Addendum for the
Wind River/Sweetwater River Local Sage Grouse Conservation Plan

Twin Creek Lek southeast of Lander (photo courtesy Stan Harter, WGFD)

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March 5, 2014

Introduction

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

Sage-grouse conservation has changed significantly since the Wind River/Sweetwater River Local Working Group finalized our Sage-Grouse Conservation Plan in 2007. These changes have occurred not only at the local level but on the state and national levels as well. Sage-grouse are currently recognized as a candidate species which warrants protection as a threaten species. In Wyoming, sage-grouse were precluded from the FWS taking such action in part due to the tremendous and proactive conservation efforts that originated here. These conservation efforts began at a grass-roots level in Wyoming with the formulation of local working groups. They continued to grow with the Wyoming Governor's Executive Orders and the implementation of the Wyoming Core Area Strategy for sage-grouse conservation. These efforts were swiftly emulated with the development of several sage-grouse specific conservation efforts at a national level, under the US Departments' of Agriculture and Interior; as well as in every state inhabited by sage-grouse.

The purpose of this addendum is to address those questions posed above and to provide an update to the plan. Accomplishments and new information collected 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 Wind River/Sweetwater River Conservation Area (WRSRCA) for supplemental information.

Wyoming State Actions

Wyoming Governors' Executive Orders and Greater Sage-Grouse 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 avert the work of LWGs, but to supplement those endeavors and provide a more directed statewide approach to sage-grouse conservation. 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.

In an unprecedented move to coordinate sage grouse conservation efforts across the State of Wyoming, Governor Freudenthal utilized the recommendations from the SGIT and released Executive Order 2008-2 on Aug. 1, 2008 establishing "Core Areas" for greater sage-grouse in Wyoming. These core areas contain the highest densities of sage-grouse in Wyoming based on peak male attendance at leks. Stipulations developed by the SGIT provide additional conservation measures for about 83% of the state's sage-grouse on about 25% of the land area. Following the updates prepared during the spring and summer of 2010 by the SGIT, Governor Freudenthal issued a new Executive Order on August 18, 2010 to replace the 2008 order.

Governor Matt Mead issued an Executive Order on June 2, 2011 which reiterated and clarified the intent of Wyoming's Core Area Strategy originally developed under former Governor Freudenthal's administration with the assistance of the Governor's Sage-Grouse Implementation Team and the local sage-grouse working groups. About 81% of the active leks in the WRSRCA are in core areas (Figure 1).

As a part of the updates made by the Governor's Sage Grouse Implementation Team in 2010, the WRSR LWG reviewed and revised core area boundaries to more accurately reflect actual core habitat values and sage grouse use of these habitats. Most of the changes occurred along the Lander Foothills and agricultural or residential lands near Lander, and in the Gas Hills and Green/Crooks Mountain area where past uranium mining has left the area either non-vegetated or with vegetation cover unsuitable for sage-grouse.

The Wyoming Game and Fish Department and Commission maintain management authority over candidate species and management emphasis will continue to focus on implementation of Wyoming's Core Area Strategy.

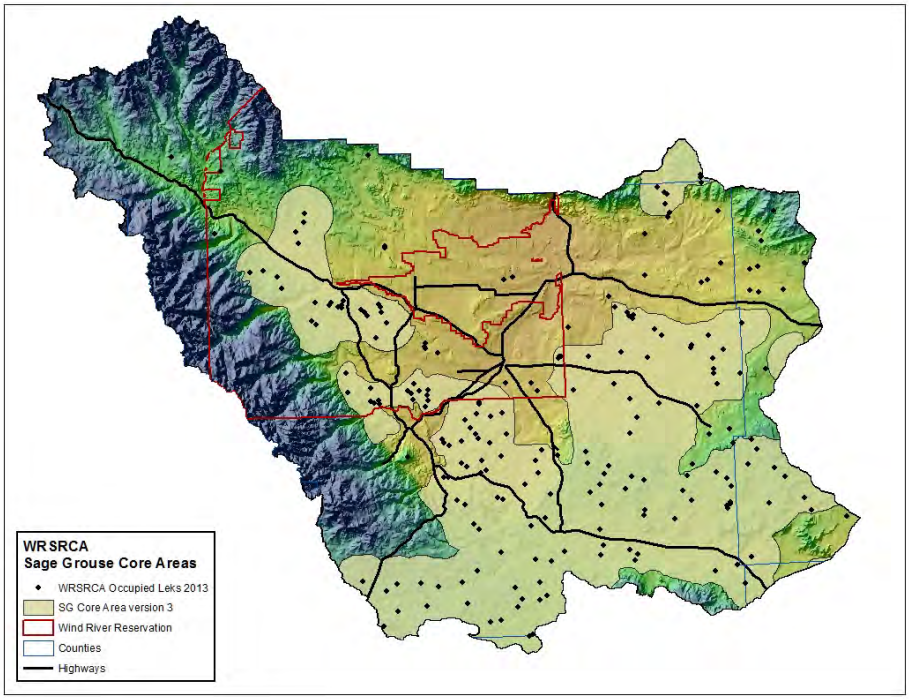

Figure 1. Greater Sage-grouse Core Areas within the Wind River/Sweetwater River Conservation Area (dots = leks).

Federal Agency Actions

U.S. Fish and Wildlife Service

On March 5, 2010 the U.S. Fish and Wildlife Service (USFWS) issued a decision of "warranted but precluded" for listing Greater Sage-grouse as threatened or endangered under the Endangered Species Act. This means Greater Sage-grouse have become a "candidate" for listing, but are precluded from immediate listing due to higher priority species. As such the USFWS will evaluate the species status 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.

In its decision document, the USFWS specifically cited Wyoming's Core Area Strategy (described above) as a mechanism that, if implemented as envisioned, should ensure conservation of sage-grouse in Wyoming and therefore help preclude a future listing.

USFWS, in conjunction with the Wyoming Governor's Office, NRCS, WGFD, Wyoming Department of Agriculture, Wyoming Association of Conservation Districts, Wyoming BLM, and the U.S. Forest Service, 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.

Bureau of Land Management (BLM)

With over 80% of core areas occurring on lands administered by the BLM, 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 IM currently in effect was distributed in March of 2012 (WY-IM 2012-019). The national IMs are WO-IM 2012-43 and 44.

The WRSR LWG area lies predominantly within the BLM's Lander Field Office, but also overlaps portions of the Casper and Worland Field Offices. The Lander and Worland Field Offices are revising their resource management plans (RMP) which will incorporate measures to enhance sage-grouse and sagebrush management, patterned after and including the state and national IMs. The Casper Field Office is in the process of completing an amendment to their existing RMP to incorporate the same types of measures to protect and enhance sage-grouse habitat. The record of decision (ROD) for Lander RMP revision is expected to be released soon and the Worland RMP revision and Casper RMP amendment are expected to be completed later in 2014.

National Conservation Objectives Team (COT) Report 2013

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

The FWS 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 FWS created a Conservation Objectives Team (COT) of state and FWS 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 sage-grouse so that the species is no longer or likely to become in danger of extinction.

In summary, the report prepared by the COT (U.S. Fish and Wildlife Service 2013) listed energy development, infrastructure, improper livestock and/or wildlife grazing practices and recreation as broad scale threats to sage-grouse in the Wyoming portions of the Wyoming Basin Management Zone with localized threats being sagebrush elimination, fire, conifer encroachment, weeds/annual grasses, mining, feral/wild horses, and urbanization. The report estimated a 10.7% probability of the subpopulation of breeding birds declining below 500 by 2107. This figure is the second lowest probability of a decline to this level for any population/sub-population across the range of greater sage-grouse. The Wind River/Sweetwater River planning area lies within this unit and this Conservation Plan as updated in 2013, and the Wyoming Core Area Strategy (described below) has implemented management actions and projects designed to address the issues.

The General Conservation Objectives identified by the COT are:

1. Stop population declines and habitat loss.
2. Implement targeted habitat management and restoration.

3. Develop and implement state and federal sage-grouse conservation strategies and associated incentive-based conservation actions and regulatory mechanisms.
4. Develop and implement proactive, voluntary conservation actions.
5. Develop and implement monitoring plans to track the success of state and federal conservation strategies and voluntary conservation actions.
6. Prioritize, fund and implement research to address existing uncertainties.

Additionally the report identified many Specific Conservation Objectives relative to identifying "Priority Areas for Conservation" (synonymous with Wyoming "Core Areas") as well as threat reduction objectives and conservation measures to accomplish those reductions. The Wind River/Sweetwater River LWG has sought to make this conservation plan revision consistent with these general and specific objectives. The WRSR LWG encourages users of this plan and the Wyoming Core Area Strategy to also review and use the COT Report.

Natural Resources Conservation Service

In 2010, the Natural Resources Conservation Service (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, fence removal or marking will be implemented on a landscape scale across a sage-grouse core area. A range/wildlife specialist was hired, under the auspices of SGI, to specifically recommend and implement grouse-related management practices on private land in the WRSRCA.

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. Some of the conservation practices implemented by NRCS, including SGI contracts are reported in the Project Commitments table in Appendix B.

Summary – Management direction and projects implemented or funded by the WRSR LWG 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 WRSR LWG will continue to consult their guidance. Conversely, the WRSR LWG will provide input to the larger scale efforts as appropriate.

Sage-grouse in the Wind River/Sweetwater River Conservation Area

As of 2013, the Wyoming Game and Fish Department's sage grouse database indicates 203 occupied leks exist within the WRSRCA. This total includes 5 new leks discovered in 2013 in Natrona County near Beaver Rim, Barlow Gap and Black Mountain. The map below (Figure 2) shows all known occupied leks from 2013, as well as the area where IR thermal imaging flights were conducted.

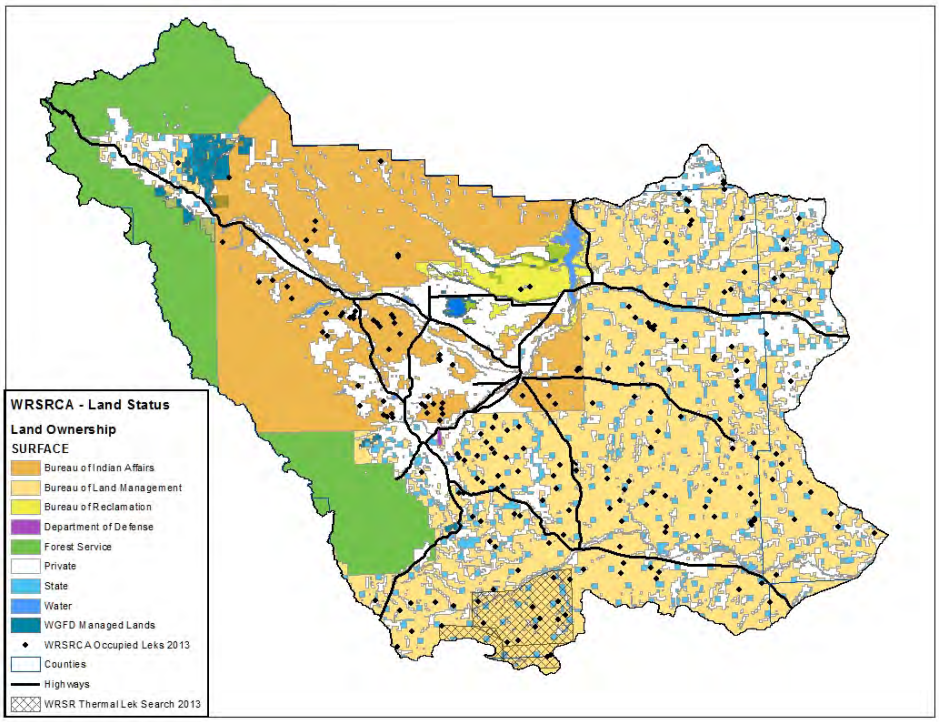

Figure 2. Land ownership and lek locations within WRSRCA as of spring 2013.

Sage-grouse are generally found throughout the WRSRCA except in heavily forested, agriculturally developed, or urbanized areas. Sage-grouse leks in the WRSRCA are located within the Lander WGFD Region, 4 BLM Resource Areas, 5 Wyoming counties, and the WRR. There were 203 known occupied leks within the conservation area in 2013. Anecdotal information indicates the possible existence of another 6 leks on WRR; however no data are available for lek attendance. In addition, there are almost certainly leks within the WRSRCA that have not yet been documented. Similarly, there are leks that have been abandoned or destroyed that are undocumented. Lek attendance increased between 1995 and 2006, but has since declined (Figures 3, 4, 5). With intensified monitoring and search efforts since 1995, at least 76 new or newly discovered leks have been documented in the WRSRCA.

