHBLWG will propose and solicit research on sage-grouse in at least one of the following areas, beginning in 2007:**

- Development of a reliable population estimation technique (or validation of techniques currently being developed) for sage-grouse in the Big Horn Basin, to be used in establishing minimum population goals;
- Evaluate the impacts of predators (especially "new" predators) and implement management actions accordingly;
- Evaluate grazing regimes and habitat treatments that have potential to benefit sage-grouse habitats; and/or
- Assess impacts of weather on sage-grouse and their habitats.

Conservation Goal #4: **EDUCATE THE PUBLIC ABOUT SAGE-GROUSE AND CONSERVATION OF THEIR HABITATS**

Objective: **In 2007, The BHBLWG will contact coordinators of Project Learning Tree and WILD About OREO (Outdoor Recreation Education Opportunities) to discuss the development of a workshop to introduce teachers and students to the importance of sage-grouse and the sagebrush steppe in Wyoming. This workshop could include coordinating field trips to view sage-grouse leks.**

Objective**: Present information to the public about potential impacts of subdivisions on sage-grouse. This should be an on-going effort.** – In March 2006 and 2007, presentations were given by a BHBLWG member as part of "Living on a Few Acres" program hosted by Cody Conservation District.

Monitoring And Adaptive Management

The distribution, trend and abundance of sage-grouse populations are the ultimate indicators of success of the conservation strategies presented in this document. Therefore, reliable and comparable methods of monitoring sage-grouse populations and habitats are critical to evaluate effectiveness of conservation actions implemented across the landscape. Consistent monitoring will provide data necessary to measure long-term success of this plan, as well as provide the basis for adapting management to take advantage of newly acquired information and changing environmental conditions.

Monitoring

Techniques currently used for monitoring sage-grouse populations in the Big Horn Basin are consistent with those recommended by the Western Association of Fish and Wildlife Agencies' (WAFWA's) Sage-Grouse and Columbian Sharp-Tailed Grouse Technical Committee. In 2005, this Committee organized a sub-committee to develop and/or update protocols for sage-grouse population monitoring. Updated protocols recommended by the Technical Committee should be implemented in Big Horn Basin as they become available. The current protocol will be contained in WGFD's Wildlife Management Techniques Manual when the updated version is released.

The Bureau of Land Management began a process to identify appropriate methods for assessing and monitoring sagebrush habitats at multiple scales. These methods should be available for implementation in 2007 and should be the means by which sagebrush habitats are monitored across the range, including the Big Horn Basin.

Adaptive Management

Adaptive management incorporates monitoring and research into land use planning and project implementation. It integrates monitoring and research with habitat management to test planning assumptions. Projects and management actions should be changed if monitoring or research data indicate that goals are not being achieved. Quantitative (measurable, not subjective) data must be collected for adaptive management to succeed.

The BHBLWG has developed an adaptive management approach for vegetation management. Management actions should be based upon current ecological condition at a particular site and its potential desired plant community. This effort originated as a decision matrix to determine which RMPs to implement when addressing possible impacts of grazing management on grouse habitat. This process could be implemented for most vegetation management actions and may be applicable to reclamation of disturbed areas.

Using Adaptive Management to Manage Vegetation for Sage-grouse

In determining how to improve sage-grouse habitat, an adaptive management approach is recommended. Using adaptive management to manage vegetation integrates monitoring and research with habitat projects (e.g., mowing, burning, inter-seeding, grazing management). Implementation of projects should be modified based upon results of monitoring and research. Thus, a "continuous loop" of management and monitoring is created which may lead to improved sage-grouse habitats (Fig. 29). In some instances, *not* doing a project is habitat management and *not* changing management actions is being adaptive. Not all sites have potential to support sagebrush and sage-grouse; therefore efforts need to be on those areas where success is probable.

When assessing if a habitat management project is needed two questions should be answered: Are sage-grouse numbers limited by quantity or quality of habitat in the area? Are the necessary habitat components (see General Sage-grouse Biology And Habitats section, above) for at least one life-stage (e.g., brood-rearing, winter) of sage-grouse being provided in an area? If these questions cannot be answered, more monitoring may be needed. If they can be answered, will vegetation management improve conditions for sage-grouse or is current management adequate?

All interested parties should be involved in vegetation management decisions. On public land, biologists and range managers from the land management agency should involve grazing permittees, state wildlife/habitat managers and, depending on the type of project, recreationists, special-use permit holders (oil/gas leases) and neighboring landowners. On private land, the willing landowner should involve state wildlife/habitat managers, NRCS District Conservationist, appropriate federal range and wildlife managers and neighboring landowners.

Key factors determining if changes are needed in management are based upon sage-grouse and vegetation. The specific life-stage(s) for which sage-grouse currently use a particular parcel of land (allotment, pasture, drainage, or landscape) and the habitat requirements during that life-stage must be known. Treatments may also be applied in hopes of attracting a specific life-stage of grouse. The existing plant community and condition of the vegetation need to be assessed using appropriate range surveys.

NRCS range personnel can determine dominant soil type and ecological site for a project area. NRCS's Field Office Technical Guide (FOTG) provides in-depth descriptions of all ecological sites in Wyoming. State-and-Transition Models within FOTG (Fig. 30) provide production capability and potential plant communities for each ecological site. Landowners, land managers and biologists must then determine if the existing plant community and condition is optimal for that ecological site and for the desired sage-grouse life-stage for which habitat is being provided.

If the existing plant community is not in optimal condition or if a different community is desired at the site, vegetation management may be necessary. State-and-Transition models provide possible management options (transitions) on how to move an area from current conditions to the desired plant community. Transitions that may have caused an undesirable plant community to occur at that ecological site are also provided. Some examples of management options include long-term prescribed grazing or brush treatment. Management options/actions can be implemented using a variety of recommended management practices (RMPs) to achieve optimal habitat conditions for various life-stages of sage-grouse.

Selection of RMPs depends on which habitat management options are selected. RMPs may not be appropriate for every set of conditions. The user must determine relevance and appropriateness of each RMP, which may require modification to meet site-specific conditions. Some RMPs for vegetation management practices are included. RMPs for livestock grazing are too numerous to list here and vary greatly, depending on ecological site, condition of vegetation community, precipitation, past livestock management, wildlife use levels, class of livestock, and ranch economics. WAFWA's sage-grouse technical committee, BLM, Society for Range Management, various state agriculture departments, and other ranching interests are developing lists of RMPs for livestock grazing in sage-grouse habitat. After current and desired vegetation communities are assessed, interested land and livestock managers should implement those selected RMPs to improve sage-grouse habitat using grazing management.

The adaptive management approach could also be applicable in reclamation of disturbed areas. If a site has been disturbed to a point that has changed the soil profile, such as strip mining, this technique may not be useful. We stress the need to use adaptive management in mine reclamation. Monitoring of reclamation efforts needs to occur. If initial reclamation actions were not successful, new actions should be taken. With assistance from industry representatives, the BHBLWG compiled some RMPs that may be useful in mitigating impacts of mining and oil/gas exploration and development on sage-grouse habitats. RMPs for bentonite mining and oil/gas development are listed separately (pages 65 and 67, respectively), but some actions may be applicable to both types of disturbances or mitigations.

Figure 29. Flowchart depicting vegetation management for sage-grouse using adaptive management.

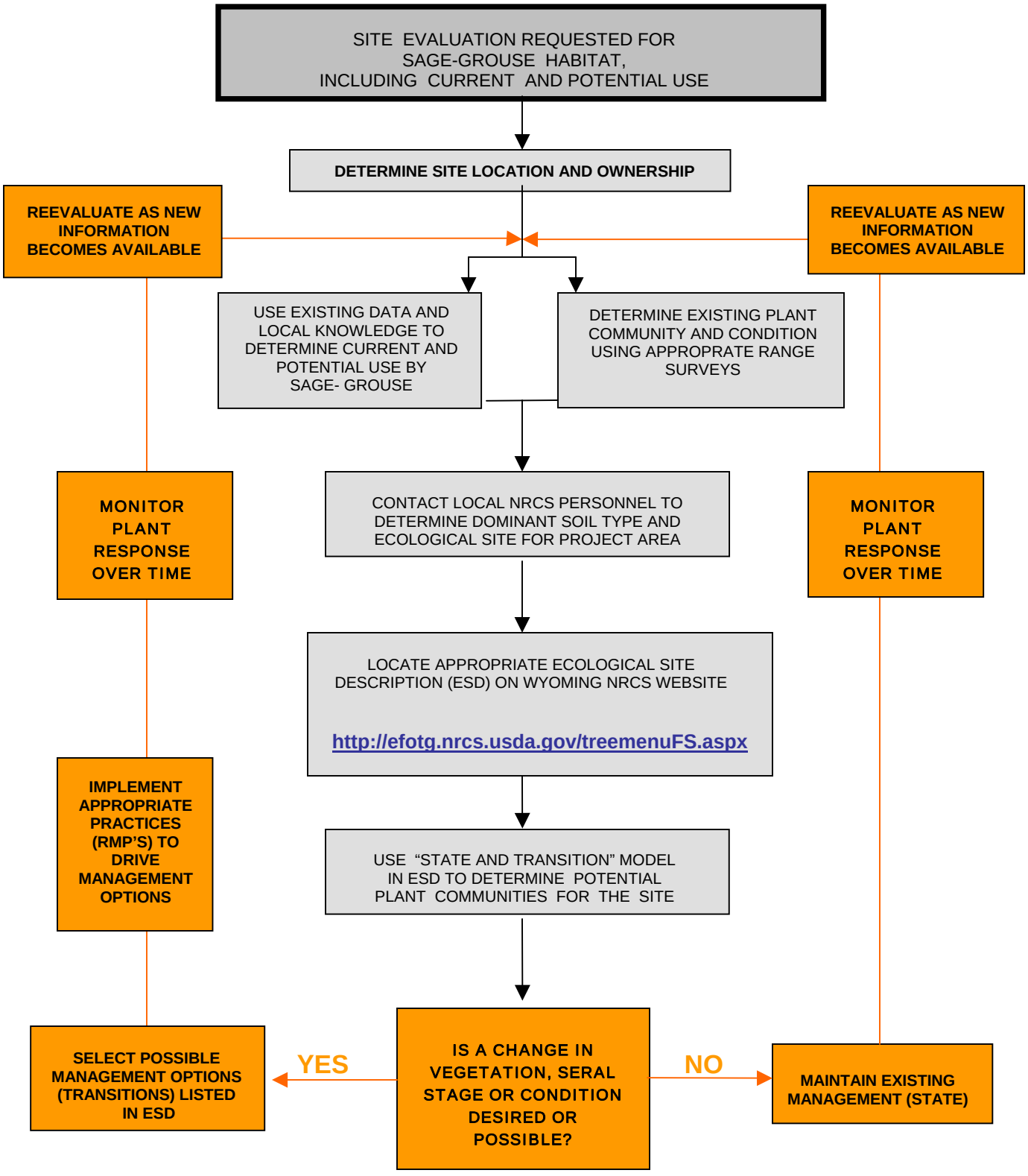
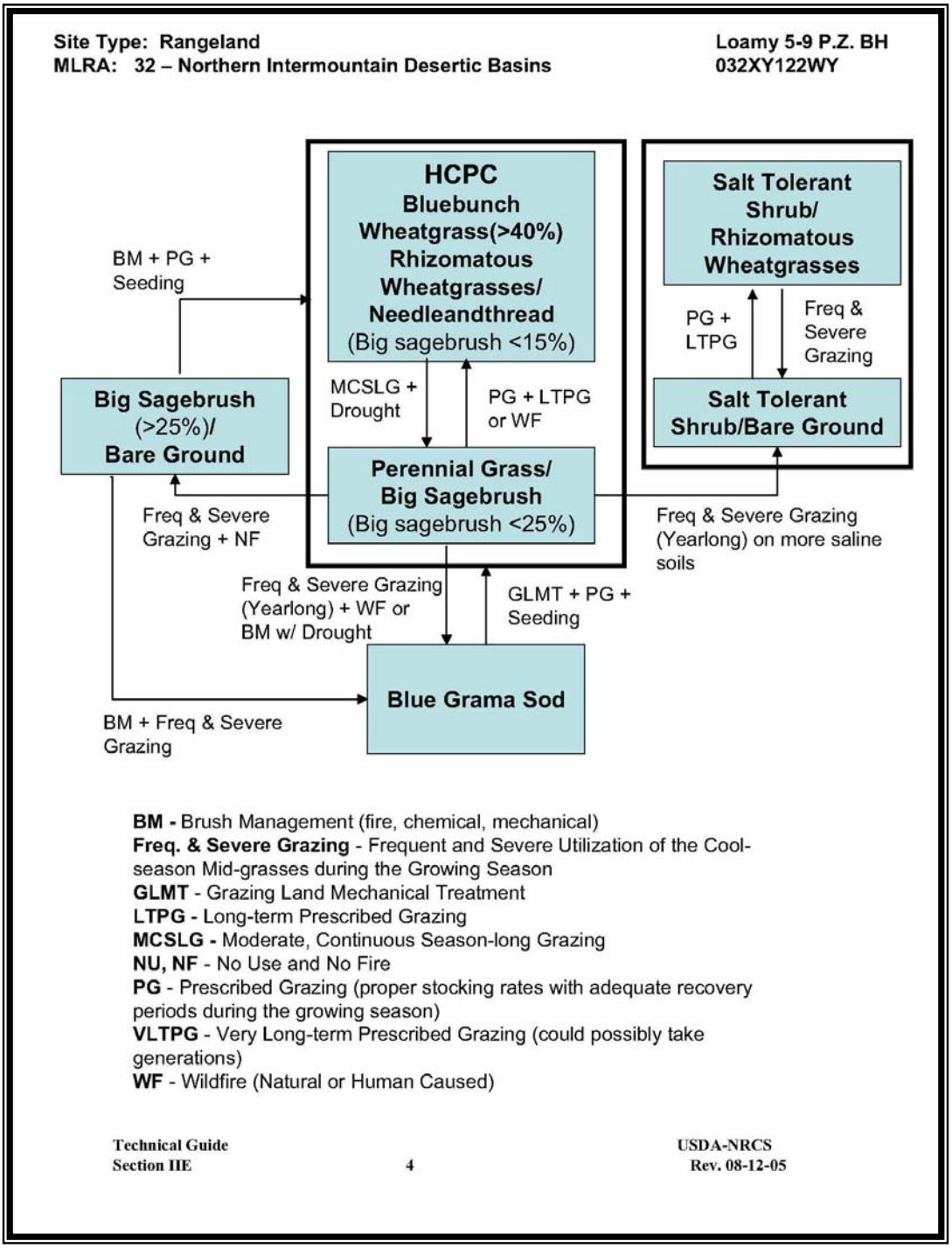