Of the 203 known occupied leks in the WRSRCA, 175 were checked in 2013 by WGFD, BLM, USFWS, and SATFG, assisted by several researchers, consultants, and volunteers. Of those checked, 83 were counted and 92 were surveyed. Of the 156 leks where status was confirmed, 140 (90%) were active and 16 (10%) were inactive. Average annual maximum male attendance at count leks was 23.1, which is 50% below the average since 2003 (46.4), and 70% below the peak in 2006 (76.0). Annual sage-grouse reports for the WRSR LWG area provide additional population information and are available on the Wyoming Game and Fish Department web site.

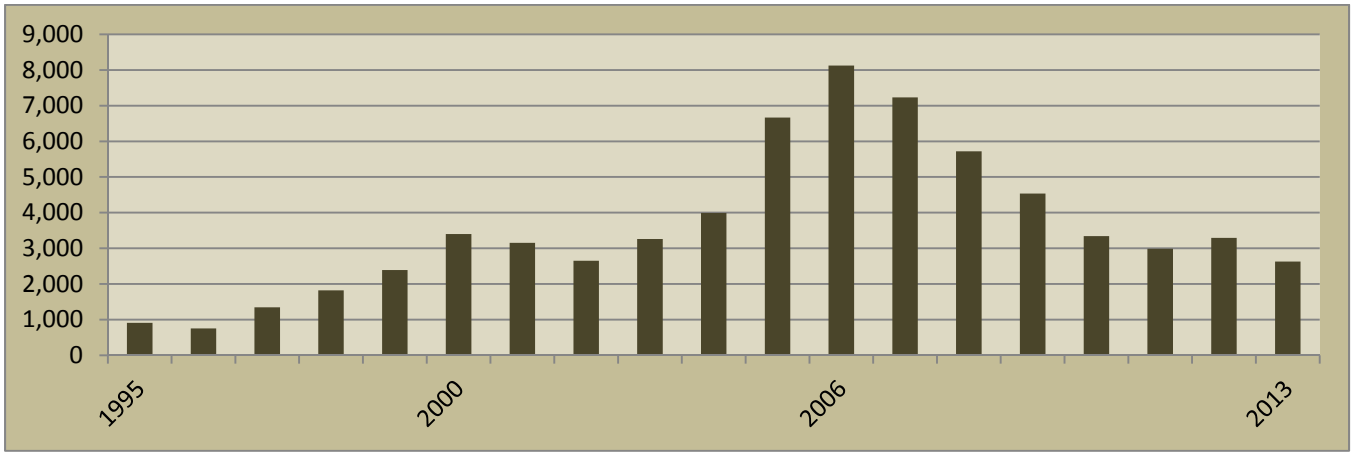

Figure 3. Total male attendance at leks within the Wind River/Sweetwater River Conservation Area, 1995 – 2013.

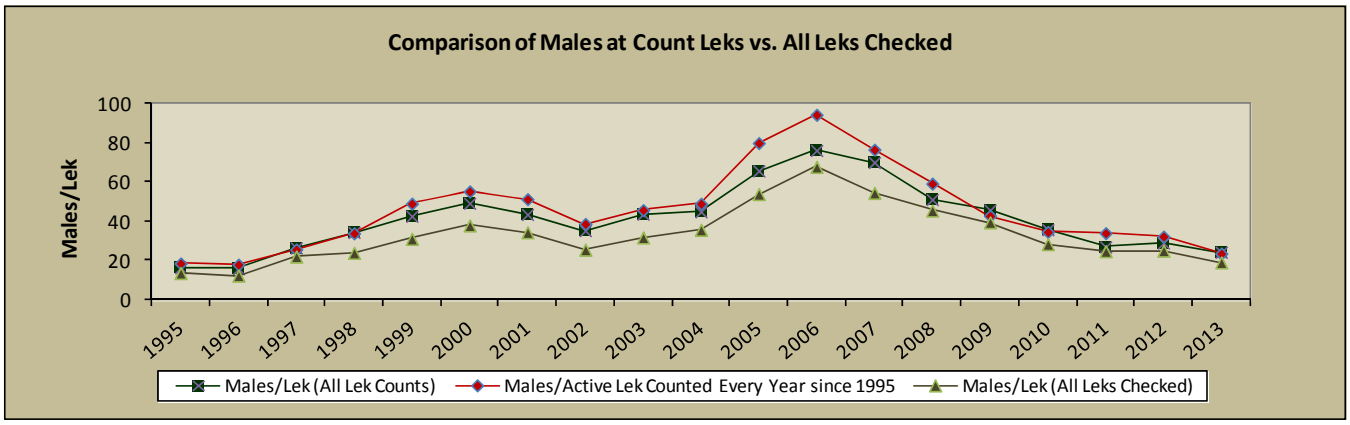

Figure 4. Average males per lek in the Wind River/Sweetwater River Conservation Area, 1995 – 2013.

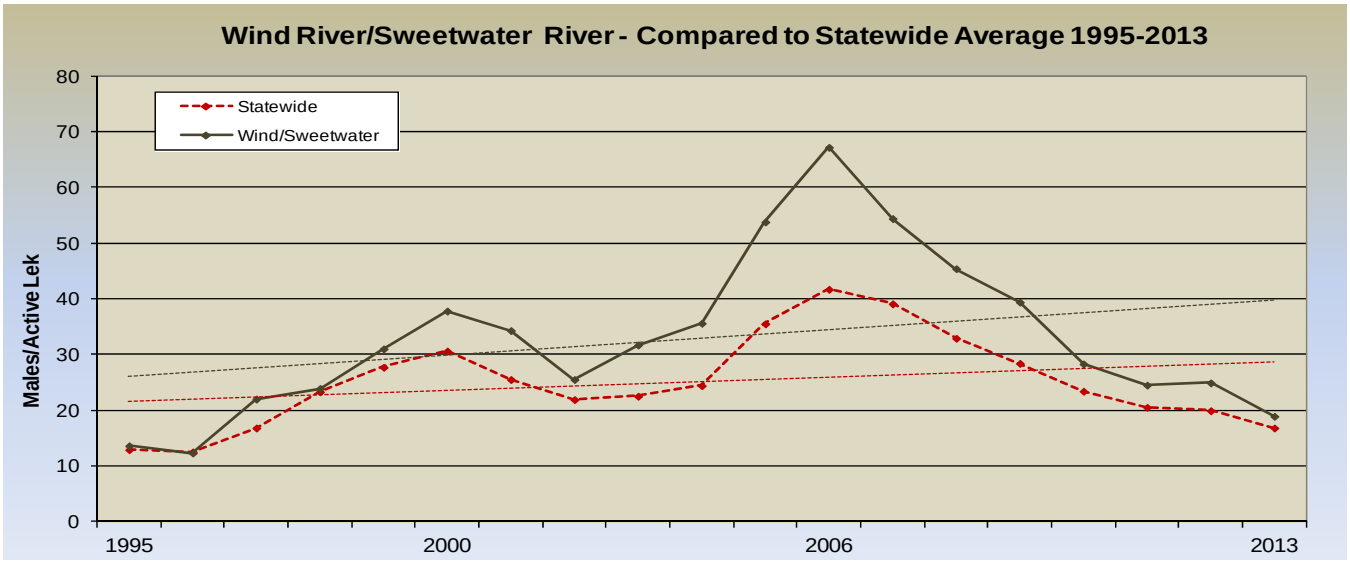

Figure 5. Average male lek attendance in WRSRCA compared with Wyoming statewide trends, 1995 – 2013.

FACTORS INFLUENCING SAGE-GROUSE POPULATIONS AND HABITATS

The Wind River/Sweetwater River Local Sage-grouse Conservation Plan 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 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 WRSR LWG felt that sage-grouse populations could be most affected by (in alphabetical order): conflicting wildlife and wild horse management, hunting, mineral and energy development, parasites and diseases, predation, recreation, residential development, vegetation management (including farming, invasive plants, livestock grazing, and vegetation treatments), and weather. Some research on sage-grouse in the Wind River/Sweetwater River Conservation Area has been conducted since the plan was written or is currently on-going, but a comprehensive investigation into limiting factors has not been attempted.

Conflicting Wildlife and Wild Horse Management

Conflicting Wildlife Management

Big game seasonal ranges were updated by Wyoming Game and Fish Department and US Fish and Wildlife Service/Shoshone Arapaho Tribal Fish and Game personnel in 2011-12. The following map (Figure 6) shows currently designated crucial winter ranges within the WRSR Conservation Area. Any habitat projects planned to improve big game habitats will follow the Sage Grouse Core Area Strategy recommendations and "Wyoming Game and Fish Department Protocols For Treating Sagebrush To Be Consistent With Wyoming Executive Order 2011-5; Greater Sage-Grouse Core Area Protection (7/8/2011)". These measures will ensure sage grouse and their habitats are considered when treating habitats intended to benefit other species while not negatively affecting sage grouse.

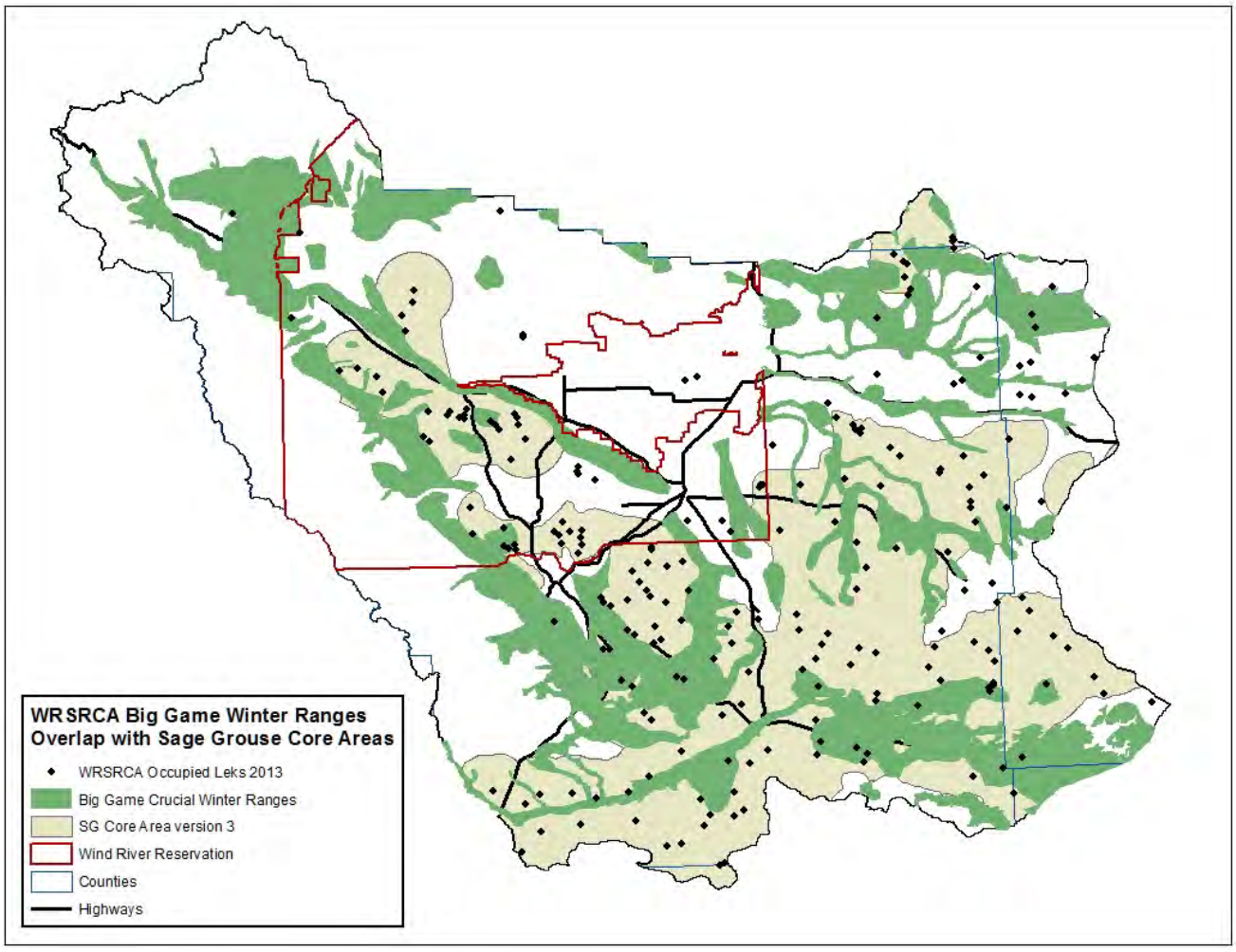

Figure 6. Sage grouse leks (dots), core area, and big game crucial winter ranges within the WRSRCA.

Conflicting Wild Horse Management

Wild horse populations in the seven Horse Management Areas (HMAs) have been inventoried since the LWG plan was finalized in August 2007. Figure 7 shows how these HMAs overlap greater sage-grouse Core Areas in the WRSRCA. Periodic roundups/gathers have been conducted to keep HMAs within the Appropriate Management Levels (AML) established for each herd. The BLM is treating horses with fertility control vaccines to slow herd growth and reduce the frequency of roundups. In addition, the BLM and Wild Horse Advocacy Groups are looking at other options to control population growth since most long-term and short-term holding facilities are at capacity. Due to budget constraints and lawsuits, no roundups were conducted in 2013.

As of July, 2013, the Antelope Hills, Crooks Mountain, and Green Mountain HMAs are above the high end of their AML range. Estimated populations are 116 horses in Antelope Hills, 167 horses in Crooks Mountain, and 450 horses in Green Mountain. These population numbers indicate the HMAs are 41%, 67%, and 50% over their respective AML. The remaining four HMAs (Muskrat Basin, Conant Creek,

Rock Creek, and Dishpan Butte) are managed as the North Lander Complex with an AML of 320-536 horses. The current population for this Complex is estimated at 487 horses, within the AML range.

BIA's Wind River Agency conducted a comprehensive helicopter aerial survey of feral horses on Wind River in March 2012. A minimum of 2,100 horses were counted. Estimates of total feral horses were over 3,000. Most of these horses were concentrated in the northwest portion of the Reservation in the Crow Creek/Spring Mountain/Mail Camp Road area, and near the Ft. Washakie/Ethete area and occur in sage-grouse habitat.

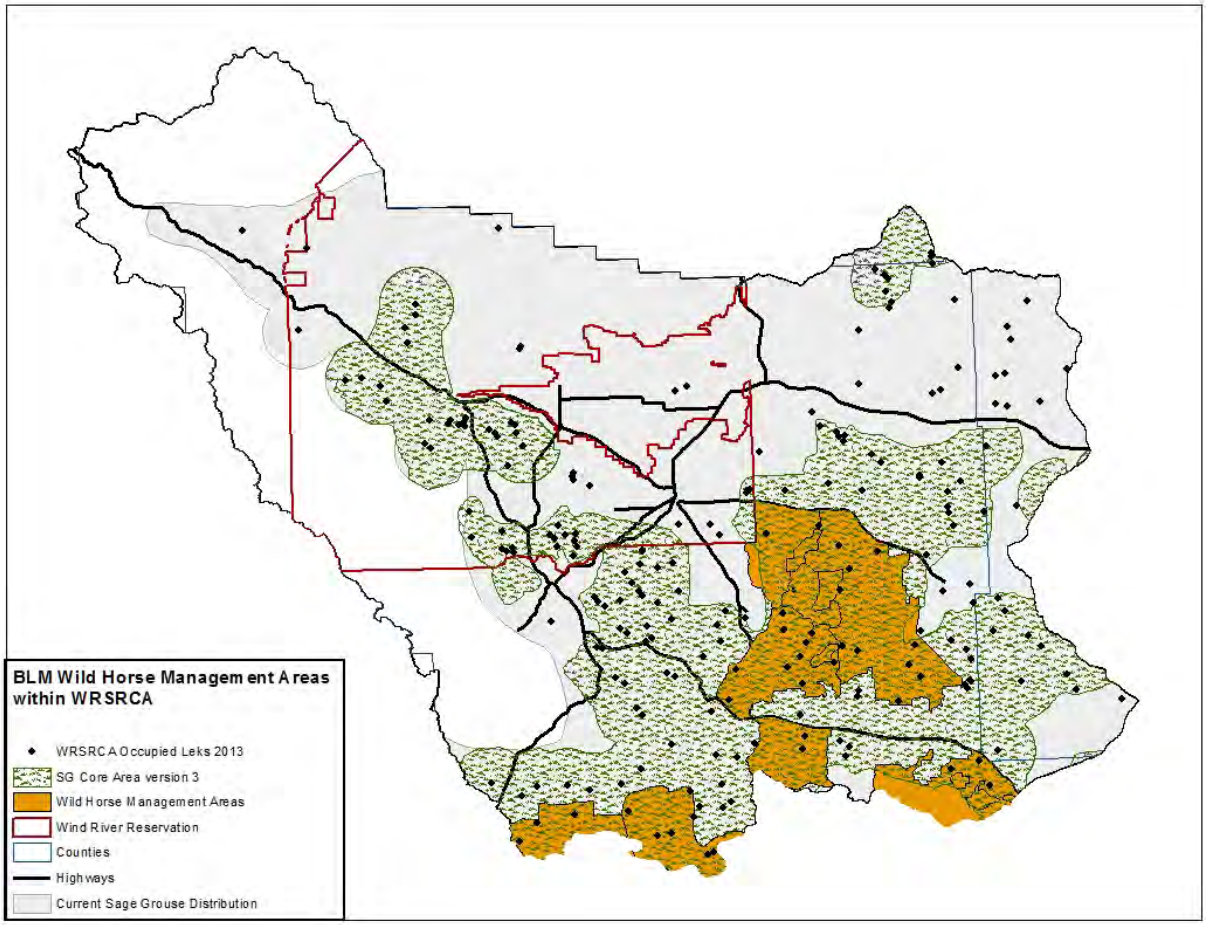

Figure 7. Wild horse management areas within the WRSRCA and overlap with sage grouse core areas.

Hunting

Regulated hunting is the cornerstone of the North American Model of Wildlife Conservation, a system that keeps wildlife a public and sustainable resource, scientifically managed by professionals. Many greater sage-grouse populations can, and do, support hunting under this model (WGFD - Hunting and Sage Grouse, 2010). The Wind River/Sweetwater River Conservation Area has some of the most robust habitats in the entire sage grouse range. As outlined in the table below (Table 1a and 1b), bag limits, season lengths, and harvest levels do not appear to be excessive for the population of sage grouse within the WRSRCA. Wings are collected from harvested birds annually at barrels placed at major exits from hunting spots within the WRSRCA. Data gathered from these wings are used to calculate age and sex ratios, and chick survival as illustrated in Table 2 and Figure 8 below. Hunting seasons and harvest from the WRR are not included in these data.

Table 1. Sage grouse hunting season and harvest data for Wyoming Sage Grouse Management Area E (WRSRCA).

a. Season

Year	Season Start	Season End	Length	Bag/Possesion Limit
2003	Sep-27	Oct-5	9	2/4
2004	Sep-23	Oct-3	11	2/4
2005	Sep-23	Oct-3	11	2/4
2006	Sep-23	Oct-3	11	2/4
2007	Sep-22	Oct-2	11	2/4
2008	Sep-22	Oct-2	11	2/4
2009	Sep-19	Sep-30	12	2/4
2010	Sep-18	Sep-30	13	2/4
2011	Sep-17	Sep-30	14	2/4
2012	Sep-15	Sep-30	16	2/4

b. Harvest

Year	Harvest	Hunters	Days	Birds/ Day	Birds/ Hunter	Days/ Hunter
2003	669	307	617	1.1	2.2	2.0
2004	1398	572	1444	1.0	2.4	2.5
2005	2994	930	2080	1.4	3.2	2.2
2006	1710	558	1183	1.4	3.1	2.1
2007	1776	788	1696	1.0	2.3	2.2
2008	2144	863	2059	1.0	2.5	2.4
2009	2295	875	2114	1.1	2.6	2.4
2010	2495	1056	2866	0.9	2.4	2.7
2011	1779	771	1801	1.0	2.3	2.3
2012	2068	890	2296	0.9	2.3	2.6
Avg	1,933	761	1,816	1.1	2.5	2.3

Table 2. Composition of Harvest by Wing Analysis

Year	Sample Size	Percent Adult		Percent Yearling		Percent Young		Chicks/ Hens
		Male	Female	Male	Female	Male	Female	
2003	236	11.9	26.3	0.0	4.7	23.7	33.5	1.8
2004	369	11.9	12.5	0.0	2.2	35.8	37.7	5.0
2005	633	13.6	22.7	5.1	7.1	21.0	30.5	1.7
2006	366	26.0	25.4	4.6	4.6	13.4	26.0	1.3
2007	397	23.9	29.2	1.0	3.0	17.1	25.7	1.3
2008	538	21.6	24.5	5.6	5.6	17.8	24.7	1.4
2009	598	16.7	24.6	6.9	8.9	14.7	28.3	1.3
2010	476	16.0	30.3	4.4	6.7	15.1	27.5	1.2
2011	376	9.0	27.1	6.9	8.5	14.4	34.0	1.4
2012	443	18.5	36.1	6.3	6.8	11.1	21.2	0.8
2013	202	18.8	29.7	0.5	9.4	14.9	26.7	1.1

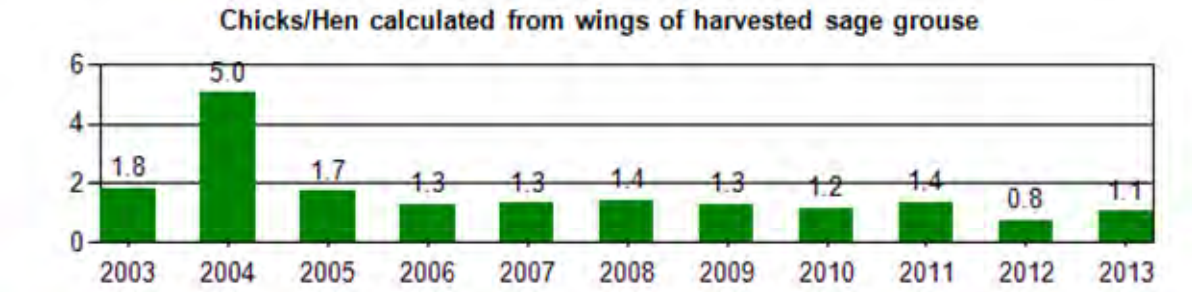

Figure 8. Chick survival as calculated from wings of harvested sage grouse within WRSRCA.

Wind River Reservation Hunting Seasons

Due to a decline in sage-grouse population, the Eastern Shoshone and Northern Arapaho Joint Business Council closed the spring "males-only" sage-grouse season in 2010. This season was a traditional hunt in which less than 30 males are usually taken. Because several leks that were hunted had declined to less than five attending males, a hunter could potentially remove the last remaining males. The decline was associated with causes other than hunting since other very remote leks with no hunting pressure declined by similar amounts.

Mineral and Energy Development

Coal and Other Mineral Development (Mining)

Essentially no mining has occurred since 2007, however several uranium mining (surface, sub-surface, and in-situ) operations are proposed as outlined below.

Uranium

Interest in uranium exploration and development in the WRSRCA has increased in recent years although current market prices are depressed. Because of the length of time it takes to process and approve mining permits, operators continue to submit Notices of Intent for mining operations so that approvals are in place once uranium prices begin to rise. There are currently three proposed uranium

projects in the WRSRCA, each occurring in areas that have had historic open pit/heap leach uranium mining. Two projects, an in-situ project for Cameco Resources (approximately 8,500 acres) and an open pit/heap leach project for Energy Fuels (approximately 12,400 acres) are located in the Gas Hills Mining District. The Cameco project will likely be permitted by the end of 2013. The Energy Fuels project is currently on hold and is not expected to be permitted for several years. Energy Fuels has also submitted an NOI for an open pit/heap leach project (approximately 3,600 acres) on Sheep Mountain which is in the Green Mountain Mining District. This project is anticipated to be permitted in late 2014 or early 2015. The three uranium project areas are outside of designated Core Area but within suitable habitat for greater sage-grouse. There are no leks identified near the Sheep Mountain project, however several leks occur in and around the two uranium projects proposed in the Gas Hills area.

Oil, Natural Gas, and Coalbed Natural Gas Industry

Oil and Natural Gas Development within WRSRCA

Oil and gas fields are scattered throughout the WRSRCA. With the exception of the Bison Basin field, most of these development areas are outside of Core Area. A proposed full field development EIS has begun that analyzes the development of an additional 4,250 natural gas and oil wells in the Moneta Divide Project area located in Fremont and Natrona counties. The project area encompasses approximately 265,000 acres of land. The majority of the project boundary is outside of Core Area, but a small part (approximately 11%) on the southern end of the project area is within Core Area.

The historic Bison Basin field is undergoing some expansion and new wells and roads are being developed in Core Area. Disturbance calculations are conducted on proposed development actions within Core Area to ensure the 5% disturbance threshold is not exceeded.

The Beaver Creek field has experienced limited new development since the WRSRCA plan was completed. This field is entirely outside of Core Area but supports greater sage-grouse habitat. Much of the new development has been related to the drilling of a few gas wells and installing/upgrading pipelines and powerlines. The field operator, Devon Energy, had proposed to drill numerous coal bed natural gas wells, but have recently revised their plans to focus solely on convention oil and gas production.