Figure 30. Example of a State-and-Transition model from Natural Resources Conservation Service's Field Office Technical Guide showing potential vegetation communities and the transitions between communities for a "loamy, 5-9" precipitation, Big Horn Basin ecological site.



HCPC, an acronym for Historic Climax Plant Community, was not defined on this page of the field guide.

Recommended Management Practices for Grazing Management

Management practices prescribed for grazing in a State-and-Transition model from Natural Resources Conservation Service's Field Office Technical Guides provide a good starting point when field evaluations indicate grazing management needs to be changed. After current and desired vegetation communities are assessed, interested land and livestock managers should refer to RMPs to improve rangelands using grazing. Depending on the situation, many options may exist for land and livestock managers to consider when altering grazing for improved sage-grouse habitats.

For example, a pasture on a loamy site dominated by big sagebrush with a canopy cover over 15% and an understory of less than optimal cool season grasses probably needs a management change. To improve this vegetative community the frequency and severity of growing season grazing needs to be more closely managed. Proper stocking rates help manage grazing intensity. Fewer livestock could be taken to the pasture or livestock could be in the pasture for a shorter time. Herding, salting, or water management could be used to change livestock distribution within the pasture. Flexible grazing rotation plans manage frequency of grazing through prescribed movement of livestock thus allowing for adequate plant recovery periods.

Recommended Management Practices for Vegetation Treatments

- Treatments should provide a mosaic of treated and untreated areas. Treatment pattern should be irregular and avoid large blocks.
- Manage for a variety of sagebrush cover, depending on how the area is used by sage-grouse: 15-25% sagebrush canopy cover for nesting, 5-15% cover in summer habitat and 20-35% in wintering areas. Treatments should be conducted in areas with high shrub cover (>30%) and poor herbaceous vegetation. Conversely, no treatment should be considered where sagebrush cover is less than 20%.
- Avoid conducting sagebrush treatments without first addressing cheatgrass (and other invasive weeds) presence, particularly in Wyoming big sagebrush communities.
- Sagebrush treatments should be limited in size, not exceeding 120m (400ft) in width.
- Conifer/juniper invasion into sagebrush dominated landscapes should be treated to promote healthy sagebrush system.
- Consider creation of fire breaks in areas of large continuous sagebrush. Treatments to create firebreaks should be designed to enhance sage-grouse habitat.
- Protect and maintain areas of unburned sagebrush within perimeter of treated areas or wildfires to serve as seed source.
- Defer livestock grazing for 1-2 growing seasons post-treatment to allow for establishment of herbaceous vegetation. Consider using temporary electric fencing around treated areas to allow for use in the untreated portion of a pasture or allotment.
- Avoid treating nesting habitats during the nesting season.
- Use extreme caution when treating Wyoming big sagebrush in areas with less than 8” annual precipitation.
- If herbaceous vegetation is scarce or nonexistent prior to treatment, consider seeding treated areas with native grass and forb species.
- Evaluate all wildfires greater than 40 acres in occupied sage-grouse habitat to determine if rehabilitation of the burned area is needed. When rehabilitation is necessary, the first priority is protection of the soil resource. Use appropriate mixtures of sagebrush, native grasses, and forbs that permit burned areas to recover to a sagebrush-perennial grass habitat.
- Maintain sagebrush cover within 300m of treated areas, riparian areas and other foraging areas.
- Additional treatments in adjacent areas should be deferred until the previously treated area again provides suitable sage-grouse habitat.
- Monitor treated areas to detect invasive vegetation and treat any infestations.
- Use of chemicals to “thin” or control sagebrush is usually inappropriate for winter and breeding habitat.
- Brush beating should be done in strips (usually 10-20m wide) not to exceed ¼ (25%) of the width of untreated strips. Strips should conform to the terrain and should not be straight lines and should be perpendicular to prevailing wind.
- Determine threshold levels of habitat alteration that can occur without negatively impacting specific sage-grouse populations. As a general rule, treat no more than 20% of any seasonal habitat type until results are evaluated.
- 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.

Recommended Management Practices for Mining and Reclamation

The user must determine relevance and feasibility of each RMP, which may require modification to meet site-specific conditions.

General mining and reclamation practices:

- Perform an order 1 or 2 soil survey of the area planned for mining to determine the quality of soil available for reclamation.
- Reduce unnecessary disturbance by using developmental drilling data to narrow planned mining disturbance, and reduce road construction.
- Train equipment operators in proper soil handling and mining practices, and monitor them regularly.
- When the mining series is large enough, use a castback mining sequence, and spread soils live at appropriate phases.
- Leave islands of native vegetation within pits for a source of native seed.
- Keep reclamation concurrent with mining.
- Make use of timing stipulations to reduce impacts to sensitive species during certain times of the year and day.
- Place soil, spoil, and bentonite stockpiles outside of sagebrush habitat.
- Save and use all overburden that is chemically suitable as a growth medium to put a buffer between chemically unsuitable spoil and vegetation establishment zone.
- Because of limited soil resources, and a normally abrupt decrease in soil quality with depth, stockpile topsoil and subsoil separately when initially stripping the soil, or during castback mining, spread live topsoil and subsoil separately.
- Create varied topography during the contouring portion of reclamation. Avoid flat, smooth contouring in most cases.
- Deep rip areas that have had regular heavy equipment traffic to reduce compaction before spreading soils.
- When replacing the soil onto contoured land, don't spread soil thin; use mosaics of deeper soil
- Leave surface fairly rough to provide microenvironments, however, clods should not be large.
- Seed in mid to late fall after the risk of germination and freezing of young seedlings has past.
- Include forbs in the seed mix, when available.
- Use "water harvesting" techniques such as furrows, pitting, snow fences, depressions in reclamation, etc.
- Consider using multi-stage plantings. When allowed, use non-native species, to prepare the topsoil, reduce erosion, and control noxious weeds, then reseed in later years with desirable native vegetation (grasses, forbs, shrubs).
- Where needed, fence reclamation to reduce grazing and browsing on emerging vegetation.
- Monitor and mitigate failed reclamation in a timely manner (three to five years).
- Consider off-site sage grouse habitat mitigation such as developing water sources.

Mining RMPs (Cont.)

Sagebrush Establishment Practices:

- Replace topsoil to create deeper pockets in low-lying areas such as drainages and depressions rather than spreading it evenly over the entire reclaimed area.
- Use recently harvested sagebrush seed for best viability.
- Use locally harvested seed or seed harvested from similar climate.
- Seed with a minimum of two to four pounds PLS sagebrush seed per acre.
- Plant sagebrush seed in depressions and drainages that collect more water than in uplands.
- Plant sagebrush seed on the soil surface or onto snow.
- Reduce competition between sagebrush establishment and other vegetation species.
- Consider the incorporation of organic matter to enhance the soil's water retention capacity.
- Plant sagebrush seed on north facing slopes.
- Create snow fences using topography and natural features (e.g., boulders) and plant sagebrush seed in those areas.
- To improve sagebrush and herbaceous establishment, use cost effective (i.e. drip) irrigation in arid areas.
- Monitor reclamation sites for noxious weeds and other invasive species; treat any undesirable vegetation immediately for best results using chemical or mechanical methods (including hand pulling)

Recommended Management Practices for Oil and Gas Exploration, Development, and Production Operations

The following is an overview of the basic types of construction sites. In most cases, specific requirements for each site are contained in the surface-use agreement negotiated with the surface owner or the federal land manager. The user must determine relevance and feasibility of each RMP, which may require modification to meet site-specific conditions.

Project design phase:

- The well pad should be constructed as small as possible to minimize soil and surface disturbance.
- Multiple wells should be drilled from existing pads or the same pad, to minimize disturbance when possible.
- Use directional drilling where appropriate to minimize impacts to sage-grouse.
- The topsoil should be removed from the site in lifts and placed at the edge of the location for reuse.
- Reduce the drilling location (pad) to the smallest size possible to support safe production operations. Re-spread stock piled topsoil on those areas to be re-vegetated as soon as possible.
- Locate wells and roads away from nesting, brood rearing, and winter habitats and at least ¼ mile away from leks, where appropriate.
- Utilize horizontal drilling, where geologically feasible, to maximize oil and gas recovery, while minimizing the number of wells necessary to develop a producing reservoir.

Construction of the roads:

- Disturbance of new areas should be avoided whenever possible. Whenever possible, existing roads should be utilized or expanded to minimize the amount of new surface disturbance.
- Topsoil should be removed and stored along the Right of Way (ROW).
- After the road is built, the topsoil should be spread on the road out slopes and seeded
- Stream crossings should be avoided when possible. Existing crossings or bridges should be used.
- Vehicles should be confined to authorized traffic routes.
- Areas disturbed, as a result of road construction, should be re-vegetated as soon as practical after construction.

Construction of pipelines/flowlines:

- The pipeline/flowline should be constructed in the roadway ROW, when possible, and the topsoil will have already been removed during road construction.
- Re-contouring should take place on the ROW.
- The ROW area should be re-seeded.

Oil/gas RMPs (cont.)

General:

- Utilize central production, treatment, and compression facilities to minimize the footprint on the landscape.
- Plugged and abandoned locations and access roads should be reclaimed as soon as possible.
- Water wells drilled for oil and gas exploration or development, may be released to the BLM or private surface owners for livestock, wildlife, and sage-grouse watering sources. Operators should consult with the BLM Natural Resource Specialists and biologists and/or WG&F biologists to determine where additional water sources may be beneficial to sage grouse.
- Consider use of timing stipulations to reduce impacts to sage-grouse during certain times of the day and year, regardless of mineral ownership.
- Seeding should be completed in the fall before the ground is frozen, or in the spring after the ground has thawed.
- Sage-grouse friendly seed mixtures should be utilized where specified and approved by the BLM.
- Sage-grouse friendly seed mixtures may be utilized on operator owned lands or other private lands as approved by the surface owner.
- Monitor and mitigate failed reclamation in a timely manner.
- Where necessary, fence reclamation areas to reduce impacts from livestock and feral horses.
- Where necessary and practical, use water-harvesting techniques such as ripping, pitting, snow fences, depressions, etc.
- Consider/utilize irrigation to help establish vegetation in naturally dry environments and drought impacted areas.
- Rip, drill, or seed with contours 90 degrees from prevailing winds to help catch precipitation and minimize loss of seed.
- Control noxious weeds on disturbed areas.
- Use certified weed free seed.
- Evaluate the option of using pallets/mats for drilling operations to reduce disturbance to topsoil and vegetation.
- Reduce vehicle traffic and/or disturbance by remote monitoring of producing wells.
- Utilize noise reduction devices and technology to minimize impacts.
- Incorporate organic matter into the soil to increase the carbon content and enhance the soil's ability to retain moisture.
- Consider off-site mitigation, such as water development and vegetative treatments.
- Utilize erosion control structures and good engineering practices to minimize environmental impacts and prevent offsite sediment transport.
- For new exploration activities (includes private as well as public lands):
    - When proposing a new well or project, identify important sage-grouse habitats out to a 3-mile radius around active leks.
    - Design, locate, and construct projects to avoid the important habitats.
    - If important habitats cannot be avoided, mitigate impacts with enhancement of disturbed habitats and/or timing restrictions within the identified area.
    - If important habitats cannot be avoided or enhanced within the identified area; work with land management agency and/or private landowner to fund off- site habitat enhancement project(s).