Oil and Gas Development – Statewide Synthesis of Research Results

Oil and gas development is an issue for sage-grouse conservation in Wyoming and across the Intermountain West because development has accelerated rapidly since 1990 and 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 but most of the peer-reviewed papers resulting from this research were published after Wyoming's local conservation plans were completed in 2007 and 2008.

Sage-grouse populations are impacted at oil and gas well densities commonly permitted in Wyoming (Naugle et al. 2011, Hess and Beck 2012, Kirol 2012). Impacts have not been detected at well densities less than about 1 well/mi2, but above this threshold, losses of leks have been 2-5 times greater inside

than outside of development, and numbers of grouse at remaining leks decline by 32 to 77% (Doherty et al. 2010). The magnitude of loss has varied from one field to another, but impacts are always negative and typically severe (Harju et al. 2010). High site fidelity (loyalty) of adult males to leks and adult females to nesting habitat and lower survival of adult sage-grouse combine with lek avoidance by younger birds (Holloran et al. 2010) to result in time lags of 2-10 years between when development began and the loss of local sage-grouse leks (Holloran 2005, Walker et al. 2007a, Harju et al. 2010). Energy development also impacts sage-grouse habitats and vital rates outside the breeding season away from leks. Vital rates are measures such as nest success, hatching success and survival (Taylor et al. 2012). The risk of chick death has been shown to be 1.5 times higher for each additional well site visible within 0.6 mi of brood locations compared to random locations (Aldridge and Boyce 2007), and sage-grouse avoid otherwise suitable winter habitat disturbed by energy development (Doherty et al. 2008, Carpenter et al. 2010, Dzailak et al. 2012, 2013).

The specific mechanisms that lead to avoidance and decreased fitness have not been empirically tested but rather suggested from multiple correlative and observational studies. For example, abandonment may increase if leks are repeatedly disturbed by raptors perching on power lines near leks (Ellis 1984), by vehicle traffic on nearby roads (Lyon and Anderson 2003), or by noise and human activity associated with energy development during the breeding season (Remington and Braun 1991, Holloran 2005, Kaiser 2006, Blickley and Patricelli 2012). However, recently completed research in Wyoming (Blickley et al. 2012), experimentally demonstrated that noise from natural gas drilling and roads resulted in a decline of 29% and 73% respectively in male peak attendance at leks relative to paired controls; declines were immediate and sustained throughout the experiment. Collisions with nearby power lines and vehicles and increased predation by raptors may also increase mortality of birds at leks (Connelly et al. 2000a). Alternatively, roads and power lines may indirectly affect lek persistence by altering productivity of local populations or survival at other times of the year. For example, sage-grouse deaths associated with power lines and roads occurs year-round (Beck et al. 2006, Aldridge and Boyce 2007), and ponds created by coal bed natural gas development may increase the risk of West Nile virus mortality in late summer (Walker et al. 2004, Zou et al. 2006, Walker et al. 2007b). Anthropogenic developments (e.g. produced water features and distance to wells) appear to facilitate depredation (Dzialak et al. 2011, Webb et al. 2012). Loss and degradation of sagebrush habitat can also reduce carrying capacity of local breeding populations (Swenson et al. 1987, Connelly et al. 2000a, 2000b, Crawford et al. 2004). Birds may avoid otherwise suitable habitat as the density of roads, power lines, or energy development increases (Lyon and Anderson 2003, Holloran 2005, Kaiser 2006, Doherty et al. 2008, Carpenter et al. 2010, Hess and Beck 2012, Kirol 2012).

Long-term studies in the Pinedale Anticline Project Area in southwest Wyoming present the most complete picture of impacts over time. Early in development, nest sites were farther from disturbed than undisturbed leks, the rate of nest initiation from disturbed leks was 24 percent lower than for birds breeding on undisturbed leks, and 26 percent fewer females from disturbed leks initiated nests in consecutive years (Lyon and Anderson 2003). As development progressed, adult females remained in traditional nesting areas regardless of increasing levels of development, but yearlings that had not yet imprinted on habitats inside the gas field avoided development by nesting farther from roads (Holloran 2005). The most recent study confirmed that yearling females avoided gas field infrastructure when selecting nest sites, and yearling males avoided leks inside of development and were displaced to the

periphery of the gas field (Holloran et al. 2010). Recruitment of males to leks also declined as distance within the external limit of development increased, indicating a high likelihood of lek loss near the center of developed oil and gas fields (Kaiser 2006). The Pinedale work also showed that population level sage-grouse declines are explained in part by lower annual survival of female sage-grouse. (Holloran 2005).

Wind Power

Wind energy development in Wyoming has been proceeding at an accelerated pace over the last few years although wind energy exploration has slowed since the development of the Core Area strategy. Recently, some interest has been expressed in developing wind energy within the WRSRCA. 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.

Parasites and Diseases

West Nile Virus

Fremont County

- A few sage grouse have tested positive for WNV in the past decade.
- A telemetry study on the Wind River Reservation found 3 known and 5 suspected positive mortalities due to WNV between April 2006 and May 2008
- This accounted for about 30% of the mortality (27 deaths) during that period. (Total mortality of collared birds was about 25%)
- Other known mortality causes were due to raptor predation (11%), mammalian predator (15%), unknown predation (11%) and unknown (52%).
- Of the known mortality causes 23% was from WNV
- Other than the previous study, very few sage grouse or other wildlife were known to die from West Nile Virus in Fremont County.
- Mortality is somewhat difficult to detect in free ranging wildlife, and determining the cause of mortality is even worse, unless fresh carcasses are discovered.
- Populations have declined since a peak in 2006, with WNV likely being a contributing factor.

Rest of Wyoming

- Most West Nile Virus positives in sage grouse have been reported from the Powder River Basin of northeast Wyoming.
- Some reasons include the intensive Coalbed Natural Gas developments and increases in standing water associated with produced water ponds
- Lek counts inside CBNG fields indicated an 82% decline, whereas lek counts outside CBNG fields only showed a 12% decline (2007) although the decline was due to multiple causes
- Other wildlife species are susceptible to WNV, but its affects have not been as pronounced.
- Overall, West Nile Virus impacts to Wyoming's wildlife have not been as extreme as anticipated in its early stages of detection in the state.

Pesticides

In 2011, APHIS conducted an aerial application of Dimilin, a low toxicity growth inhibitor, for grasshopper control in a Reduced Area and Agent Treatments (RAATs) approach (alternating strip of sprayed and unsprayed areas) over 145,000 acres of sagebrush steppe on the Wind River Reservation from the North Fork Popo Agie River to Bull Lake and from the foothills of the Wind River Mountains to Highway 287. Grasshopper abundance was rather limited and the spray would likely produce minimal increases in abundance of herbaceous forage for livestock. On average, leks on the Reservation have been declining since 2007. Sage-grouse male attendance on leks in the application area did not decrease any more so than leks on the rest of the Reservation in 2012 and 2013. Based on this, there did not appear to be any negative effects on male attendance from spraying.

Predation

Raven control

A raven damage management project is being conducted at landfills in the Lander and Riverton area in 2013. USDA – Wildlife Services placed the corvicide DRC-1339 to reduce the raven population for several reasons: Sage grouse population recovery, Agricultural depredation complaints and human health and safety complaints at industrial facilities.

USDA APHIS Wildlife Services personnel have conducted at least 2 predator control or monitoring projects in the Gas Hills/Beaver Rim area over the past few years. One project was designed to study predation on sage grouse nests using artificial eggs and remote cameras.

Project Goals

1. Identify which predators/animals depredate sage grouse nests
2. Measure, if possible, the differences in nesting success of sage grouse in areas of little predator control as opposed to areas with intense predator control.

Methods

Artificial nests were constructed and infrared trail cameras placed nearby to record wildlife movements around the nest. Small brown chicken eggs were used and nest sites were chosen close to known lek areas. Each camera was stationed at a nest site for one week and then rotated to a different site. Each camera was placed at 4 different sites, for a total of 40 different nest sites annually. The cameras were checked twice weekly for activity.

Results

A total of 320 artificial nests were monitored for this study, (40 unique nest sites monitored annually for 8 years), with 146 nests documented with predation damage (45.7%). Of the damaged nests, 108 were damaged by ravens (74% of damaged nests) and 16 were damaged by magpies (11% of damaged nests). Although not peer reviewed research, the results of this study tend to mimic those of peer reviewed science indicating the majority of nest predation is caused by corvids (ravens, crows, magpies, etc). Other nest predators detected by this study included, badger, coyote, red fox,

Another study involved coyote control to evaluate the impact of predator control on the Beaver Rim mule deer population, with secondary monitoring for sage grouse. No results are available for this study as to impacts for sage grouse.

Recreation

Recreational impacts to sage-grouse populations include potential disturbance of breeding and nesting activities, and habitat fragmentation due to road usage. Research suggests road-related disturbances during the breeding season may cause sage-grouse leks to become inactive over time, cause fewer hens which do breed on disturbed leks to initiate nests, and increase the distance from the lek hens will move to selected nesting habitat (WGFD 2003). Dust from roads and other surface disturbances can adversely affect plants and animals.

Recreational viewing of leks can disrupt breeding activities, especially when conducted from close proximity, outside of a vehicle, and/or on a long-term basis. The Twin Creek lek southeast of Lander has been designated as a public viewing for the WRSRCA. This lek has a long history of public viewing and the birds seem to be tolerant of this disturbance, as well as the proximity of this lek to U.S. Highway 287.

The increased use of off-road vehicles and other outdoor recreational activities may result in greater disturbance of sage-grouse and degradation of habitats. These impacts are more likely to occur on public lands, or on leks adjacent to public roads. Recreation is most likely to influence sage-grouse in the Lander-South Hudson focus area, along with Historical Trail visitors and Handcart Re-enactments in the Upper Sweetwater focus area, with localized influences elsewhere in the WRSRCA.

The Lander BLM Field Office has initiated a project to conduct a "*Road Attribute Inventory in Greater Sage-Grouse Core Habitat".* The project proposes to hire a contractor to inventory roads and collect associated attributes in the Twin Creek Travel Management Area (TMA). Attributes such as average travel speed, road width, surface type, use levels, proximity to seasonal habitats, and vegetation impacts (e.g. dusting, braiding etc.) cannot be positively ascertained from maps and air photos and require site visits to collect. These attributes are likely the most important variables in determining the influence of an individual road or network of roads on GSG habitat and distribution. The BLM will use a contractor that has experience in other western states with collecting this type of data for the BLM for use in travel management decisions.
The eventual use of the collected attributes is to develop a travel management plan for the TMA. BLM guidance directs that a travel management plan consider impacts of roads on other resources including wildlife and species of concern. Part of the plan is to identify resource conflicts and develop specific measures for monitoring the effectiveness of the plan.

Demand for community-based recreation is increasing. Therefore, we can anticipate continued or increased levels of visitor use in habitats adjacent to communities. Conservation measures should be investigated to proactively address this demand.

Residential Development

Conservation Easements

Within the WRSRCA, several privately owned properties have been placed under conservation easements with deed restrictions ranging from minimal to no new construction of houses, barns, or other buildings. Conservation easements are mostly located in the Lander Foothills, Sweetwater River, Twin Creek, Dubois, and Ervay Basin areas as shown on the map below (Figure 9).

These conservation easements will provide protection of crucial wildlife habitat, water quality and maintain migration routes, and traditional agricultural uses of the land.

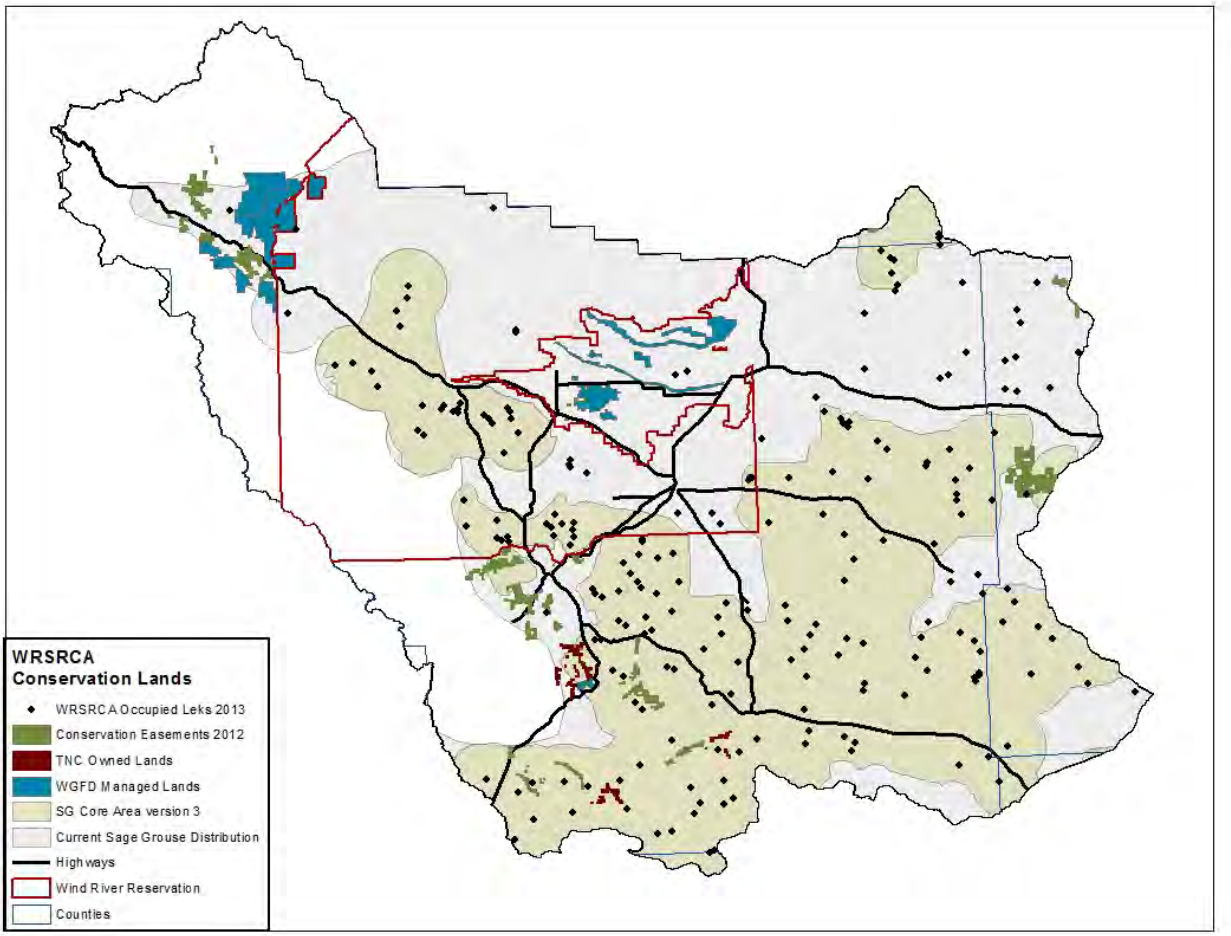

Figure 9. Lands with conservation protections in WRSRCA (2013). Data provided by WGFD, TNC.

Wind River Reservation

The number of homesites (single dwelling homes on 2.5 acres) reviewed by the Lander Fish and Wildlife Conservation Office of the USFWS between 2003 and 2013 was 567. The percentage of these homesites that are actually constructed is uncertain but likely greater than 80%. These dwellings typically occur in areas already fragmented by human constructions, along highways, and in fallow agricultural fields, and have marginal effect on viable sage-grouse habitat; however, occasionally a homesite will be located in undisturbed sage-steppe habitat and may affect sage-grouse. The image

below (Figure 10) shows homesites in relation to sage-grouse leks in a select area of the Reservation near Ethete and Ft. Washakie. A few leks are at risk from homesite encroachment and include Sacagawea, Blue Trail, Boulder Flat and the Sharpnose Draw leks.

Sage-grouse leks in the Lander/Ft. Washakie/Ethete area and their proximity to new homesites since 2003, Wind River Reservation.

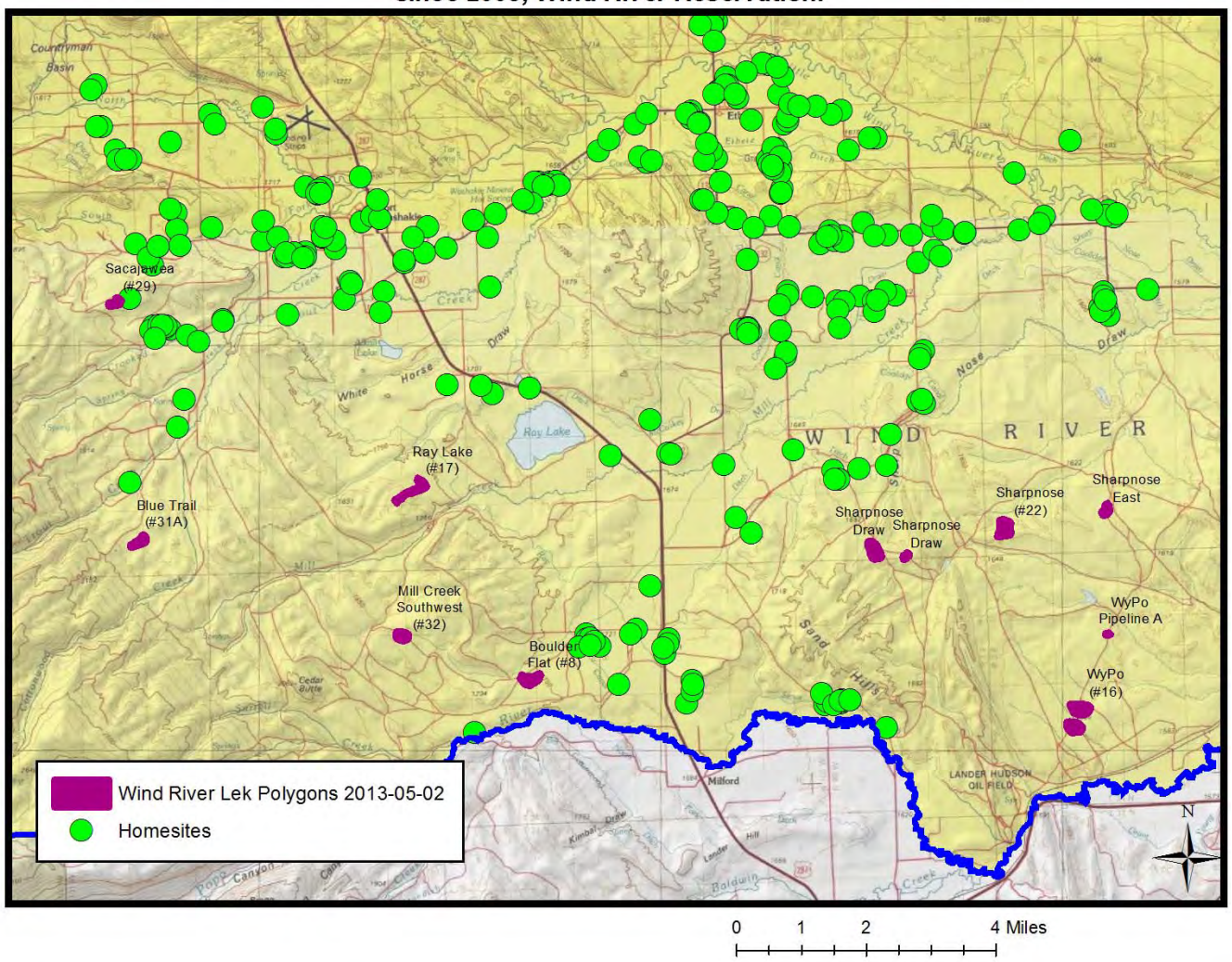

Figure 10. Proximity of homesites and sage grouse leks on the Wind River Reservation since 2003.

Vegetation Management

- Since adoption of the WRSR LWG plan in 2007, a number of vegetation treatments have been implemented with the intention of improving habitats for sage grouse, mule deer, and other wildlife. A summary of these treatments follows, with specific treatments and acreages treated listed within Appendix A in the Project Commitments (Table 2) and Recommended Action (Table 3) updates. Funding for treatments provided by Sage Grouse Conservation Funds is also reported in Table 1 of Appendix A.
- A reclamation study was initiated in the Beaver Creek and Lysite energy development fields.
- A research project has been collecting pre-treatment data for studying the response of sage grouse to treatments in Wyoming big sagebrush. Treatments are planned for winter 2013-14, weather permitting. Contingency treatment dates are in place to avoid disturbance of sage grouse during breeding, nesting, and early brood rearing periods.

Farming

No appreciable conversion of sagebrush habitats to farmland has occurred since 2007.

Invasive Plants

A few projects have been implemented targeting control of invasive plants in the WRSRCA, mainly along riparian corridors, with Russian olive and salt cedar being the primary species of concern. Other Weed and Pest District projects have targeted leafy spurge, Russian and spotted knapweeds, and other noxious weeds. At least 4 projects were implemented to attempt reduction of cheatgrass (Bromus tectorum) in the WRSRCA in recent years. The herbicide Plateau® was applied to more than 2,000 acres in the Lander – South Hudson focus area. This herbicide has been effective at reducing fall germination of cheatgrass seeds, if applied just before germination occurs.

Livestock Grazing

Because of the reduced amount of forage produced due to drought conditions, the BLM worked with grazing permittees to reduce grazing on public lands in 2012 and 2013. In many grazing allotments, grazing permittees reduced their livestock numbers and/or shortened the length of time livestock were allowed graze. These actions allowed for some plant grow to remain for other wildlife species, including greater sage-grouse.

Reclamation in Energy Development Fields

Energy Development Reclamation Study

Extremely dry conditions have led to unsuccessful reclamation on newly constructed oil and gas pads in the Lysite and Beaver Creek areas. WGFD assisted the BLM, NRCS, ConocoPhillips, and Devon Energy in the development of a reclamation study being conducted at Conoco-Phillips' Lysite field and at Devon's Beaver Creek field. In an effort to increase reclamation success both companies agreed to complete various planting techniques on three different soil types at each oil field. Tests were set up on a clayey, sandy and saline site on both units. Each pad was divided into a split plot design to test 3 variables: cover crop vs. no cover crop, drilling vs. broadcasting, and irrigated vs. non-irrigated. In 2009, the sections selected to receive a cover crop were planted with barley in May and mowed in July-August.

Native seeds were drilled or broadcast in November 2009. Barley germinated at all but one saline site. Initially the reclamation study team decided not to erect temporary electric fencing because of cost, but grazing on the cover crop was significant. Fences were erected over winter to prevent cattle from grazing seedlings.

Both fields received significant moisture in April, May and early June 2010 and the study team decided not to irrigate. Russian thistle and halogeton were the dominant species present when monitoring was completed in mid-June. A few native species were found in very low numbers, some from the seeding and some recruited from neighboring areas. The saline site in the Conoco-Phillips field had the worst results with very poor germination. Monitoring has been intermittent, with plans to continue in 2014. Long-term results are not yet available.

Vegetation Treatments and Practices for Habitat Improvement

Government Draw Habitat Improvement Project

The Government Draw project area provides sage-grouse wintering, breeding, nesting, and early brood-rearing habitat south of Hudson, Wyoming. The area has experienced season-long cattle grazing since the early 1900s in conjunction with a long-term lack of disturbance, resulting in older age-class sagebrush stands with little regeneration and limited herbaceous understory. Recent sage-grouse studies indicate that hens with their chicks leave shortly after hatching to migrate to higher elevation habitats having greater vegetation diversity. Chick mortality can be high as these young birds must navigate across a highway and travel 20+ miles to reach preferred habitats. Increasing herbaceous plant abundance, species diversity, and the overall nutrient quality of the vegetation community may encourage birds to remain longer on their nesting and early brood-rearing habitats. Larger chicks would be better able to make the arduous trip and the end result should be increased chick survival.

Goals:

1. Improve sage-grouse nesting and early brood-rearing habitat.
2. Lengthen time spent by sage-grouse in nesting and early brood-rearing habitats.
3. Increase chick survival.
4. Utilize knowledge gained for other treatments throughout the Lander-South Hudson focus area.

Objectives:

1. Increase forb density and diversity within treated areas.
2. Increase sage-brush recruitment and age-class diversity within treated areas.
3. Increase perennial grass plant density and diversity within treated areas.
4. Create a mosaic of vegetation communities.

The project entailed conducting different vegetation treatment methods on sagebrush/grass rangeland to determine each method's effectiveness in improving sage-grouse habitat. Prescribed fire was planned for a part of the project area having deep soils covered predominantly by Basin big sagebrush (*Artemisia tridentata tridentata*). Due to poor herbaceous cover (fine fuels) and limited time of opportunity, burning was not successful in 2006, and will be delayed until prescribed burning conditions are met and grazing deferment may be achieved. Timing of the treatment should consider grass, forb, and sagebrush recruitment goals and prevention of cheatgrass (*Bromus tectorum*) establishment and/or expansion. Initial results from the limited amount of burned areas indicate prescribed fire should not be considered as a high priority treatment in this habitat type.

This project was experimental in nature, designed to enhance herbaceous vegetation with the objective of increasing early brood-rearing habitat. Mechanical treatments were employed and included using a mower on 1,250 acres and Lawson pasture aerator on about 75 acres on sites with shallow soils and covered by Wyoming big sagebrush. Treated zones consisted of irregular mosaic patterns, alternating with a mosaic of untreated zones. Treatment areas were deferred from livestock grazing for the first growing season. Initial monitoring indicated an increase in hawksbeard *(Crepis spp.)*, a forb utilized by sage-grouse, in the aerated treatment zone. Grasses appear to be increasing in vigor, but it is uncertain if cover has increased as yet. Dry summers have most likely inhibited seedling establishment. Sagebrush cover was reduced by 60-80% in most of the treated sites. However, stems remaining after treatment indicate a rapid response to the removal of surrounding sagebrush.