The Big Horn Basin LWG felt it was important to reiterate RMPs listed in the State-wide Plan for specific factors that we did not discuss in detail, including recreation, pesticide use, farming and residential development. Some new RMPs, not previously listed in the State-wide Plan, have been included below. These RMPs are applicable to the Big Horn Basin and should be implemented where/when possible to lessen impacts to sage-grouse and sagebrush habitats. Refer to the State-wide Plan for additional RMPs relevant to all the factors listed in this plan.

Recommended Management Practices for Recreation

1) Develop travel management plans and enforce existing plans.
2) Restrict off-road-vehicle use in occupied sage-grouse habitats
3) Avoid recreational activities in sage-grouse nesting habitat during the nesting season.
4) Restrict organized recreational activities between March 15 and July 15 within two miles of a lek site.
5) Recreational facilities should be located at least two miles from lek sites and in areas that are not in crucial sage-grouse habitat
6) Establish and maintain a small number of lek viewing sites and minimize viewing impacts on these sites. Viewing sage-grouse on leks (and censusing leks) should be conducted so that disturbance to birds is minimized or preferably eliminated.
7) Agencies should generally not provide all lek locations to individuals simply interested in viewing birds.
8) Develop and provide information related to recreation and its impacts on sage-grouse habitat.
9) Discourage dispersed camping within important riparian habitats occupied by sage-grouse during late summer.
10) Avoid construction of overhead lines and other perch sites in occupied sage-grouse habitat. Where these structures must be built, or presently exist, bury the lines, locate along existing utility corridors or modify the structures in key areas.
11) Control dust from roads and other surface disturbances.
12) Inform the public that dog training on sage-grouse outside the hunting season is illegal.

Recommended Management Practices for Pesticide Use

1) Determine the extent of pesticide use within sage-grouse habitats.
2) Examine what, if any, effects each pesticide use may have on sage-grouse populations.
3) Where possible, adjust alfalfa harvest timing instead of applying pesticides to control weevils.
4) Make use of current laboratory analysis procedures where sage-grouse mortality is observed. Report where pesticides have caused mortality in sage-grouse.
5) Determine which pesticides and application strategies are simultaneously beneficial to agriculture and least harmful to sage-grouse.
6) Research effects of pesticides on sage-grouse in Wyoming with a specific goal of testing impacts of actual rangeland applications.
7) Work with county Weed and Pest Districts to identify low-toxicity alternatives to pesticides classified as a medium to very high risk to game birds.
8) Encourage simple, standardized record-keeping formats for all Weed and Pest Districts, that would allow access to pesticide use information in their counties and statewide.
9) Address grasshopper issues using Reduced Area Application Treatments approach.

Recommended Management Practices for Farming

1) Map suitable sage-grouse habitat and focus conservation and management efforts on areas where the most benefit can be realized.
2) Develop and provide information on funding options available to landowners who wish to improve sage-grouse habitat.
3) Work with private landowners to prepare habitat maps, which identify seasonal habitats for sage-grouse and to develop a voluntary site-specific management program.
4) Provide landowners with information on sage-grouse and how to provide for and protect sage-grouse habitat.
5) Develop water sources to benefit both crop production and healthy riparian habitat. Avoid surface and sub-surface water depletion that impacts sage-grouse habitats.
6) Improve visibility of new fences, and of existing fences where problems have been documented, in sage-grouse habitats.
7) Research and develop incentives that would reward farmers who provide the type of habitat that maintains and enhances sage-grouse populations.
8) Maintain sagebrush cover adjacent to beneficial crops (e.g., alfalfa, soybeans).
9) Do not mow fields in a circular pattern toward the center; mow from the center outward or mow fields starting from an adjacent barren area toward heavy cover. Install a "flushing bar" on the swather to flush birds ahead of the mower.

Recommended Management Practices for Residential Development

1) Encourage assimilation of sage-grouse information into county plans as they are developed. Develop and distribute appropriate literature for developers and county planners.
2) Limit free-roaming dogs and cats.
3) Maintain appropriate stocking rates of livestock on small acreages.
4) Encourage cluster development, road consolidation and common facilities that would have a reduced impact on sage-grouse.
5) Where necessary to build or maintain fences, evaluate whether increased visibility, alternate location, or different fence design will reduce hazards to flying grouse.
6) Maintain healthy sagebrush communities on small acreages.
7) Plan development to allow for sage-grouse movement.
8) Where possible protect habitat through conservation. (i.e. land exchanges, conservation easements, leases or CRP type programs)
9) Develop or locate funding sources to encourage maintenance or improvement of sage-grouse habitat on private lands.
10) Locate and manage sanitary landfills, dumps and trash transfer stations to eliminate predator impacts to sage-grouse.
11) Provide education on the effects of residential development on sage-grouse habitat and populations. Facilitate conservation districts and extension agents' ability to educate the public about sage-grouse.
12) Consider developing travel management plans that would allow seasonal closure and reclamation of roads.
13) Reduce noise from industrial development or traffic especially in breeding and brood-rearing habitats.
14) Avoid construction of overhead lines and other perch sites in occupied sage-grouse habitat. Where these structures must be built, or presently exist, bury the lines, locate along existing utility corridors or modify the structures in key areas.
15) Control dust from roads and other surface disturbances.

IMPLEMENTATION STRATEGY

Commitments, Actions, and Recommendations

The intent of this table is to provide a quick reference, with limited detail, to commitments, actions, recommendations and other activities that have potential to benefit sage-grouse or sagebrush habitats. This table was structured to provide some insight on: factors affecting grouse, brief description of the commitment or action, responsible parties for implementation, potential funding sources, and approximate timeframe for implementation. Actions with no funding source or time schedule specified have not been finalized. Objectives are presented in order ranked by the BHBLWG as to 1) urgency, 2) feasibility, 3) benefits to multiple species, 4) importance to sage-grouse populations and 5) importance to sagebrush habitats.

Commitments are actions that an agency or group has agreed to complete or has already completed, some of which are outside the scope of the BHBLWG.

Recommendations are projects identified by the BHBLWG to promote sage-grouse and sagebrush habitat conservation. The BHBLWG will be contacting responsible parties over the next two years to secure commitments for accomplishing these actions.

Factor	Objective/ Commitment/ Recommendation	Action	Responsible parties[1]	Funding sources[1]	Time schedule
Invasive plants	**BHBLWG objective**	Land managers/owners, working with local Weed and Pest Districts, should conduct at least one project to control invasive plants in or near sage-grouse habitat, annually beginning in 2007.	BHBLWG, BLM, NRCS, W&P, BNF, SNF	BHBLWG, BLM, W&P, NRCS, BNF, SNF	on-going
	Commitment	Heart Mountain sage-grouse habitat enhancements - Reduce noxious weed infestations and prevent further spread of weeds to protect native rangeland and riparian plant communities.	TNC	TNC, BHBLWG, Park Co W&P, Marathon Oil	spring 2006

[1] Acronyms used in Responsible parties and Funding sources columns are defined in Appendix C

Factor	Objective/ Commitment/ Recommendation	Action	Responsible parties[1]	Funding sources[1]	Time schedule
Vegetation management	**BHBLWG objective**	Vegetation treatments on public lands or on private land with public funds should be designed to maintain or enhance sage-grouse habitat on a landscape scale, while considering ecological, economic and cumulative impacts. RMPs should be incorporated into sagebrush treatments as feasible.	BLM, WGFD, NRCS, BNF, SNF	BLM, WGFD, NRCS, BNF, SNF	on-going
	Commitment	Heart Mountain Sage-grouse Habitat Enhancements - prescribed burning and mowing to improve diversity in monotypic sagebrush	TNC	TNC, BHBLWG, Marathon Oil,	spring 2006
	Commitment	YU Bench Habitat Enhancement – mowed 800 acres in long, linear strips to increase diversity, seeded forbs and constructed a drip irrigation system and fences to enhance herbaceous production	BLM, WGFD	BLM, WGFD, BHBLWG, Marathon Oil	completed summer 2006
	Commitment	Buffalo Creek/Sand Draw sagebrush treatments – Mowed 300 acres to increase diversity and age class of sagebrush	WGFD, BLM	Marathon Oil, BLM, WGBGLC	completed summer 2006
	Commitment	Table Mountain and Emblem Bench sage-grouse habitat improvement - Mowing and seeding planned to increase grass and forb cover and provide diversity in sagebrush	BLM, WGFD	BHBLWG, BLM	proposed 2007
Livestock grazing management	**BHBLWG objective**	Land managers should use the Adaptive Management process to evaluate habitat conditions for sage-grouse, identify desired vegetation communities best suited for the site and obtain a list of RMPs to use for management of the site when grazing plans are revised.	BHBLWG, BLM, landowners, NRCS, BNF, SNF	BHBLWG, BLM, SNF, landowners, NRCS, BNF	on-going

Factor	Objective/ Commitment/ Recommendation	Action	Responsible parties[1]	Funding sources[1]	Time schedule
Livestock grazing management	**Commitment**	Heart Mountain sage-grouse habitat enhancements - Designed a grazing system to produced desired plant communities and ensure adequate forage remains.	TNC	TNC, NRCS, BHBLWG, Marathon Oil,	spring 2006
Water development	**BHBLWG objective**	The BLM, WGFD, and NRCS should assure that new water developments in sage-grouse habitats, provide access for sage-grouse and where possible, existing water developments should be retro-fit to provide access to water.	BLM, WGFD, NRCS, permittees, BHBLWG	BLM, WGFD, NRCS, permittees, BHBLWG	on-going
	Commitment	Water trough escape ramps – Retrofit existing stock tanks with ramps to allow wildlife to escape	Landowners, NRCS, Conservation Distr.	WNRTF, NRCS, BHBLWG, other LWGs	spring 2007
Invasive plants	**BHBLWG objective / commitment**	Land managers should monitor and evaluate proposed or implemented vegetation treatments in sage-grouse habitat to determine if invasive plant management is necessary.	BLM, WGFD, NRCS, BNF, SNF	BLM, WGFD, NRCS, BNF, SNF	on-going
Water development	**BHBLWG objective / commitment**	Through the life of the working group, the group will help facilitate funding to complete at least one water project per year with specific sage-grouse benefits. Agencies are expected to continue efforts each year to achieve this objective.	BHBLWG, BLM, landowners, BNF, SNF	BHBLWG, WNRTF, BLM, WGFD, landowners, BNF, SNF	began in 2006
	Commitment	Feraud Reservoir – Cleaning of reservoir	Guardians of the Range, BLM, North Gooseberry permittees,	Marathon Oil, Washakie Co CD, WHFW, WNRT	completed August 2006

Factor	Objective/ Commitment/ Recommendation	Action	Responsible parties[1]	Funding sources[1]	Time schedule
Water development	**Commitment**	PW Spring Restoration Project – Development and protection (fence) of 2 springs in sage-grouse lek and nesting habitat	Spring Gulch Cattle Co. (landowner), BLM	Spring Gulch Cattle Co. (landowner), BLM, BHBLWG	completed 2006
	Commitment	Heart Mountain sage-grouse habitat enhancement - Fenced water sources for wildlife use and provided additional watering sites	TNC	TNC, BHBLWG, Marathon Oil,	spring 2006
	Commitment	North Butte guzzlers-Installed 2 water collection tanks for sage-grouse	WGFD, BLM	BHBLWG	Spring 2007
Habitat and Monitoring	**BHBLWG objective / commitment**	Seek funding to support identification, delineation and mapping of important sage-grouse habitats with initial GIS coverages developed by Dec. 2011.	BHBLWG, BLM, WGFD, BNF, SNF	BHBLWG, BLM, SNF, BNF, WGFD	began in 2005
	Commitment	Aerial flights to detect winter use areas	WGFD, BLM, BNF	WGFD, BLM, BNF	2005-07
	Commitment	Inventoried and mapped sagebrush density north of Shell Creek and in Bluebank area	WGFD, BLM	WGFD	summer 2005
	Commitment	Big Horn Basin land cover mapping – Map vegetation cover, with emphasis on determining sagebrush density	WGFD, BLM	BHBLWG, WGFD, BLM, USFWS, RMEF	began in summer 2007
Energy/ mineral development	**BHBLWG objective**	Industry and permitting agencies should re-establish sagebrush habitat on disturbed sites previously occupied by sage-grouse by incorporating RMPs as appropriate.	BLM, WDEQ/LQD, mining companies, oil/gas companies	BLM, WDEQ/LQD, mining companies, oil/gas companies	on-going