Several more sites have been identified for treatments in Government Draw, but implementation has been postponed pending the results of a University of Wyoming research project studying sage grouse responses to habitat treatments (report below).

Figure 11 below shows sagebrush production as measured by current year leader growth at several transects within WRSRCA from 2004 to 2010. Data collected in 2008 – 10 shows clear improvement of sagebrush production in treated sites over untreated sites in Government Draw and other locations. Monitoring of these transects has been temporarily interrupted due to changes in the Wyoming Game and Fish Department's Habitat Biologist position in Lander.

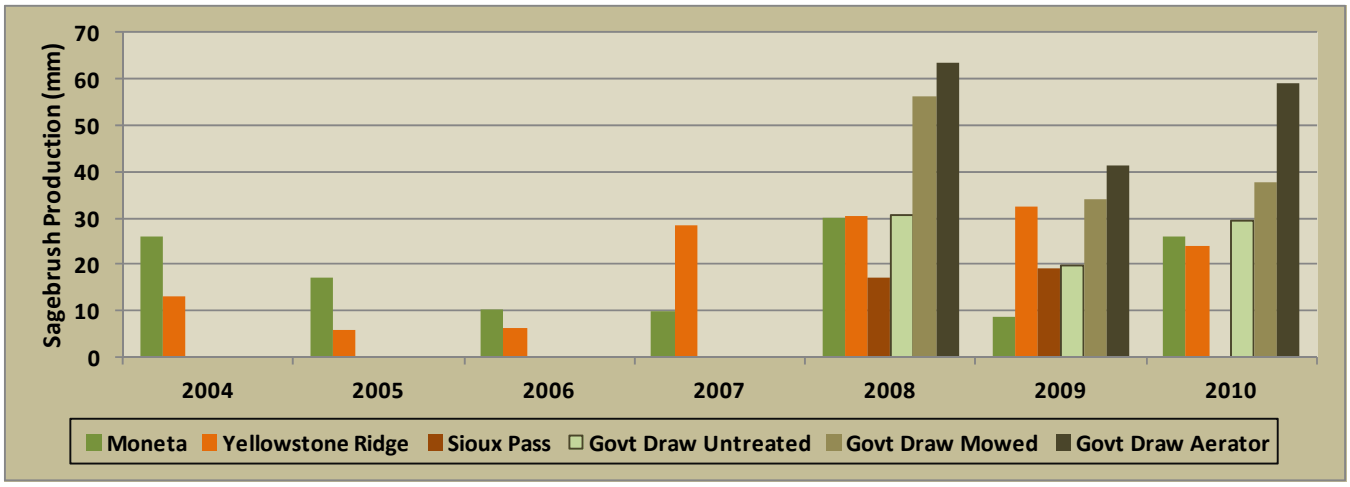

Figure 11. Sagebrush production at several transects within WRSRCA, 2004 – 2010. *Data from WGFD*

Twin Creek Mowing Treatments

Several sites were mowed in the Twin Creek area by BLM in the past few years. Resulting vegetation responses were similar to those observed in the Government Draw treatments. Lander BLM personnel have been monitoring the vegetation response, but data were not available at the time of this Addendum.

University of Wyoming research - "Response of Greater Sage-grouse to Treatments in Wyoming Big Sagebrush"

This research is a multi-year study intended to measure demographic response of sage grouse to sagebrush treatments in the Beaver Rim area north of Sweetwater Station and Jeffrey City. Mowing treatments have begun in the Dishpan Butte and Cedar Rim project areas and tebuthiuron (Spike 20P®) applications are planned for spring 2014. More detail about this project is found in the research section of this plan addendum on page 31.

Lander Front Mule Deer Habitat Improvement

Multiple vegetation treatments geared toward improving mule deer habitats have been implemented in the Lander Foothills, Twin Creek, and Beaver Creek areas since 2005. Several of these projects involved removal of juniper and other vegetation which has encroached into sagebrush or mountain shrub habitats over the last century. Removal of this encroaching vegetation should allow desirable vegetation to be rejuvenated, enhancing the treatment areas' values for mule deer forage as well as potential increased habitat available for sage grouse. Individual project reports are included in tables found in Appendix A.

Habitat Improvement Projects on Wind River Reservation

Several habitat improvement projects have been implemented on the Wind River Reservation over the past few years. Each project is listed within tables found in Appendix A.

Weather

Sage-grouse evolved with variable weather and long-term climatic change, and survived multiple ice-ages and droughts. Annual weather fluctuations, multi-year weather events, and long term climatic change all influence sage-grouse populations through physical stress and by modification of habitats. Annual variations in precipitation and temperature can affect annual sage-grouse production and may be site-specific. Cold, wet weather during early brood-rearing can physically stress and kill young chicks and have adverse affects on insect populations and plant growth. However, cool, wet springs can be advantageous to sage-grouse by promoting herbaceous growth, especially forbs. Extremely hot-dry conditions during the early summer forces sage-grouse to congregate on the few riparian areas that remain well hydrated, thereby increasing the potential for predation and the risk of disease. In general, wet years are good for sage-grouse production and dry years can inhibit production.

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

RESEARCH

Several sage grouse research projects have been or are being conducted within the WRSRCA in recent years. Abstracts (if available) or project descriptions for those projects follow: Citations are included in the literature cited section for completed and published research.

Grazing System and Linear Corridor Influences on Greater Sage-Grouse (Centrocercus urophasianus) Habitat Selection and Productivity – *Kuipers, 2004*

ABSTRACT: Sage-grouse (Centrocercus urophasianus) range-wide population declines have induced criticism of livestock management practices in sagebrush steppe. To clarify the influences of livestock grazing management on sage-grouse nesting and early brood rearing (EB) habitats, we radio-collared 101 sage-grouse females and tracked them to seasonal habitats. Females were collared near 2 leks within close proximity of 4 livestock grazing systems near Lander, Wyoming, from 2000-2003. Systems included a high intensity spring rotational deferred (DR), a summer grazed moderate to light intensity rest rotational (SR), a spring and fall grazed moderate to light intensity rest rotational (SFR), and a rested from livestock area (NG). We measured vegetation at nest and EB sites (10-14 days post hatch) and random locations within systems. Vegetation was compared at successful versus unsuccessful nests, sage-grouse use habitats (nests and broods) versus all systems combined, and system versus system. Nests had greater total shrub canopy cover, successful nests had greater residual grass heights, and EB sites had greater total shrub cover and food forbs. All habitat use analyses indicated that the vegetation variables did influence selection and success, although the influence was weak. The SR and NG systems best influenced important sage-grouse habitat variables during the study duration, which occurred during a substantial drought. Positive influences were attributed to reduced spring grazing and low forage utilization rather than grazing system type. Additionally, we examined the influences of linear corridor presence (maintained roads, 2-tracks roads, and trails) on sage-grouse nest selection and success on an exploratory basis. Nests from 253 radio-collared females near Lander, Pinedale, and Kemmerer, Wyoming, were used. Trails were found to have negative influences on nest success at 25 m, no influence at 50 m and a positive influence at 100 m. Maintained roads and 2-tracks had positive influences on nest success at 100 m. Lander nests and randoms were used to determine nest selection. Two-track roads at 25 m and trails at 50 m increased the likelihood of nest selection, while 2-tracks at 100 m decreased selection

Migration, Transition Range and Landscape Use by Greater Sage-Grouse (Centrocercus urophasianus) – *Jensen, 2006*

Abstract: Greater sage-grouse (*Centrocercus urophasianus*) populations have shown noticeable declines in the past 50 years, due largely to habitat degradation and loss. To provide insight into population differences, I studied two populations. One population near Hudson, Wyoming was believed to be migratory and the second population on McGraw Flats about 25 km south of Hudson, Wyoming was believed to be non-migratory. Bird locations were monitored by radio-telemetry to determine migration distances and timing, productivity of each population, sites used seasonally, and sites used as stop-over locations when migrating between nesting or early brood-rearing sites and summer sites. Productivity appeared to be high during the study for the Hudson population while low sample sizes and high standard errors prevented conclusions regarding the McGraw population. Variation in nesting habitat was observed between the two populations. The birds in the non-migratory

McGraw population selected nest sites with greater grass height and less residual grass height. In contrast, the Hudson birds selected sites with greater dead sagebrush (*Artemisia spp.*) density, residual grass height, and less Wyoming sagebrush (*Artemisia tridentata wyomingensis*) cover. No differences in habitat use were observed between transition sites and paired random sites for the Hudson population although differences were noted between sites used by brooding and non-brooding females. A nesting, terrain-use model using nests from four past studies in western Wyoming (i.e. Pinedale, Farson, Lander, Kemmerer) was also developed. This exercise showed increased use of sites with low-to-moderate variation in terrain although much variability existed among sites, apparently due to different elevations. Aspect did not appear to influence nest site selection. However, it seems likely that terrain is considered by nesting greater sage-grouse. This study emphasized the need to manage greater sage-grouse and their habitats on the landscape scale given the large home ranges and distinct seasonal habitats of migratory populations.

Examining the Effects of Noise from Energy Exploration and Development on the Breeding Biology of the Greater Sage-Grouse – *Patricelli, et al. University of California – Davis*

The goal of this project is to investigate the effects of noise from natural gas development on sage-grouse reproductive behaviors. This project has three major objectives. First, we monitored noise sources in Sublette and Campbell counties that are associated with energy development, including drilling rigs, compressor stations, roads, and generators. Second, to examine the impacts of noise on sage-grouse, we conducted a noise playback experiment on leks in our study site in Fremont County from 2006-2009. We found an immediate and sustained decline in male lek attendance and elevated fecal stress hormone levels on noise leks relative to paired control leks. Third, we adapted landscape-level noise modeling software (NMSimNord) and are now using it, along with our measurements from noise sources, to map the "acoustic footprint" of natural gas development in the Pinedale Anticline from 1998-2011. The model has recently been upgraded and expanded, and while this allows us to model noise propagation under different weather conditions that occur in sagebrush habitat, it also has significant bugs. We are currently working with our partners at the National Park Service and the model programmer to fix these bugs and to implement scripts that will allow us to model a large number of noise sources simultaneously. The spatial data layers generated by the model are being included in habitat-selection models to determine the role that noise has played in sage-grouse declines, determine the noise exposure threshold for this species, and determine what metric or metrics are most appropriate for characterizing noise impacts.

Sage-Grouse Movements and Survival Study on the Wind River Reservation *–*
Hnilicka, USFWS/WRR, 2007

Sage-grouse (*Centrocercus urophasianus*) have attracted much attention in recent years. The species has been petitioned for listing as Threatened or Endangered on several occasions due to large population declines from historic highs, shrinking distribution throughout its range, and threats to its habitat (US Fish & Wildlife Service 2005).The Wind River Reservation (Wind River) contains excellent sage-grouse habitat and has a minimum of 60 leks. Of these, a minimum of 26 were active in 2008 averaging 31 displaying males since 1986 (Figure 1). The primary intent of this study was to acquire baseline information on movements and seasonal ranges - information that will assist in managing this population sustainably. Secondary priorities were to obtain data on survival and nesting success.

Vocal and anatomical evidence for two-voiced sound production in the greater sage-grouse Centrocercus urophasianus – *Krakauer, et al. UC-Davis, 2009*

Greater sage-grouse, *Centrocercus urophasianus*, have been a model system in studies of sexual selection and lek evolution. Mate choice in this species depends on acoustic displays during courtship, yet we know little about how males produce these sounds. Here we present evidence for previously undescribed two-voiced sound production in the sage-grouse. We detected this 'double whistle' (DW) using multi-channel audio recordings combined with video recordings of male behavior. Of 28 males examined, all males produced at least one DW during observation; variation in DW production did not correlate with observed male mating success. We examined recordings from six additional populations throughout the species' range and found evidence of DW in all six popula. ons, suggesĀng that the DW is widespread. To examine the possible mechanism of DW production, we dissected two male and female sage-grouse; the syrinx in both sexes differed noticeably from that of the domestic fowl, and notably had two sound sources where the bronchi join the syrinx. Additionally, we found males possess a region of pliable rings at the base of the trachea, as well as a prominent syringeal muscle that is much reduced or absent in females. Experiments with a live phonating bird will be necessary to determine how the syrinx functions to produce the whistle, and whether the DW might be the result of biphonation of a single sound source. We conclude that undiscovered morphological and behavioral complexity may exist even within well-studied species, and that integrative research approaches may aid in the understanding of this type of complexity.