Factor	Objective/ Commitment/ Recommendation	Action	Responsible parties[1]	Funding sources[1]	Time schedule
Energy/ mineral development	**Commitment**	Test plots to increase establishment of sagebrush on bentonite reclamation by planting sagebrush seedlings and using an experimental, inexpensive drip irrigation system	Shell Valley Consulting	BHBLWG, bentonite companies	began in spring 2007
Vegetation management	**BHBLWG objective / commitment**	By 2008, the BHBLWG will initiate efforts to create a GIS data layer that encompasses all of the available habitat treatments that have taken place Basin-wide for use in assessing cumulative impacts and guidance on future habitat treatments.	WGFD, BLM, NRCS, BNF, SNF, USGS	WGFD, BLM, BNF, SNF, NRCS	on-going
	Commitment	Big Horn Basin land cover mapping – This project should be able to detect sagebrush habitats that have been treated, depending upon rate of sage re-establishment	WGFD, BLM	BHBLWG, WGFD, RMEF BLM, USFWS, WNRTF	began in summer 2007
Research	**BHBLWG objective**	The BHBLWG will propose and solicit research on sage- grouse in at least one of the following areas: • Development of a reliable population estimation technique (or validation of techniques currently being developed) for sage-grouse in the Big Horn Basin, to be used in establishing minimum population goals; • Evaluate the impacts of predators (especially "new" predators) and implement management actions accordingly; • Evaluate grazing regimes and habitat treatments that have potential to benefit sage-grouse habitats; and/or • Assess impacts of weather on sage-grouse and their habitats.	BHBLWG, WGFD, BLM, Univ. Wyoming, other universities	BHBLWG, WNRTF, WGBGLC	proposals submitted beginning spring 2005, another RFP sent out in Sept. 2007 for more proposals

Factor	Objective/ Commitment/ Recommendation	Action	Responsible parties[1]	Funding sources[1]	Time schedule
Energy/mineral development	**BHBLWG objective**	By 2008, conduct at least one workshop/field tour to present successful low impact exploration, production, and/or reclamation techniques that could be used throughout the Basin.	Bentonite companies, Oil/gas companies	BHBLWG	
Energy/mineral development	**BHBLWG objective**	Where and when loss of sage-grouse habitat is unavoidable, industry should use off-site mitigation to produce similar habitat values.	Bentonite companies, Oil/gas companies	Bentonite companies, Oil/gas companies	
Education	**BHBLWG objective**	The BHBLWG will provide and request publication of two articles in local Conservation District newsletters on the potential effects of invasive plants on sage-grouse by 2008.	BHBLWG, Weed and Pest Districts	BHBLWG, Weed and Pest Districts	
Conflicting wildlife management	**BHBLWG objective / commitment**	WGFD should analyze impacts on sage-grouse when developing population objectives and strategies for big game species.	WGFD	WGFD	currently in practice
	BHBLWG objective / commitment	WGFD, in cooperation with federal state, local government and private landowners, should monitor vegetation use by big game wildlife in areas identified as important sage-grouse habitat and identify any resulting negative effects to sage-grouse habitat likely being caused by big game species. Areas where specific habitat problems are occurring should be identified and prioritized for corrective management actions to be taken that will reduce or eliminate negative impacts to sage-grouse.	WGFD, BLM, landowners	WGFD	began in 2004

Factor	Objective/ Commitment/ Recommendation	Action	Responsible parties[1]	Funding sources[1]	Time schedule
Livestock grazing	**BHBLWG objective**	Conduct two Big Horn Basin workshops/field tours by 2008 to demonstrate livestock management practices that can be beneficial to sage-grouse habitat.	BHBLWG	BHBLWG	
Livestock grazing, Vegetation management	**BHBLWG objective / commitment**	Within one year of plan adoption, the BHBLWG will identify and work with willing landowner(s), BLM and NRCS to apply the Ecological Site Description/Adaptive Management process to manage at least one project area for improved sage-grouse habitat.	BHBLWG, BLM, NRCS, WGFD, landowners, grazing permittees	BHBLWG, BLM, NRCS, WGFD, landowners, grazing permittees	by 2008
Farming	**BHBLWG objective**	Develop and facilitate distribution of a brochure on farming for sage-grouse, coordinated with UW Extension by December 2007.	BHBLWG, UW Coop Extension Service	BHBLWG, UW Coop Extension Service	
Water, Energy/Mineral development	**BHBLWG objective / commitment**	Develop reservoirs, wetlands, or other water sources as part of reclamation of mined lands in areas with limited water.	Mineral/Oil/Gas companies, WDEQ, BLM	Mineral/Oil/ Gas companies,	as possible, currently in practice
Conflicting wild horse management	**BHBLWG objective**	Request “Interested Party” status for the Big Horn Basin Local Working Group on all actions on the McCullough Peaks and 15-Mile horse herds through the life of the working group.	BHBLWG	BHBLWG	
Education	**BHBLWG objective**	In 2007, the working group will contact the coordinators of Project Learning Tree and WILD About OREO, CRM in the Classroom and Ag in the Classroom to discuss the development of a workshop to introduce teachers/students to the importance of sage-grouse and the sagebrush steppe in Wyoming. This workshop could include coordinating field trips to view sage-grouse leks.	BHBLWG, WGFD, Dept Ag	BHBLWG, WGFD, Dept Ag	

Factor	Objective/ Commitment/ Recommendation	Action	Responsible parties[1]	Funding sources[1]	Time schedule
Hunting	**BHBLWG objective / commitment**	The WGFD should recommend hunting regulations that are responsive to fluctuations in sage-grouse population levels.	WGFD	WGFD	each year sage-grouse seasons are established
Monitoring	**BHBLWG objective / commitment**	Field personnel with WGFD and BLM should utilize the Wildlife Observation System (WOS) and/or Wyoming Natural Diversity Database (WyNDD) to document sage-grouse locations and other relevant data.	WGFD, BLM	WGFD, BLM	Completed - Letter was written 4/1/06 to BLM and WGFD offices with this suggestion.
Energy/ mineral development	**BHBLWG objective / commitment**	The BHBLWG will request that the NRCS area resource conservationist contact the Bridger Plant Materials Center to develop sage-grouse friendly seed mixes from existing plant materials for the Big Horn Basin.	BHBLWG	BHBLWG	Completed - Letter sent through NRCS to Plant Materials Center, October 2006.
Water, energy development	**BHBLWG objective / commitment**	BHBLWG will submit a letter to the WDEQ & Region 8, EPA stating support for continued historic (pre-1975), conventional oil field surface discharges of water in sage-grouse habitats that meet the needs of wildlife and livestock without bioaccumulation of contaminants at levels that would be hazardous to human health and the environment.	BHBLWG	BHBLWG	Completed - letter was sent Feb. 2006

Factor	Objective/ Commitment/ Recommendation	Action	Responsible parties[1]	Funding sources[1]	Time schedule
Energy/mineral development	**BHBLWG objective**	BHBLWG will write a letter in 2007 requesting that permitting agencies allow use of appropriate, non-native vegetation species to aid in reclamation of difficult areas.	BLM, WDEQ/LQD, oil/gas and mining companies	BHBLWG	
Predation	**BHBLWG objective**	Reduce impacts of predation where and when science has shown it to be negatively impacting a grouse population.	Local Predator Boards, ADMB, WGFD	Local Predator Boards, ADMB, WGFD	as problems are identified
Monitoring	**BHBLWG objective / commitment**	Improve quantity, quality, and reliability of data collected on sage-grouse. 1) WGFD, BLM, industry and volunteers should use established protocols for monitoring leks and lek complexes. 2) WGFD and BLM should develop standardized methodology for surveying and documenting sage-grouse broods. 3) State and federal agencies and industry should prioritize funds to insure personnel to adequate implement protocols for monitoring sage-grouse	WGFD, BLM	WGFD, BLM	immediately

Factor	Objective/ Commitment/ Recommendation	Action	Responsible parties[1]	Funding sources[1]	Time schedule
Urban expansion, Education	**BHBLWG objective / commitment**	Present information to the public about potential impacts of subdivisions on sage-grouse and how to minimize impacts of living in the "country" on wildlife and habitats.	BHBLWG	County Conservation Districts, BHBLWG	In March 2006, BHBLWG gave a presentation as part of "Living on a Few Acres" program hosted by Cody Conserv. District. **This will be an on-going effort**.
Oil/gas development	Recommendation / **BHBLWG objective**	Implement those RMPs, as feasible, to mitigate impacts to sage-grouse	Oil/gas exploration and development companies	Oil/gas exploration and development companies	
Bentonite mining	Recommendation / **BHBLWG objective**	Implement those RMPs, as feasible, to mitigate impacts to sage-grouse	Bentonite companies, othe mining companies	Bentonite companies, other mining companies	
Monitoring	Recommendation / **BHBLWG objective**	WGFD should compile harvest data on sage-grouse that more accurately represents the Big Horn Basin sub-population. Management Area 37 should be split on the Bighorn Mountain divide, with the west portion of that area made into a new management area or combined with Management Area 21.	WGFD	WGFD	BHBLWG sent request to WGFD on 8/272007; WGFD began process to create new area

Commitments and Actions outside the scope of the Big Horn Basin Local Working Group.

The following list of actions and commitments are being undertaken or proposed by agencies and industry, outside the scope of the Big Horn Basin Local Working Group, to assure sage-grouse populations in the BHBCA remain viable. Actions are listed alphabetically by Factor and not by order of importance.

Factor	Objective/ Commitment/ Recommendation	Action	Responsible parties	Funding Sources	Time schedule
Energy/mineral development	**BLM Commitment**	Apply seasonal stipulations on surface disturbing activities on suitable sage-grouse habitats within two miles around active leks.	BLM, mineral/oil/gas companies	no funding required	currently in place
	BLM Commitment	Apply no surface occupancy within ¼ mile of all active sage-grouse lek locations for all surface disturbing activities.	BLM, mineral/oil/gas companies	no funding required	currently in place
Habitat management	**Commitment**	Constructed 2, 1-acre fenced exclosures with water drip irrigation systems on YU bench to provide late summer green herbaceous forage for sage-grouse broods	BLM, WGFD, Marathon Oil	BLM, SFW, Marathon Oil	2006, 2007 completed
	Commitment	Through a settlement agreement, Bill Barrett Corporation has donated $25,000 (held by WHFW) for sage-grouse habitat projects in the southwest corner of the Big Horn Basin	Biodiversity Associates, WHFW, BHBLWG	Bill Barrett Corporation	beginning 2006 – funds have not been obligated to date
Habitat management & water development	**Commitment**	Installed exclosures around 6 springs (4 acres) to protect and enhance the wetland/riparian area, benefiting fish, wildlife, livestock, and overall watershed health.	BLM, WGFD, grazing permittee	BLM, WGFD, RMEF, grazing permittee	2004
	Commitment	Maintained 8 existing fenced spring exclosures (20 acres) to continue to protect and enhance the wetland/riparian area, benefiting fish, wildlife, livestock, and overall watershed health.	BLM, WGFD	BLM	2004

Factor	Objective/ Commitment/ Recommendation	Action	Responsible parties	Funding Sources	Time schedule
Habitat management & water development	**Commitment**	Installed exclosures around 5 springs (5 acres) to protect and enhance the wetland/riparian area, benefiting fish, wildlife, livestock, and overall watershed health.	BLM, WGFD, RMEF, WNRTA, grazing permittee	BLM, grazing permittee	2005
	Commitment	Maintained 10 existing fenced spring exclosures (25acres) to continue to protect and enhance the wetland/riparian area, benefiting fish, wildlife, livestock, and overall watershed health.	BLM, WGFD	BLM	2005
	Commitment	Installed exclosures around 7 springs (8 acres) to protect and enhance the wetland/riparian area, benefiting fish, wildlife, livestock, and overall watershed health.	BLM, WGFD, grazing permittee	BLM, WGFD, RMEF, WNRTF, grazing permittee	2006
	Commitment	Maintained 10 existing fenced spring exclosures (25acres) to continue to protect and enhance the wetland/riparian area, benefiting fish, wildlife, livestock, and overall watershed health.	BLM, WGFD	BLM	2006
	Commitment	Installed 223,622 ft water pipeline, 65 stock tanks, 14 spring developments, 25 stock ponds, and 3 wetland developments to improve vegetation conditions on approximately 132,000 acres of possible sage-grouse habitat in the Kirby Creek drainage	Kirby Creek CRM, BLM, NRCS, grazing permittee, Hot Springs Co. Conserv. Dist.	Kirby Creek CRM, BLM, NRCS, Hot Springs Co. Conserv. Dist., grazing permittee, WyDEQ, WNRTF, WGFD, WGBGLC	2003 to present

Factor	Objective/ Commitment/ Recommendation	Action	Responsible parties	Funding Sources	Time schedule
Habitat management & water development	**Commitment**	Installed exclosures around 2 springs (4 acres) to protect and enhance wetland/ riparian area, benefiting fish, wildlife, livestock, and overall watershed health.	BLM, WGFD, grazing permittee	BLM, WGFD, RMEF, WNRTA, grazing permittee	2007
Invasive Plants	**Commitment**	Treated approximately 500 acres of noxious weed infestations within sage-grouse habitats with herbicide.	BLM	BLM	2006
	Commitment	Kirby Creek Special Weed Management Zone – Treating salt cedar, Russian olive, knapweed and thistle in 15 miles of riparian zone along Kirby and Buffalo Creeks and nearby upland reservoirs	Hot Springs Co W&P, Kirby Ck CRM	Hot Springs Co W&P, Kirby Ck CRM	on-going since 2002
	Commitment	Cottonwood/Grass Creek Watershed Weed Mgmt Zone– Removed and treated Russian olives, white top, salt cedar, knapweed and musk thistle along 9 miles of riparian zone	Hot Springs Co W&P, Cottonwood/ Grass Creek CRM	Hot Springs Co W&P, Cottonwood/ Grass Creek CRM	on-going since 2004
Livestock management	**Commitment**	Highway Junction Allotment. Convert to non-growing season use/partially fence out riparian. Intent – ensure/improve native rangeland health, provide habitat for various wildlife (active leks present), and ensure an adequate feed source/cover for domestic livestock and wildlife of the area. There are ~5731 public acres within the allotment boundary.	BLM, grazing permittee, private land owner	BLM, grazing permittee, private land owner	2004, 2005, completed 2006
	Proposal	Implementation of ecological site descriptions and adaptive management into improving grazing management on 30,000 acres of sage-grouse habitat on BLM and private lands in the Nowater and Gooseberry watersheds	NRCS, grazing permittee, BLM	NRCS, grazing permittee, BLM	To be initiated in 2008

Factor	Objective/ Commitment/ Recommendation	Action	Responsible parties	Funding Sources	Time schedule
Livestock management	**Commitment**	Ramul Individual Allotment - Convert to non-growing season use to improve native rangeland health, provide habitat for various wildlife (active leks in area), and ensure an adequate feed source/cover for domestic livestock and wildlife of the area. There are ~135 public acres within the allotment boundary.	BLM, grazing permittee	BLM, grazing permittee	completed spring 2007
	Commitment	Hamilton Dome Allotment (~11,125 acres) - Partial deferment of allocated growing season use AUMs to non-growing season use to improve native rangeland health, provide habitat for various wildlife (active leks in area), and ensure an adequate feed source/cover for domestic livestock and wildlife of the area.	BLM, grazing permittee	BLM, grazing permittee	completed spring 2007
	Commitment	Milk Creek Allotment (382 acres) - Partial deferment of allocated growing season use AUMs to non-growing season use to improve native rangeland health, provide habitat for various wildlife (sage-grouse brood rearing), and ensure an adequate feed source/cover for domestic livestock and wildlife of the area.	BLM, grazing permittee	BLM, grazing permittee	completed spring 2007
	Commitment	Manderson Group Allotment - Change in season of use from April-July cattle use to October-February cattle use on 6531 acres of public land to improve native rangeland health, provide habitat for various wildlife (sage-grouse leks within five miles), and ensure an adequate feed source/cover for domestic livestock and wildlife of the area.	BLM, landowner, grazing permittee	BLM, grazing permittee	completed in 2006

Factor	Objective/ Commitment/ Recommendation	Action	Responsible parties	Funding Sources	Time schedule
Livestock management	**Commitment**	Designed rotational grazing strategies on 16 allotments encompassing 46,500 acres of rangelands to improve ecological status and insure that adequate residual forage remains on the watershed. These positive shifts in vegetative composition translate to increases in desirable species, herbaceous cover values, height and diversity of vegetation and decreased soil erosion.	BLM, grazing permittees	BLM, grazing permittees	implemented in 2004
	Commitment	Designed rotational grazing strategies on 5 allotments encompassing 5,400 of rangelands to improve ecological status and insure that adequate residual forage remains on the watershed. These positive shifts in vegetative composition translate to increases in desirable species, herbaceous cover values, height and diversity of vegetation and decreased soil erosion.	BLM, grazing permittees	BLM, grazing permittees	implemented in 2005
	Commitment	Designed rotational grazing strategies on 10 allotments encompassing 57,400 of rangelands to improve ecological status and insure that adequate residual forage remains on the watershed. These positive shifts in vegetative composition translate to increases in desirable species, herbaceous cover values, height and diversity of vegetation and decreased soil erosion.	BLM, grazing permittees	BLM, grazing permittees	implemented in 2006
	Commitment	Designed rotational grazing strategies on 6 allotments encompassing 33,900 of rangelands to improve ecological status and insure that adequate residual forage remains on the watershed. These positive shifts in vegetative composition translate to increases in desirable species, herbaceous cover values, height and diversity of vegetation and decreased soil erosion.	BLM, grazing permittees	BLM, grazing permittees	implemented in 2007

Factor	Objective/ Commitment/ Recommendation	Action	Responsible parties	Funding Sources	Time schedule
Mining	**Commitment**	A cumulative effects analysis is being conducted on impacts of bentonite mining on sagebrush habitats and sage dependent wildlife species.	BLM	BLM	To be completed by Sept. 2007
Monitoring	**Commitment**	Aerial flights and ground surveys to delineate sage-grouse winter concentration areas	WGFD, BLM	BLM, WGFD	2005, 06, 07 and ongoing
Monitoring	**Commitment**	Volunteers and agency personnel conduct lek surveys/counts annually and report data to WGFD. Brood surveys are also conducted annually.	WGFD, BLM	WGFD, BLM	annually
Off-site mitigation (bentonite mining), Water development	**Commitment**	Installed a water guzzler near three leks and nesting/winter habitat along Bear Creek	Wyo-Ben Inc	Wyo-Ben Inc	2005
Off-site mitigation (Oil/gas), Vegetation management, water development	**Commitment**	Donated $30,000 for habitat improvement projects to benefit sage-grouse in the BHBCA: (see project details above) • Heart Mountain Sage-grouse Habitat Enhancements • YU Bench Habitat Enhancement • Buffalo Creek/Sand Draw Sagebrush treatments • Feraud Reservoir	Marathon Oil	Marathon Oil	2004, 2005, 2006
Predator management	**Commitment**	A 3-year effort to control badgers, skunks, fox and feral cats to determine affects on sage-grouse in the Cottonwood and Grass Creek drainages	Hot Springs Predator Management Board, Cottonwood/ Grass Creek CRM, WS	Hot Springs Predator Management Board, WS	began in 2007

Factor	Objective/ Commitment/ Recommendation	Action	Responsible parties	Funding Sources	Time schedule
Travel management	**Commitment**	Upper Nowood Travel Management Area, 50,000 acres - Reduced number of miles of roads per square mile.	BLM	BLM	2006 - ongoing enforcement
	Commitment	South Brokenback Travel Management Area, 25,000 acres - Reduced number of miles of roads per square mile.	BLM	BLM	2006 - ongoing enforcement
	Proposal	Alkali road and Hyattville Logging road travel management – Proposed to reduce number of miles of roads per square mile.	BLM	BLM	summer 2007
	Proposal	Purchase water trailer, rip and reseed closed roads	BLM	BLM	2008
Vegetation management	**Commitment**	South Butte sagebrush treatments – Mowed 300 acres to increase diversity and age class of sagebrush	BLM, WGFD	BLM	completed summer of 2004
	Commitment	Red Gulch/Alkali sage-grouse habitat inventory – Identified issues with sage-grouse habitat (i.e. conifer encroachment, sagebrush health) and recommended vegetation treatments.	BLM	BLM	summer 2004 - ongoing
	Commitment	Nowater sage-grouse habitat inventory - Identified issues with sage-grouse habitat (i.e. conifer encroachment, sagebrush health) and recommended vegetation treatments.	BLM	BLM	summer 2004 - ongoing
	Commitment	Switchback Allotment - Mowed 38 acres of sagebrush to increase age-class diversity of sagebrush and increase forb and grass abundance specifically to benefit sage-grouse.	BLM	BLM	completed 2005

Factor	Objective/ Commitment/ Recommendation	Action	Responsible parties	Funding Sources	Time schedule
Vegetation management	Proposal	Bader Draw prescribed fire – Will burn 30% of 1200 acre treatment block to thin dense sagebrush stand and improve diversity of herbaceous vegetation	NRCS, private landowner	NRCS, private landowner	fall 2008
	Commitment	Moss Ranch/Little Mountain prescribed burn - Treated 5000 acres of monotypic sagebrush stands to improve overall watershed/ecological condition and to promote grass/forb production and allow for a younger age class of sagebrush to re-establish.	BLM, grazing permittees, WGFD	BLM, WGFD, RMEF, WNRTF, FNAWS-WY	1995 thru 2006
	Commitment	YU Bench habitat enhancement – Treated mechanically 575 acres of Wyoming sagebrush in long, linear strips to increase plant diversity and seeded forbs to enhance the herbaceous component. Installed (2) exclosures with drip irrigation systems to enhance herbaceous production.	BLM, grazing permittees, WGFD	BLM, grazing permittees, WGFD, SWF, WNRTF	2006
	Commitment	Heart Mountain watershed enhancement - Treated 230 acres of Wyoming and mountain sagebrush with prescribed fire to enhance overall watershed condition and to promote diversity and a higher ecological status	BLM, grazing permittees, WGFD	BLM, grazing permittees, WGFD, RMEF	2006
	Commitment	Fork in the Road sage-grouse habitat enhancement - Treated 110 acres of monotypic sagebrush stands with prescribed fire to improve overall watershed and ecological condition and to promote grass/forb production and allow for a younger age class of sagebrush to re-establish.	BLM, grazing permittees, WGFD	BLM, grazing permittees, WGFD	completed 2006

Factor	Objective/ Commitment/ Recommendation	Action	Responsible parties	Funding Sources	Time schedule
Vegetation management	**Commitment**	Polecat Bench sagebrush/grouse habitat enhancement - Mechanically treated 200 acres of Wyoming sagebrush to improve overall watershed/ecological condition in monotypic sagebrush stands and to promote grass/forb production and allow for a younger age class of sagebrush to re-establish.	BLM, grazing permittees, WGFD	BLM, grazing permittees, WGFD	2006
	Proposal	Heart Mountain watershed enhancement - Proposed treatment with prescribed fire 100 acres of Wyoming and mountain sagebrush to enhance overall watershed condition, and to promote diversity and a higher ecological status	BLM, grazing permittees, WGFD	BLM, grazing permittees, WGFD, RMEF	proposed 2007
	Commitment	Polecat Bench sagebrush/grouse habitat enhancement - Mechanically treated 157 acres of monotypic sagebrush stands to improve overall watershed/ecological condition and to promote grass/forb production and allow for a younger age class of sagebrush to re-establish	BLM, grazing permittees, WGFD	BLM, grazing permittees, WGFD	2004
	Commitment	Moss Ranch/Little Mountain prescribed burn - treated 105 acres of Wyoming sagebrush & Utah juniper to improve overall watershed/ ecological condition in monotypic sagebrush stands and to promote grass/forb production and allow for a younger age class of sagebrush to re-establish.	BLM, grazing permittees, WGFD	BLM, grazing permittees, WGFD, RMEF	2004
	Commitment	Sage Creek sagebrush/grouse habitat enhancement - treated 400 acres of Wyoming sagebrush mechanically and with prescribed fire to improve overall watershed/ecological condition in monotypic sagebrush stands and to promote grass/forb production and allow for a younger age class of sagebrush to re-establish	BLM, grazing permittees, WGFD	BLM, grazing permittees, WGFD	2004
	Commitment	YU Bench habitat enhancement –treated mechanically 850 acres of Wyoming sagebrush in long, linear strips to increase plant diversity and seeded forbs to enhance the herbaceous component.	BLM, WGFD, grazing permittees	BLM, WGFD, BHBLWG, grazing permittees	2004