Tactical Allocation of Effort among Multiple Signals in Sage Grouse: An Experiment with a Robotic Female – *Patricelli and Krakauer, UC-Davis, 2010*

Males in many species have complex, multicomponent sexual signals, and there may be trade-offs between different signal components. By adjusting their signaling behaviors, males may be able to produce more attractive courtship displays in the face of these trade-offs, but this possibility has rarely been tested. In this study, we examined adaptive adjustment of display behaviors during courtship in a lek-breeding bird, the greater sage grouse (*Centrocercus urophasianus*). We measured the potential trade-off between display quantity (display rate) and quality (a temporal feature of displays) in a wild population of sage grouse using controlled approaches of a robotic female to experimentally induce changes in male display rate. We found that males who are more successful in mating can increase quantity without a decline in quality, with only unsuccessful males expressing an apparent trade-off. Male mating success was also positively correlated with responsiveness to changes in receiver distance, suggesting that successful males may avoid a trade-off by tactically adjusting their display rate—saving energy by displaying at low levels when females are farther away and at higher levels as females approach. Alternative explanations for this differential response to female proximity are discussed. Our results suggest that to be successful, males may need both the ability to produce attractive signals and the ability to effectively allocate their display effort by responding to female behaviors.

Identifying and Prioritizing Greater Sage-Grouse Nesting and Brood-Rearing Habitat for Conservation in Human-Modified Landscapes – *Dzialak, MR. et al. 2011*

Background

Balancing animal conservation and human use of the landscape is an ongoing scientific and practical challenge throughout the world. We investigated reproductive success in female greater sage-grouse (Centrocercus urophasianus) relative to seasonal patterns of resource selection, with the larger goal of developing a spatially-explicit framework for managing human activity and sage-grouse conservation at the landscape level.

Methodology/Principal Findings

We integrated field-observation, Global Positioning Systems telemetry, and statistical modeling to quantify the spatial pattern of occurrence and risk during nesting and brood-rearing. We linked occurrence and risk models to provide spatially-explicit indices of habitat-performance relationships. As part of the analysis, we offer novel biological information on resource selection during egg-laying, incubation, and night. The spatial pattern of occurrence during all reproductive phases was driven largely by selection or avoidance of terrain features and vegetation, with little variation explained by anthropogenic features. Specifically, sage-grouse consistently avoided rough terrain, selected for moderate shrub cover at the patch level (within 90 m2), and selected for mesic habitat in mid and late brood-rearing phases. In contrast, risk of nest and brood failure was structured by proximity to anthropogenic features including natural gas wells and human-created mesic areas, as well as vegetation features such as shrub cover.

Conclusions/Significance

Risk in this and perhaps other human-modified landscapes is a top-down (i.e., human-mediated) process that would most effectively be minimized by developing a better understanding of specific mechanisms (e.g., predator subsidization) driving observed patterns, and using habitat-performance indices such as those developed herein for spatially-explicit guidance of conservation intervention. Working under the hypothesis that industrial activity structures risk by enhancing predator abundance or effectiveness, we offer specific recommendations for maintaining high-performance habitat and reducing low-performance habitat, particularly relative to the nesting phase, by managing key high-risk anthropogenic features such as industrial infrastructure and water developments.

Experimental Evidence for the Effects of Chronic Anthropogenic Noise on Abundance of Greater Sage-Grouse at Leks *– Blickley, et al. 2012*

Increasing evidence suggests that chronic noise from human activities negatively affects wild animals, but most studies have failed to separate the effects of chronic noise from confounding factors, such as habitat fragmentation. We played back recorded continuous and intermittent anthropogenic sounds associated with natural gas drilling and roads at leks of Greater Sage-Grouse (*Centrocercus urophasianus*). For 3 breeding seasons, we monitored sage grouse abundance at leks with and without noise. Peak male attendance (i.e., abundance) at leks experimentally treated with noise from natural gas drilling and roads decreased 29% and 73%, respectively, relative to paired controls. Decreases in abundance at leks treated with noise occurred in the first year of the study and continued throughout the experiment. Noise playback did not have a cumulative effect over time on peak male attendance.

There was limited evidence for an effect of noise playback on peak female attendance at leks or male attendance the year after the experiment ended. Our results suggest that sage-grouse avoid leks with anthropogenic noise and that intermittent noise has a greater effect on attendance than continuous noise. Our results highlight the threat of anthropogenic noise to population viability for this and other sensitive species.

Potential Acoustic Masking of Greater Sage-Grouse Display Components by Chronic Industrial Noise – *Blickley and Patricelli, 2012*

ABSTRACT: Anthropogenic noise can limit the ability of birds to communicate by masking their acoustic signals. Masking, which reduces the distance over which the signal can be perceived by a receiver, is frequency dependent, so the different notes of a single song may be masked to different degrees. We analyzed the individual notes of mating vocalizations produced by Greater Sage-Grouse (Centrocercus urophasianus) and noise from natural gas infrastructure to quantify the potential for such noise to mask Greater Sage-Grouse vocalizations over both long and short distances. We found that noise produced by natural gas infrastructure was dominated by low frequencies, with substantial overlap in frequency with Greater Sage-Grouse acoustic displays. Such overlap predicted substantial masking, reducing the active space of detection and discrimination of all vocalization components, and particularly affecting low-frequency and low-amplitude notes. Such masking could increase the difficulty of mate assessment for lekking Greater Sage-Grouse. We discuss these results in relation to current stipulations that limit the proximity of natural gas infrastructure to leks of this species on some federal lands in the United States. Significant impacts to Greater Sage-Grouse populations have been measured at noise levels that predict little or no masking. Thus, masking is not likely to be the only mechanism of noise impact on this species, and masking analyses should therefore be used in combination with other methods to evaluate stipulations and predict the effects of noise exposure.

Experimental Chronic Noise is Related to Elevated Fecal Corticosteroid Metabolites in Lekking Male Greater Sage-Grouse (Centrocercus urophasianus) - *Blickley, J. L., et al. 2012*

ABSTRACT: There is increasing evidence that individuals in many species avoid areas exposed to chronic anthropogenic noise, but the impact of noise on those who remain in these habitats is unclear. One potential impact is chronic physiological stress, which can affect disease resistance, survival and reproductive success. Previous studies have found evidence of elevated stress related hormones (glucocorticoids) in wildlife exposed to human activities, but the impacts of noise alone are difficult to separate from confounding factors. Here we used an experimental playback study to isolate the impacts of noise from industrial activity (natural gas drilling and road noise) on glucocorticoid levels in greater sage-grouse (Centrocercus urophasianus), a species of conservation concern. We non-invasively measured immunoreactive corticosterone metabolites from fecal samples (FCMs) of males on both noise-treated and control leks (display grounds) in two breeding seasons. We found strong support for an impact of noise playback on stress levels, with 16.7% higher mean FCM levels in samples from noise leks compared with samples from paired control leks. Taken together with results from a previous study finding declines in male lek attendance in response to noise playbacks, these results suggest that chronic noise pollution can cause greater sage-grouse to avoid otherwise suitable habitat, and can cause elevated stress levels in the birds who remain in noisy areas.

Drawn into the vortex: The facing-past encounter and combat in lekking male greater sage-grouse (Centrocercus urophasianus) – *S.M. Pellis et al. 2013*

ABSTRACT: Lekking male greater sage-grouse (Centrocercus urophasianus) compete with neighbours not only by strutting to attract females but also by directly challenging othermales. These challenges include approaching another male and adopting an anti-parallel orientation at close quarters ('facing past encounter') and fighting, in which the birds strike one another with their wings. Facing past encounters and facing past encounters that led to fights in free-living sage-grouse were videotaped and analysed to test predictions arising from two sets of hypotheses to account for the features of such encounters. They could be used to assess or threaten opponents (index signal or threat signal hypotheses) or they may be the result of a stalemate in which one bird's attempts to gain an vantage point for attack are neutralised by counter moves by the other bird (combat hypothesis). Frame-by-frame analyses of both facing past encounters and fights were used to extract data to test specific predictions arising from the three hypotheses. The results, overall, support the hypothesis that the facing past orientation arises from combat. However, the results also suggest that, once in the anti-parallel orientation, opportunities emerge for communication to take place.

Recommended Management Strategies to Limit Anthropogenic Noise Impacts on Greater Sage-Grouse in Wyoming – *Patricelli, et al. 2013*

ABSTRACT: Recent research has demonstrated that noise from natural gas development negatively impacts sage-grouse (Centrocercus urophasianus) abundance, stress levels, and behaviors. Other types of anthropogenic noise sources are similar to gas-development noise and, thus, the response by sage-grouse is likely to be similar. The results of research suggest that effective management of the natural soundscape is critical to the conservation and protection of sage-grouse. The goals of this review are to discuss current approaches in the management of new and existing noise sources in Wyoming and recommend research priorities for establishing effective noise management strategies. We make 4 interim recommendations: (1) that noise-management objectives should be set relative to typical ambient noise levels in sage-grouse habitat before development; the best currently available measurement of residual noise levels levels (L90) in undisturbed areas suggest an ambient level of 16 to 20 dBA; (2) that an increase in median noise levels (L50) of 10 dBA above ambient be allowed; (3) that management strategies be expanded to protect the soundscape in areas critical for mating, foraging, nesting, and brood-rearing activities of sage-grouse, rather than protecting the lek area alone; and (4) management strategies be focused on the siting of roads or limiting of traffic volumes during crucial times of the day (0600 to 0900 hours) and season (i.e., breeding season), rather than setting targets for vehicle noise exposure. Roads should be sited or traffic should be seasonally limited within 1.3 to 1.7 km from the edge of critical areas for nesting, foraging and breeding. We emphasize that protections based on these interim recommendations may need to be revised upon completion of ongoing and future research.

Successful Sage−grouse Show Greater Laterality in Social Behaviors *- Krakauer, A.H.*; Blundell, M.; Scanlan, T.; Wechsler, M.; McCloskey, E.; Yu, J.; Patricelli, G.L.; UC-Davis (in revision)*

Lateral biases in behaviors are common across animals. Greater lateralization may be beneficial (e.g., if it allows for more efficient neural processing), yet few studies have considered the possible importance of inter−individual variaĀon in lateral biases in wild animals, particularly for social behaviors. We examined lateral biases in lekking male greater sage−grouse (Centrocercus urophasianus), a species

with obviously lateral orientations during aggressive and courtship interactions and in which male mating success can readily be measured. In both agonistic facing−past events and courtship strut displays, successful males showed greater bias. The greater resolution of angular orientation in our courtship data revealed that bias depended on the region of the visual field being used; struts were left biased in the frontal hemifield and right−biased in the lateral hemifield. Our results suggest that more successful males were more lateralized, although variation in social context and portion of the visual field being used are also important to consider.

Response of Greater Sage-grouse to Treatments in Wyoming Big Sagebrush - *Smith and Beck, University of Wyoming (2013 Progress Report)*

Wyoming big sagebrush (*Artemisia tridentata wyomingensis*) has been treated through chemical application, mechanical treatments, and prescribed burning to increase herbaceous forage species released from competition with sagebrush overstory. Originally intended to provide more forage for livestock, these techniques have been applied to improve habitat for sagebrush wildlife species such as greater sage-grouse (*Centrocercus urophasianus*). Treatments are intended to rejuvenate sagebrush stands by killing older sagebrush plants to promote growth of younger sagebrush plants and increase herbaceous production. Studies evaluating habitat treatments have reported varied results and generally lack the replication necessary for evaluation of demographic rates and fine-scale habitat use of sage-grouse in response to treatments. Our study, centered near Jeffrey City in Fremont and Natrona Counties, Wyoming is designed as a Before-After Impact-Control study with 3 years of pre-treatment and 3-to-5 years of post-treatment data comparing demographic rates and habitat selection patterns within treated and non-treated sites. We initiated our study in spring 2011 by capturing female sage-grouse and affixing VHF necklace-mounted radio transmitters to measure pre-treatment nest and brood-rearing success and microhabitat use. We also began attaching GPS transmitters in spring and summer 2012 to female grouse. In fall 2013 we received funding to implement treatments in fall 2013. In 2011, 2012, and 2013 we monitored survival at 161 nests and 78 broods from n = 258 VHF or GPS marked females. Identifying sage-grouse demographic and habitat use responses will aid in determining the efficacy of habitat treatments intended to enhance habitat for sage-grouse and other vertebrate species associated with the sagebrush biome.

Effects of Mowing and Herbicide Treatments on the Nutritional Quality of Sagebrush in south-central Wyoming – *Forbey, Boise State University, and Beck, et al – University of Wyoming*

To meet some of the population and habitat objectives outlined in the Wyoming Greater Sage Grouse Conservation Plan and to better understand sage-grouse distribution and population trends, there is a need to identify how various habitat treatments such as mowing and herbicides influence the quality of winter and breeding habitats for sage-grouse. Specifically, we aim to identify how management treatments influence the quality of sagebrush, specifically Wyoming big sagebrush, as food in treated Wyoming big sagebrush communities.