Factor	Objective/ Commitment/ Recommendation	Action	Responsible parties	Funding Sources	Time schedule
Vegetation management	**Commitment**	Heart Mountain watershed enhancement - treated mechanically and with prescribed fire 230 acres of Wyoming and mountain sagebrush to enhance overall watershed condition, and to promote diversity and a higher ecological status.	BLM, WGFD, grazing permittees, RMEF	BLM, WGFD, grazing permittees, RMEF	2004
	Commitment	Sage Creek sagebrush/grouse habitat enhancement - mechanically treated 271 acres of Wyoming sagebrush to improve overall watershed/ecological condition in monotypic sagebrush stands and to promote grass/forb production and allow for a younger age class of sagebrush to re-establish	BLM, grazing permittees, WGFD	BLM, grazing permittees, WGFD	completed 2005
	Commitment	YU Bench habitat enhancement –mechanically treated 850 acres of Wyoming sagebrush in long, linear strips to increase plant diversity and seeded forbs to enhance the herbaceous component.	BLM, grazing permittees, WGFD	BLM, grazing permittees, WGFD	2005
	Commitment	Polecat Bench sagebrush/grouse habitat enhancement - treated 266 acres of Wyoming sagebrush mechanically to improve overall watershed/ecological condition in monotypic sagebrush stands and to promote grass/forb production and allow for a younger age class of sagebrush to re-establish	BLM, grazing permittees, WGFD	BLM, grazing permittees, WGFD	2005
	Commitment	Heart Mountain watershed enhancement - treated mechanically and with prescribed fire 160 acres of Wyoming and mountain sagebrush to enhance overall watershed condition, and to promote diversity and a higher ecological status.	BLM, grazing permittees, WGFD	BLM, grazing permittees, WGFD, RMEF	2005

Factor	Objective/ Commitment/ Recommendation	Action	Responsible parties	Funding Sources	Time schedule
Vegetation management	**Commitment**	Moss Ranch/Little Mountain prescribed burn - treated 255 acres of Wyoming sagebrush & Utah juniper to improve overall watershed/ecological condition in monotypic sagebrush stands and to promote grass/forb production and allow for a younger age class of sagebrush to re-establish	BLM, grazing permittees, WGFD	BLM, grazing permittees, WGFD, RMEF	2006
	Proposal	Polecat Bench sagebrush/grouse habitat enhancement - propose treatment mechanically and with fire 400 acres of Wyoming sagebrush to improve overall watershed/ecological condition in monotypic sagebrush stands and to promote grass/forb production and allow for a younger age class of sagebrush to re-establish.	BLM, grazing permittee, WGFD	BLM, grazing permittee, WGFD	proposed 2007
	Proposal	Breteche Creek watershed enhancement - proposed treatment with prescribed fire of 30 acres of Wyoming & mountain sagebrush to improve ecological status, diversity and overall watershed health for big game and other sagebrush obligates.	BLM, grazing permittees, WGFD	BLM, grazing permittees, WGFD, RMEF	proposed 2007
	Proposal	Till/disc 152 acres of blue grama sod and seed with native forbs and grasses to enhance overall watershed condition and improve wildlife habitat.	BLM, WGFD	BLM	2006
	Proposal	Till/disc 150 acres of blue grama sod and seed with native forbs and grasses to enhance overall watershed condition and improve wildlife habitat.	BLM, WGFD	BLM	proposed 2007
	Proposal	Till/disc 155 acres of blue grama sod and seed with native forbs and grasses to enhance overall watershed condition and improve wildlife habitat.	BLM, WGFD	BLM	proposed 2008

Factor	Objective/ Commitment/ Recommendation	Action	Responsible parties	Funding Sources	Time schedule
Vegetation management	Proposal	Moss Ranch/Little Mountain prescribed burn - Proposed treatment of 200 acres of Wyoming sagebrush & Utah juniper to improve overall watershed/ecological condition in monotypic sagebrush stands and to promote grass/forb production and allow for a younger age class of sagebrush to re-establish	BLM, grazing permittees, WGFD	BLM, grazing permittees, WGFD, RMEF, WNRTA	proposed 2007
Water development	**Commitment**	West Five Mile Allotment - provide more dependable water for cattle and wildlife (including sage-grouse) by excavating silt from six reservoirs.	BLM, grazing permittee	BLM, grazing permittee	partially completed in 2005/2006
	Commitment	Installation of a 2 wildlife guzzlers within sage-grouse breeding, nesting and brood rearing habitat in the Squaw Teats/East Ridge area.	BLM	BLM, WGFD, Wy Water for Wildlife, Bowhunters of Wyoming	installed spring 2007
	Commitment	Fifteenmile Wild Horse Herd Management Area: reservoir maintenance – improve water availability by construction of 2 new pits at old reservoir locations in sage-grouse habitat.	BLM	BLM	2004
	Commitment	Upper Nowater Stockwater Well #2 - Improve water availability by drilling a water well and providing a water tank in sage-grouse habitat.	BLM, grazing permittee	BLM, grazing permittee	2005
	Commitment	Upper Nowater Stockwater Pipeline - Improve water availability by providing additional water sources in sage-grouse habitat.	BLM, grazing permittee	BLM, grazing permittee	2006
	Commitment	Cottonwood/Grass Creek Watersheds – Developed numerous springs, installed 42,000 ft pipeline and 23 water tanks for wildlife and livestock	Cottonwood/ Grass Creek CRM	BLM, WGFD, landowner	2005 to present

Factor	Objective/ Commitment/ Recommendation	Action	Responsible parties	Funding Sources	Time schedule
Water development	Proposed	Cottonwood/Grass Creek Watersheds – Develop numerous springs, install 237,000 ft pipeline and 53 water tanks for wildlife and livestock	Cottonwood/ Grass Creek CRM	BLM, WGFD, landowner	2008 and on-going
	Proposal	Installation of a 2 wildlife guzzlers within sage-grouse breeding, nesting and brood rearing habitat in the Nowater & Kirby Creek areas.	BLM, WGFD	BLM, WGFD, Water for Wildlife, Bowhunters of Wyoming	installation in 2008

Funding Opportunities for Conservation Efforts

Many options exist for funding sage-grouse conservation. The list below includes funding sources that can address various scales of projects ranging from the individual landowner to multi-state efforts. Private foundations, companies and individuals often partner with other funding sources in conservation efforts. Finding and making contact with these potential partners is best accomplished on a local level. Contact the sources for detailed information, eligibility and application criteria. The following list of potential funding sources is not intended to be all encompassing.

In 2005, Governor Freudenthal requested a supplemental budget appropriation of $500,000 from the Wyoming State Legislature to be used to fund administration of the eight local sage-grouse working groups and conservation projects endorsed by them. The legislature approved this request. Of the $500,000 appropriation, $425,000 was dedicated for conservation projects. Four of the projects submitted by the BHBLWG were approved and received full or partial funding, totaling $15,600.

In 2006, the State of Wyoming's General Fund budget passed by the legislature included a $1.1 million appropriation for sage-grouse conservation. This included about $135,000 for the administrative costs of local working group functions and mapping and $1-million for implementation of local conservation plan projects. This funding was available for expenditure from July 1, 2006 – June 30, 2008. Seven of the 8 Local Working Groups (LWGs), Bates Hole, Big Horn Basin, Northeast, South-Central, Southwest, Upper Green River and Wind River/Sweetwater, received $134,000 over the biennium while the Jackson Hole LWG received $62,000 over the biennium.

LWGs chose to either solicit projects within their local communities or chose to fund projects already identified through their planning process. The funding was to be used for plan implementation, as opposed to the interim funding that was used to fund the 2005-2006 projects. Projects were outlined and justified in local Conservation Plans. Projects funded before plan finalization were also included in the Plan. The funding was to be spent at any time over the two-year period between July 1, 2006 and June 30, 2008 (with the possibility of encumbrance through the field season). Cooperative funding partnerships were encouraged.

This state appropriation was used to funds projects listed in the Table of Commitments, Actions, and Recommendations (page 71) with BHBLWG listed as a funding source. A list of other potential funding sources, aside from the General Fund appropriations, is provided below. Additional funding sources via the WAFWA's Greater Sage-Grouse Conservation Strategy and/or other national scale funding sources may become established in the subsequent years.

Potential Funding Sources

STATE OF WYOMING SOURCES:

Wyoming Wildlife and Natural Resource Trust Account - Created by legislative action in 2005 for the purposes of preserving and enhancing Wyoming's wildlife and natural resources. Income from the trust account is used to fund a wide variety of conservation programs. http://wwnrt.state.wy.us

Wyoming Game and Fish Department (WGFD) Trust Fund - Matching grants program for riparian or upland habitat improvement, water development, and industrial water projects. http://gf.state.wy.us

Landowner Incentive Program (LIP) - WGFD/U.S. Fish & Wildlife Service – Provides Federal funds to enhance habitats for sensitive fish and wildlife species on private lands. Priorities in Wyoming are grassland, sagebrush and prairie watersheds. Matching funds, goods or services are required. http://gf.state.wy.us

Wyoming Sage-Grouse Conservation Fund - WGFD/Wyoming State General Fund – Funding approved by the legislature via the Governor's budget request designed to implement projects identified in local Sage-Grouse Conservation Plans. http://gf.state.wy.us

Wyoming Animal Damage Management Board (ADMB) – Provides funding for the purposes of mitigating damage caused to livestock, wildlife and crops by predatory animals, predacious birds and depredating animals or for the protection of human health and safety. http://www.wyadmb.com

Small Water Project Program (SWPP) - Wyoming Water Development Commission (WWDC) – Projects may provide improved water quality, habitat and water for fish and wildlife, improved habitat within the riparian corridor, increased recreational opportunities, or address environmental concerns by providing water supplies to support plant and animal species, or serve as instruments to improve range land conditions. Projects may include construction/rehabilitation of small reservoirs, ponds, wells, pipelines and conveyance facilities, springs, windmills, and wetland developments. http://wwdc.state.wy.us/smallwaterproj/smallwaterproj.html

FEDERAL SOURCES:

U.S. Dept. of Interior, Fish and Wildlife Service (http://www.fws.gov**):**

Partners for Fish and Wildlife Program – Provides assistance to private landowners who want to restore or improve habitat on their property. The landowner is reimbursed based on the cost sharing formula in the agreement, after project completion.

Private Stewardship Program – Provides grants or other assistance to individuals and groups engaged in private conservation efforts that benefits species listed or proposed as endangered or threatened under the Endangered Species Act, candidate species, or other at-risk species on private lands. Maximum Federal share is 90%.

Cooperative Conservation Initiative - Supports efforts to restore natural resources and establish or expand wildlife habitat. Maximum Federal share is 50%.

Multi-state Conservation Grant Program - Supports sport fish and wildlife restoration projects identified by the International Association of Fish and Wildlife Agencies. Maximum Federal share is 100%.

Tribal Landowner Incentive Program - For actions and activities that protect and restore habitats that benefit Federally listed, proposed, or candidate species, or other at-risk species on tribal lands. Maximum Federal share is 75%.

Tribal Wildlife Grants – Provides for development and implementation of programs for the benefit of tribal wildlife and their habitat. Maximum Federal share is 100%.

Conservation Grants - Provides financial assistance to States to implement wildlife conservation projects such as habitat restoration, species status surveys, public education and outreach, captive propagation and reintroduction, nesting surveys, genetic studies and development of management plans. Maximum Federal share is 75 % for a single state or 90% for two or more states implementing a joint project.

U.S.D.A. Farm Service Agency (FSA) (http://www.fsa.usda.gov/pas/**):**

Conservation Reserve Program (CRP) - A voluntary program for agricultural landowners. Through CRP, you can receive annual rental payments and cost-share assistance to establish long-term, resource conserving covers and enhance wildlife habitat on eligible agricultural land.

U.S.D.A. Natural Resource Conservation Service (NRCS) (http://www.wy.nrcs.usda.gov**)**

Conservation Innovation Grants (CIG) - CIG is a voluntary program that enables the NRCS to work with public and private entities to accelerate the development and adoption of innovative conservation approaches and technologies in conjunction with agricultural production.

Conservation Technical Assistance (CTA) - Provides voluntary conservation technical assistance to land-users, communities, units of state and local government, and other Federal agencies in planning and implementing conservation systems. This assistance is for planning and implementing conservation practices that address natural resource issues.

Environmental Quality Incentives Program (EQIP) - Provides a voluntary conservation program for farmers and ranchers that promote agricultural production and environmental quality as compatible goals. EQIP offers financial and technical help to assist eligible participants install or implement structural and management practices on eligible agricultural land.

Wildlife Habitat Incentives Program (WHIP) – Provides a voluntary program to develop and improve wildlife habitat primarily on private land by providing both technical assistance and up to 75% cost-share assistance to establish and/or improve fish and wildlife habitat.

Sage-Grouse Restoration Project (SGRP) – Cooperative effort involving private landowners, agencies, organizations and universities in a process to evaluate and document, through research and demonstration areas, the effects of NRCS conservation practices in restoring sage-grouse habitat and populations.

Grazing Land Conservation Initiative (GLCI) grants - A nationwide collaborative process of individuals and organizations working to maintain and improve the management, productivity, and health of the Nation's privately owned grazing land. This process has formed coalitions that actively seek sources to increase technical assistance and public awareness activities that maintain or enhance grazing land resources.

Cooperative Conservation Partnership Initiative (CCPI) - A voluntary program established to foster conservation partnerships that focus technical and financial resources on conservation priorities in watersheds and airsheds of special significance. Under CCPI, funds are awarded to State and local governments and agencies; Indian tribes; and non-governmental organizations that have a history of working with agricultural producers.

Conservation Security Program (CSP) - A unique program that goes beyond the past approach of installing conservation practices. Instead, CSP offers rewards to those who have been good stewards of the soil and water resources on their working agricultural land. It also offers incentives for those who wish to exceed the minimum levels of resource protection and enhance the natural resources on the land they manage. The program is available in designated watersheds.

U.S. Dept. of Interior, Bureau of Land Management (http://www.blm.gov **)**

Challenge Cost Share – This program is designed to leverage funds with partners to monitor and inventory resources; implement habitat improvement projects; develop recovery plans; protect or document cultural resources; provide enhanced recreational experiences; and to better manage wild horse and burro populations. Matching funds, goods or services are required.

Cooperative Conservation Initiative (CCI) – CCI was designed to remove barriers to citizen participation in the stewardship of our natural resources and to help people take conservation into their own hands by undertaking projects at the local level. Projects must seek to achieve the actual restoration of natural resources and/or the establishment or expansion of habitat for wildlife. Matching funds, goods or services are required.

U.S.D.A. Forest Service (http://www.fs.fed.us**)**

Cooperative project funding – Contact local U.S. Forest Service personnel for information about opportunities to develop partnerships in projects involving National Forests or National Grasslands.

Partnership Resource Center - The Partnership Resource Center of the National Forest Foundation (NFF) and the USDA - Forest Service (FS) provides partnering organizations and FS staff with the information to enhance working relationships. Partnerships expand opportunities for obtaining grants. Many funding sources prefer or require them because projects involving partnerships have an increased potential for success. http://www.partnershipresourcecenter.org

NON-GOVERNMENTAL ORGANIZATIONS (NGOs):

Cooperative Sagebrush Initiative (CSI) – CSI is an emerging region-wide, citizen-led effort aimed at conserving the western sagebrush steppe biome through a collaborative, coordinated, and cost-effective public-private partnership. The Initiative intends to create incentives for landowners, local communities, and private industry to invest in habitat restoration and other conservation actions that would result in long-term, verifiable recovery of the greater sage-grouse and improvement of other species of concern in the sagebrush range.
http://www.sandcounty.net/programs/cbcn/sagewise/

Intermountain West Joint Venture (IWJV) - Joint Venture Cost-Share - Habitats within the IWJV area support nearly 100% of the range of all high priority sagebrush steppe landbird species, such as: Sage Sparrow, Sage Thrasher, Sage-Grouse and Brewer's Sparrow. The purpose of Cost-Share is long-term conservation of bird habitat through partnerships. http://iwjv.org/costshare.htm

Mule Deer Foundation (MDF) - MDF's goals center on restoring, improving and protecting mule deer habitat. MDF achieves its goals through partnering with state and federal wildlife agencies, conservation groups, businesses and individuals to fund and implement habitat enhancement projects on both public and private lands. http://www.muledeer.org

National Fish and Wildlife Foundation - Native Plant Conservation Initiative (NPCI) - NPCI grants of federal dollars are provided to non-profit organizations and agencies for conservation of native plants. NPCI grants range from $5,000 to

$40,000, averaging $15,000. Non-Federal matching funds, goods or services are required. There is a strong preference for "on-the-ground" projects that involve local communities and citizen volunteers in the restoration of native plant communities. http://www.nfwf.org/programs/npci.cfm

National Fish and Wildlife Foundation - Pulling Together Initiative (PTI) - Provides support for the formation of local Weed Management Area (WMA) partnerships. These partnerships engage federal resource agencies, state and local governments, private landowners, and others in developing weed management projects within an integrated pest management strategy. Non-Federal matching funds, goods or services are required. http://www.nfwf.org/programs/pti.cfm

National Fish and Wildlife Foundation (NFWF) - General Matching Grant Program - Provides matching grants to priority projects that address fish and wildlife conservation and the habitats on which they depend, work proactively to involve other conservation and community interests, leverage NFWF funding, and evaluate project outcomes. Government agencies, educational institutions, and nonprofit organizations may apply. Grants typically range from $10,000-$150,000. http://www.nfwf.org

National Wild Turkey Federation (NWTF) - NWTF is a grassroots, nonprofit organization established for the conservation of wild turkey and hunting heritage. NWTF supports scientific wildlife management on public, private and corporate lands. http://www.nwtf.org

North American Grouse Partnership (NAGP) - Promotes the conservation of prairie grouse and the habitats necessary for their survival and reproduction. http://www.grousepartners.org

Pheasants Forever (PF) – Some sage-grouse populations in Wyoming occur within areas that have a local PF chapter. Local chapters determine how their funds are spent. Game birds other than pheasants may be eligible for funding. http://www.pheasantsforever.org/chapters/

Rocky Mountain Elk Foundation (RMEF) - RMEF is a wildlife conservation organization with an emphasis on elk. It advocates sustainable, ethical use of resources and seeks common ground among stakeholders. RMEF funds habitat restoration and improvement projects, acquires land or conservation easements. http://www.rmef.org

The Nature Conservancy (TNC) - TNC works with conservation supporters and partner organizations to create funding for conservation worldwide using a variety of creative methods. http://nature.org

Tom Thorne Sage-Grouse Conservation Fund – Provides grants for the conservation of sage-grouse in the Upper Green River Basin. The fund was created

by Shell Exploration & Production Co. and managed by a board overseen by the Wyoming Community Foundation. www.wycf.com

Water for Wildlife - One Shot Antelope Foundation - Water for Wildlife is a conservation program designed to benefit wildlife and the environment in arid regions of the West. Emphasis focuses on the development of supplemental water resources in areas where both the habitat and wildlife are being impaired by lack of this vital resource. http://www.waterforwildlife.com

Wildlife Heritage Foundation of Wyoming - The Wyoming Wildlife Heritage Foundation is an independent, charitable organization whose purpose is to provide financial support, through philanthropy, to critical wildlife conservation efforts in Wyoming. http://whfw.org

Wyoming Governor's Big Game License Coalition - Funding generated from the sale of Governor's licenses placed in five accounts: bighorn sheep, moose, elk, mule deer and general wildlife. Funds administered by the Wildlife Heritage Foundation of Wyoming. http://whfw.org

Appendix A. Wyoming Sage-grouse Definitions (revised 12/08/06)

The following definitions have been adopted by WGFD and BLM-WY for the purposes of collecting and reporting sage-grouse data:

Lek - A traditional courtship display area attended by sage-grouse in or adjacent to sagebrush dominated habitat. A lek is designated based on observations of two or more male sage-grouse engaged in courtship displays. Before adding the suspected lek to the database, it must be confirmed by an additional observation made during the appropriate time of day, during the strutting season. Sign of strutting activity (tracks, droppings, feathers) can also be used to confirm a suspected lek. Sub-dominant males may display on itinerant (temporary) strutting areas during population peaks. Such areas usually fail to become established leks. Therefore, a site where small numbers of males (<5) are observed strutting should be confirmed active for two years before adding the site to the lek database.

Lek Complex - A group of leks in close proximity between which male sage-grouse may interchange from one day to the next. A specific distance criterion does not yet exist.

Lek Count - A census technique that documents the actual number of male sage-grouse observed attending a particular lek or lek complex. The following criteria are designed to assure counts are done consistently and accurately, enabling valid comparisons to be made among data sets. Additional technical criteria are available from the WGFD.

- Conduct lek counts at 7-10 day intervals over a 3-4 week period after the peak of mating activity. Although mating typically peaks in early April in Wyoming, the number of males counted on a lek is usually greatest in late April or early May when attendance by yearling males increases.
- Conduct lek counts only from the ground. Aerial counts are not accurate and are not comparable to ground counts.
- Conduct counts between ½ hour before sunrise to 1 hour after.
- Count attendance at each lek a minimum of three times annually during the breeding season.
- Conduct counts only when wind speeds are less than 8 kph (5 mph) and no precipitation is falling.

Lek Survey - Ideally, all sage-grouse leks would be counted annually. However, some breeding habitat is inaccessible during spring because of mud and snow, or the location of a lek is so remote it cannot be routinely counted. In other situations, topography or vegetation may prevent an accurate count from any vantage point. In addition, time and budget constraints often limit the number of leks that can be visited. Where lek counts are not feasible for any of these reasons, surveys are the only reliable means to monitor population trends. Lek surveys are designed principally to determine whether leks are active or inactive, requiring as few as one visit to a lek. Obtaining accurate counts of

the numbers of males attending is not essential. Lek surveys involve substantially less effort and time than lek counts. They can also be done from a fixed-wing aircraft or helicopter. Lek surveys can be conducted from the initiation of strutting in early March until early-mid May, depending on the site and spring weather.

Annual status – Lek status is assessed annually based on the following definitions:

- **active** – Any lek that has been attended by male sage-grouse during the strutting season. Acceptable documentation of grouse presence includes observation of birds using the site or signs of strutting activity.

- **inactive** – Any lek where sufficient data suggests that there was no strutting activity throughout a strutting season. Absence of strutting grouse during a single visit is insufficient documentation to establish that a lek is inactive. This designation requires documentation of either: 1) an absence of birds on the lek during at least 2 ground surveys separated by at least 7 days. These surveys must be conducted under ideal conditions (4/1-5/7, no precipitation, light or no wind, ½ hour before to 1 hour after sunrise) or, 2) a ground check of the exact known lek site late in the strutting season (after 4/15) that fails to find any sign (droppings/feathers) of strutting activity. Data collected by aerial surveys may not be used to designate inactive status.

- **unknown** – Leks for which status as active or inactive has not been documented during the course of a strutting season.

Management status - Based on its annual status, a lek is assigned to one of the following categories for management purposes:

- **occupied lek** – A lek that has been active during at least one strutting season within the prior ten years. Occupied leks are protected through prescribed management actions during surface disturbing activities.

- **unoccupied lek** – (Formerly “historical lek”.) There are two types of unoccupied leks, “destroyed” and “abandoned.” Unoccupied leks are not protected during surface disturbing activities.

    - **destroyed lek** – A formerly active lek site and surrounding sagebrush habitat that has been destroyed and is no longer suitable for sage-grouse breeding. A lek site that has been strip-mined, paved, converted to cropland or undergone other long-term habitat type conversion is considered destroyed. Destroyed leks are not monitored unless the site has been reclaimed to suitable sage-grouse habitat.

    - **abandoned lek** – A lek in otherwise suitable habitat that has not been active during a period of 10 consecutive years. To be designated abandoned, a lek must be “inactive” (see above criteria) in at least four

non-consecutive strutting seasons spanning the ten years. The site of an "abandoned" lek should be surveyed at least once every ten years to determine whether it has been reoccupied by sage-grouse.

- **undetermined lek** – Any lek that has not been documented active in the last ten years, but survey information is insufficient to designate the lek as unoccupied. Undetermined leks will be protected through prescribed management actions during surface disturbing activities until sufficient documentation is obtained to confirm the lek is unoccupied.

Winter Concentration Area - 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 canopy cover utilized by sage-grouse above the snow may range from 10 to 30 percent. Foraging areas tend to be on flat to generally southwest facing slopes or on ridges where sagebrush height may be less than 10 inches but the snow is routinely blown clear by wind. When these conditions are met, sage-grouse typically gain weight over winter. In most cases winter is not considered limiting to sage-grouse. Under severe winter conditions grouse will often be restricted to tall stands of sagebrush often located on deeper soils in or near drainage basins. Under these conditions winter habitat may be limiting. On a landscape scale, sage-grouse winter habitats should allow sage-grouse access to sagebrush under all snow conditions.

Large numbers of sage-grouse have been documented to persistently use some specific areas, which are characterized by the habitat features outlined above. These areas should be delineated as "winter concentration areas". Winter concentration areas do not include all winter habitats used by sage-grouse, nor are they limited to narrowly defined "severe winter relief" habitats. Delineation of these concentration areas is based on determination of the presence of winter habitat characteristics confirmed by repeated observations and sign of large numbers of sage-grouse. The definition of "large" is dependent on whether the overall population is large or small. In core population areas frequent observations of groups of 50+ sage-grouse meet the definition while in marginal populations group size may be 25+. Consultation and coordination with the WGFD is required when delineating winter concentration areas.

Appendix B. **Sage-grouse hunting seasons and harvest data for management areas in the Bighorn Basin (11, 12, 15, 16, 17, 19, 20, 21), 1982-2006.**

Year	Season Dates	Length (days)	Bag and possession Limit	Harvest	Hunters	Recreation Days	Birds/ Day	Birds/ Hunter	Days/ Hunter
1982	Sept 11-Sept 30	20	3/6	4,477	1,492	3,678	1.2	3.0	2.5
1983	Sept 10-Sept 30	21	3/6	6,927	1,709	5,057	1.4	4.1	3.0
1984	Sept 8-Sept 30	23	3/6	6,359	1,725	4,393	1.4	3.7	2.5
1985	Sept 7-Sept 29	23	3/6	4,138	1,451	3,266	1.3	2.9	2.3
1986	Sept 6-Sept 28	23	3/6	2,133	1,017	1,923	1.1	2.1	1.9
1987	Sept 5-Sept 27	23	3/6	3,182	1,303	2,558	1.2	2.4	2.0
1988	Sept 3-Sept 30	28	3/6	5,425	1,576	3,616	1.5	3.4	2.3
1989	Sept 1-Sept 30	30	3/6	3,815	1,287	3,212	1.2	3.0	2.5
1990	Sept 1-Sept 16	16	3/6	2,963	957	2,241	1.3	3.1	2.3
1991	Aug 31-Sept 30	31	3/9	3,393	1,302	3,012	1.1	2.6	2.3
1992	Sept 1-Sept 30	30	3/9	2,343	958	2,413	1.0	2.4	2.5
1993	Sept 1-Sept 30	30	3/9	2,090	1,346	3,494	0.6	1.6	2.6
1994	Sept 1-Sept 30	30	3/6	1,577	762	1,674	0.9	2.1	2.2
1995	Sept 16-Sept 30	15	3/6	728	531	1,541	0.5	1.4	2.9
1996	Sept 21-Oct 4	14	3/6	781	446	1,203	0.6	1.8	2.7
1997	Sept 20-Oct 5	16	3/6	1,199	562	1,658	0.7	2.1	3.0
1998	Sept 19-Oct 4	16	3/6	1,473	639	2,001	0.7	2.3	3.1
1999	Sept 18-Oct 3	16	3/6	1,675	688	1,769	0.9	2.4	2.6
2000	Sept 16-Oct 1	16	3/6	1,100	619	1,884	0.6	1.8	3.0
2001	Sept 22-Oct 7	16	3/6	439	357	916	0.5	1.2	2.6
2002	Sept 28-Oct 6	9	2/4	430	310	687	0.6	1.4	2.2
2003	Sept 27-Oct 5	9	2/4	365	213	683	0.5	1.7	3.2
2004	Sept 23-Oct 3	11	2/4	364	295	702	0.5	1.2	2.4
2005	Sept 23-Oct 3	11	2/4	1,291	647	1,259	1.0	2.0	1.9
2006	Sept 23-Oct 3	11	2/4	471	294	697	0.7	1.6	2.4
1982-2006 Averages		20		2,356	896	2,211	1.1	2.6	2.5

Appendix C. **Glossary of Terms, Acronyms, and Scientific Names**

Appropriate management level (AML) – refers to feral horse population level

Assessed valuations – estimated or determined market value of land and belongings

Bentonite – a clay-type mineral formed when volcanic ash reacted with salt water about 100 million years ago. Bentonite is the "clay of 1000 uses", but mainly used in oil/gas well drilling, kitty litter, and manufacture of iron ore

Brood – a group of young birds (hatch to independence) usually accompanied by a hen

Canopy cover – overstory of shrubs, often expressed as percent of an area covered by a particular shrub species

Castback mining – a strip-mining procedure where overburden from a subsequent phase of a pit series is cast back into the open hole of the previous phase for the purpose of uncovering the desired mineral of the new phase

Climax community – the end point of a successional sequence, or sere; a community that has reached a steady state under a particular set of environmental conditions and is at least somewhat self-perpetuating in time and space

Conservation – planned management and wise use of resources

Corvids – crows and ravens

Ecological community – the assemblage of plants and animals in an area that are at least somewhat interdependent, mutually self-sustaining and are constantly fixing, utilizing and dispersing energy

Ecological site description – a listing of living and non-living components and conditions of a given area

Ecology – the study of organisms and how they interact with the environment

Ecosystem – the living and non-living components of an area that interact in such a manner that the flow of energy through the area leads to clearly defined trophic structure, biotic diversity and materials cycles within that area

Ecto-parasite – an organism living on the outside of another organism and gaining nutrients and energy from the host organism

Feral – an animal that has escaped domestication and turned wild; e.g. wild horses, wild house cats

Forb - any dicotyledoneous flowering plants with broad leaves, netlike veins and solid non-joint stems.

Goal – the end toward which effort is directed, a statement of a desired future condition

Habitat – where an organism lives or can be found, includes other organisms and nonliving elements, the address of an organism

Herbaceous – refers to a plant that has a non-woody stem and which dies back at the end of the growing season

Invasive Plants – a species that is primarily a non-native to the ecosystem under consideration and whose introduction causes or is likely to cause economic or environmental harm

Landscape scale – the exact boundaries or scale of a landscape are established according to the objectives of a study or discussion. The area included may be as small as a pond or as large as several counties or states, but in all cases, ecologists recognize that energy, water, nutrients and organisms move back and forth across whatever boundaries are established.

Lek – a traditional courtship display area attended by sage-grouse in or adjacent to sagebrush dominated habitat

Lek Complex – a group of leks in close proximity between which sage-grouse may interchange from one day to the next during a breeding season; a specific distance criterion does not yet exist

Lekking – breeding behavior and displays

Live Soil – soils that are excavated from a phase of a castback mining sequence and replaced immediately on to a previously contoured phase of reclamation

Mitigation – to make less severe, reduce impacts of or to compensate for an action

Mosaic – a landscape composed of patches of discrete ecological sites and/or seral stages in a variety of sizes and shapes

Niche – the functional role that organism plays in the ecosystem; everything an organism does to live and reproduce

Objective – a strategic position to be attained or purpose to be achieved; a statement designed to attain a desired future condition that is quantifiable in both time and outputs

Overburden – spoil and soil material overlaying a deposit of economically viable mineral

Predation – a mode of life in which food is primarily obtained by the killing and consuming other organisms

Range site potential – climax plant communities that may occur on a site depending on interactions between soils, climate, and other environmental factors

Residual vegetation – vegetation remaining on a site from the previous growing season

Riparian – relating to or located on the edge of a waterway, usually refers to a vegetation community

Sagebrush obligates (near-obligates) – a species dependent on sagebrush habitat for all or part of its life. Sagebrush is required for these species to be present. Near-obligates are not as reliant upon sagebrush.

Satellite lek – an area usually occupied by subordinate male grouse performing breeding displays located near a large active lek

Seral stage – a transitory or developmental vegetative community that is naturally replaced with another plant community if left undisturbed

Small-grained mosaic – relatively "small" patches of different seral stages or plant communities on a landscape scale

Socio-economic – dealing with human (social) and financial interactions

Spoil – undesirable geologic material, below topsoil and subsoil, excavated from an area while mining for more desirable minerals

Succession – natural changes in ecological communities caused by the actions of vegetation and animals interacting with the physical environment leading to the establishment of new communities

Ungulates – hoofed mammals, e.g., deer and elk

Vegetation community – a group of plant species that usually occur together

List of Acronyms

AML – Appropriate Management Level
BHBCA – Big Horn Basin Conservation Area
BHBLWG – Big Horn Basin Local Working Group
BLM – Bureau of Land Management
BNF – Bighorn National Forest
CBNG – Coal Bed Natural Gas
CD – Conservation District
CRM – Coordinated Resource Management
ESD – Ecological Site Description
FOTG – Field Office Technical Guide (NRCS publication)
FS – Forest Service
FNAWS-WY – Foundation for North American Wild Sheep-Wyoming Chapter
HMA – Horse Management Area
LWG – Local Working Group
NRCS – Natural Resources Conservation Service
RMEF – Rocky Mountain Elk Foundation
RMP – Recommended Management Practices
SNF – Shoshone National Forest
TNC – The Nature Conservancy
USDA – United States Department of Agriculture
WAFWA – Western Association of Fish and Wildlife Agencies
WDEQ – Wyoming Department of Environmental Quality
WDEQ/LQD – WDEQ – Land Quality Division
WGBGLC – Wyoming Governor's Big Game License Coalition
WGFD – Wyoming Game & Fish Department
WHFW – Wildlife Heritage Foundation of Wyoming
WNRTF – Wildlife and Natural Resources Trust Fund
WNV – West Nile Virus
WOGCC – Wyoming Oil and Gas Conservation Commission
WSWG – Wyoming Sage-grouse Working Group (state-wide group)
W&P – County Weed and Pest Districts

List of Common and Scientific Names

Plants

Common name	Scientific name
Alfalfa	*Medicago sativa*
Aspen	*Populus tremuloides*
Burdock	*Arctium minus*
Canada thistle	*Cirsium arvense*
Cheatgrass	*Bromus tectorum*
Cottonwood	*Populus spp.*
Cudweed	*Gnaphalium palustre*
Curlycup gumweed	*Grindelia squarrosa*
Dandelion	*Taraxacum officinale*
Fleabane	*Erigeron spp.*
Fringed sagewort	*Artemisia frigida*
Hoary cress	*Cardaria draba*
Japanese brome	*Bromus japonicus*
Knapweed	*Centaurea spp.*
Leafy spurge	*Euphorbia escula*
Milkvetch	*Astragalus bisulcatus*
Mountain big sagebrush	*Artemisia tridentata subsp. Vaseyana*
Prickly lettuce	*Lactuca serriola*
Russian olive	*Elaeagnus angustifolia*
Salt cedar	*Tamarix pentandra*
Saltbush	*Atriplex spp.*
Sweetclover	*Melilotus officinalis*
Toadflax	*Linaria vulgaris*
Western salsify	*Tragopogon dubius*
Western yarrow	*Achillea lanulosa*
Willow	*Salix spp.*
Winterfat	*Eurotia lanata*
Wyoming big sagebrush	*Artemisia tridentata subsp. wyomingensis*

Birds

Common name	Scientific name
Brewer’s sparrow	*Spizella breweri*
Crow	*Corvus brachyrhynchos*
Ferriginous hawk	*Buteo regalis*
Golden eagle	*Aquila chrysaetos*
Greater sage-grouse	*Centrocercus urophasianus*
Hawks	*Buteo spp.*
Mountain plover	*Charadrius montanus*
Raven	*Corvus corax*

Mammals

Common name	**Scientific name**
Badger	*Taxidea taxus*
Black-tailed prairie dog	*Cynomys leucurus*
Bobcat	*Felis rufus*
Coyote	*Canis latrans*
Elk	*Cervus wapiti*
Ground squirrel	*Spermophilus spp.*
Mule deer	*Odocoileus hemionus*
Pronghorn antelope	*Antilocapra americana*
Raccoon	*Procyon lotor*
Red fox	*Vulpes vulpes*
Striped skunk	*Mephitis mephitis*
Swift fox	*Vulpes velox*
Weasel	*Mustela spp.*

Insects

Common name	**Scientific name**
Mosquito	*Culex tarsalus*

(many species of mosquito exist, *Culex tarsalus* is the most common carrier of West Nile Virus)

Appendix D. **List of References**

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