Why is the dietary quality of sagebrush important?

Greater sage-grouse are a sagebrush obligate species because they rely on a variety of sagebrush-dominated habitats for food, cover, and reproductive activities (Connelly et al., 2004; Crawford et al., 2004). Specifically, sagebrush is virtually the only source of food for sage-grouse during mid-to-late fall, winter, and spring before forbs begin growing (Connelly et al., 2000), comprising 100% of the sage-

grouse diet during winter. The majority of research has focused on defining sagebrush quality for sage-grouse in terms of height and canopy cover. However, because a substantial proportion of the sage-grouse diet is comprised of sagebrush from October-March, quality should not be defined solely in terms of structural characteristics. There is strong evidence that the nutritional and chemical quality of the diet is important to herbivores (Beckerton and Middleton, 1982; Beckerton and Middleton, 1983; Jakubas et al., 1993a; Jakubas et al., 1993b), including sage-grouse (Frye et al., 2013; Remington and Braun, 1985; Welch et al., 1988). Dr. Forbey and one of her graduate students recently determined that sage-grouse selected black sagebrush with lower plant secondary metabolite (PSM) concentrations over Wyoming big sagebrush in winter in southern Idaho (Frye et al. 2013). Moreover, sage-grouse selected patches and individual plants within black sagebrush patches that were higher in nutrient concentrations and lower in PSM concentrations than those not used (Frye et al. 2013, Fig 1). Thus, we propose that the dietary quality of sagebrush may have a significant impact on body condition as grouse enter the reproductive period. In support, ruffed grouse consuming diets with higher crude protein had higher reproductive success (Beckerton and Middleton, 1982). In addition, ruffed grouse consuming winter diets higher in crude protein and lower chemical defenses had higher population densities (Beckerton and Middleton, 1982; Beckerton and Middleton, 1983; Jakubas et al., 1993b).

The Effectiveness of Sage-Grouse Core Areas as an Umbrella for Conserving Non-Game Wildlife Species – *Carlisle, Chalfoun – University of Wyoming*

We are investigating how effective Greater Sage-Grouse is as an umbrella species for the conservation of non-game wildlife associated with the sagebrush-steppe ecosystem, specifically those designated as species of greatest conservation need (SGCN). Wyoming's Greater Sage-Grouse Core Population Areas and the host of current efforts to conserve sage-grouse provide a natural laboratory for testing the umbrella species concept and our findings will be useful to managers interested in indirectly conserving SGCN under the streamlined approach of the sage-grouse umbrella. In order to rigorously test sage-grouse as an umbrella species, we are implementing a four-part approach, focusing on differing spatial scales: 1) quantify overlap statewide between sage-grouse core areas and focal SGCNs' predicted spatial distribution using GIS data, 2) examine the occurrence and relative abundance of SGCN across gradients of sagebrush habitat structure and sage-grouse breeding density in the field, 3) evaluate the reproductive success of two sagebrush-obligate passerine SGCN (Brewer's Sparrow, Sage Thrasher) across gradients of sagebrush habitat structure, and 4) examine the responses of SGCN to sagebrush-reducing habitat treatments designed to improve sage-grouse brood-rearing habitat. We are currently updating the preliminary analyses for objective 1 using a more rigorous overlap analysis. We successfully completed our second field season this past summer, collecting data near Jeffrey City, WY to address objectives 2-4. Following field seasons (2014-2015) will continue to address objectives 2-4. Habitat treatments (in conjunction with K. Smith and J. Beck) are planned for implementation this fall near the Cedar Rim, Lander Region.

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APPENDIX A ACCOMPLISHMENTS

The Wind River/Sweetwater River LWG has accomplished the following:

- Developed the Wind River/Sweetwater River Local Sage-grouse Conservation Plan (August 2007)
- Assisted the Wyoming Governor's Sage-grouse Implementation Team with developing Version 3 of core area delineations
- Members have volunteered at the sage-grouse booth at the annual WGFD Hunting and Fishing EXPO
- Approved (to date) conservation projects with Wyoming Sage-grouse Conservation Funds (Table 1)
- Completed or initiated work on most of the WRSR LWG's Project Commitments (Table 2) and Recommended Actions (Table 3)

Table 1. Conservation Projects and Practices funded with Sage-grouse Conservation Funds allocated by the WRSR LWG since 2005.

Project Name	Local Working Group(s)	Budget Biennium	Conservation Funding	Project Description	Partners	Status	Total Cost
Examining Noise Effects from Energy Development	Upper Green & Wind River/ Sweetwater River	2005 - 06	$20,000 requested/ approved/ spent	Research examining the effects of noise resulting from energy development	University of California-Davis	Complete/ Ongoing	$149,320
Government Draw Sage Grouse Habitat Improvement	Wind River/ Sweetwater River	2005 - 06	*0	Habitat treatments using mower and Lawson aerator. Proposal requested funding for contracting the equipment and labor. * - With the purchase of the mower (below), WGF conducted the mowing, therefore contracting was not required	BLM, WGFD, Devon Energy, Grazing Permittees	Complete	$32,500
John Deere CX20 Rotary Cutter	Wind River/ Sweetwater River	2005 - 06	$22,149 requested/ approved; $20,532.00 spent	Purchase of mower for statewide use in sagebrush habitat treatments resulting from sage grouse conservation planning efforts around the state	WGFD	Complete	$22,149
Lander Front Habitat Improvement	Wind River/ Sweetwater River	2007 - 08	$30,000	Various habitat treatments over a large landscape. LWG $ to fund juniper removal	WGFD, BLM, Private Landowners	Complete/ Ongoing	$479,700
RB Keith Ranch Wildlife Inventory	Wind River/ Sweetwater River	2007 - 08	$11,500 requested; $6,250 approved/ spent	Wildlife and range surveys to determine conservation needs	Keith Ranch,	Complete	$37,527

Project Name	Local Working Group(s)	Budget Biennium	Conservation Funding	Project Description	Partners	Status	Total Cost
Examining Noise Effects from Energy Development	Wind River/ Sweetwater River, Upper Green, and Northeast	2007 - 08	$78,028 requested; $71,615 approved/ spent	Continuing research examining the effects of noise resulting from energy exploration and development	UC-Davis, BLM, WGFD	Complete/ Ongoing	500,000+ multiyear
Water trough escape ramps on private land	Statewide	2007 - 08	$36,000 requested/ approved	Provide pre-fab wildlife escape ramps, fence collision deterrents and spring protection fencing to private landowners throughout the state	BLM, WGFD, Permittees	Ongoing	$192,000
Twin Creek Monitoring Project	Wind River/ Sweetwater River	2007 - 08	$6,400 requested/ approved; $4,960 spent	Monitor vegetation response to grazing management including stocking rate, time/timing and longer recovery periods.	Twin Creek Ranch, NRCS?, BLM, WGFD	Complete	$8,200
Lander SG Flights	Wind River/ Sweetwater River	2007 - 08	$6,000 requested/ approved; $3,795 spent	Flights to document sage-grouse winter distribution and lek locations	WGFD, BLM	Complete	$6,000
Mower Maintenance	Wind River/ Sweetwater River	2007 - 08	$2,750 requested/ approved, $2,729.39 spent	Maintain mower in order to conduct habitat projects, esp the Government Draw Project	WGFD	Complete	$2,750
HWA Lysite Study	Wind River/ Sweetwater River	2007 - 08	$30,000 requested, $24,900 approved/ spent	Sage-grouse distribution and habitat use study to determine appropriate stipulations for natural gas development	WGFD, BLM, Industry?	Complete/ Ongoing	$1,305,800
Developing a program to predict energy development noise impacts to sage grouse	Wind River/ Sweetwater River; Northeast; Upper Green River Basin	2009 - 10	$51,250 requested/ approved	Utilize research results from previous projects to develop a computer program to predict energy development noise impacts to lekking sage grouse	UC-Davis, BLM, WGFD	Ongoing	$500,000 + multiyear
Beaver Creek invasive vegetation control	Wind River/ Sweetwater River	2009 - 10	$20,000 requested, $10,000 approved	Mechanical and chemical treatment of juniper, salt cedar and Russian olive	WGFD, Landowners, BLM, State Lands	Complete/ Ongoing	$290,388

Project Name	Local Working Group(s)	Budget Biennium	Conservation Funding	Project Description	Partners	Status	Total Cost
Keith Ranch Water Development and Grazing Management	Wind River/ Sweetwater River	2009 - 10	$27,000 requested, $20,000 approved	Water development and grazing management plan development.	Keith Ranch,	Complete	$165,266
Seasonal Habitat Mapping	Statewide	2009 - 10	$155,000 requested, $141,000 approved	Use predictive habitat models to produce sage-grouse seasonal habitat maps	Multiple Partners	Ongoing	$352,000
Sharpnose sagebrush treatment Unit 2	Wind River/ Sweetwater River	2011 - 12	$8,200 requested/ approved/ spent	Fine-grained mosaic sagebrush mowing to improve age diversity and increase herbaceous production.	Bureau of Indian Affairs, Wind River Reservation	Complete	$53,700
Estimating noise impacts for habitat selection modeling	Wind River/ Sweetwater River, et al	2011 - 12	$49,335 requested/approved/spent	Research to develop a noise model and determine noise exposure thresholds	UC-Davis, BLM, WGFD	Complete/ Ongoing	$69,415
Determining the impact of noise on greater sage-grouse using noise propagation simulations	Statewide	2013 - 14	$41,626 requested; $30,000 approved	Develop/refine a noise propagation model to predict the "acoustic footprint" of noise from energy development sources	UC-Davis, BLM, WGFD	Ongoing	$41,626
Response of Greater Sage-grouse to Treatments in Wyoming Big Sagebrush Habitat	Wind River/ Sweetwater River, et al	2013 - 14	$99,841 requested; $70,000 approved	Continue pre-treatment research of nesting and early brood rearing habitat use by sage grouse; begin stable isotope analysis to determine sage grouse chick dietary functions	University of Wyoming, BLM, WGFD	Ongoing	> $500,000 so far
Road Attribute Inventory in Greater Sage-Grouse Core Habitat	Wind River/ Sweetwater River	2013 - 14	$50,000 requested; $36,000 approved	Inventory roads and collect associated attributes in the Twin Creek Travel Management Area (TMA). Attributes such as average travel speed, road width, surface type, use levels, proximity to seasonal habitats, and vegetation impacts will be analyzed.	BLM, WGFD	Ongoing	$350,000

Table 2. WRSR LWG Project Commitments and Status. Red text indicates projects ongoing or in need of work to fully implement.

Project Commitments	Relationship to Conservation Plan Goals and Objectives	Priority by Focus Area	Original Timeline (August 2007)	Responsible Parties & Possible Funding Sources	Status as of October 2013
Assemble vegetation, topography and sage-grouse seasonal use mapping for all habitats in the WRSRCA (use existing data and determine gaps where data collection needs to be focused). Maps from statewide remote-sensing efforts may also be available soon, similar to efforts by SW LWG - WYGISC).	Goal 1. All Habitat Types	ALL	Ongoing w/ Completion by 2008	USGS, BLM, WGFD, WRR, WyGISC	Completion expected by 2015
Collect ground verifying vegetation data points on Wind River Reservation, BLM, USFS, and WGFD lands to assist with the WyGISC habitat mapping project.	Goal 1. All Habitat Types	ALL	Ongoing 2006 - 07	WRR, USFWS, BIA	**Completed 2006**
Enhance ground and aerial surveys, to discover leks not currently identified. Need to identify and prioritize potential search zones on annual basis. BLM requires searches/surveys as part of land use permitting requirements.	Goal 1A. Breeding Habitat (Obj. 1)	ALL	Ongoing 2007	BLM, WGFD, WRR/USFWS	Ongoing. Thermal IR flights done in 2013
Design bird waterers or guzzlers associated with livestock water systems to improve water availability to wildlife on Hansen's North Fork Ranch.	Goal 1D. Late Brood Rearing Habitat	Lander-South Hudson	2007	BLM, WGFD, Water for Wildlife	**Completed 2007**
Propose repairs to guzzler on Sheep Mountain.	Goal 1D. Late Brood Rearing Habitat	Lander - South Hudson	2007	BLM, WGFD, Water for Wildlife, Devon Energy	Completed 2007, but still needs work (replace tanks/troughs & valves)
Create wet meadow habitat using overflow water and erect fences around wet meadows to maintain integrity along the Sandhills water pipeline on Wind River Reservation.	Goal 1D. Late Brood Rearing Habitat	Wind River Reservation	2008?	WRR, USFWS, WY SG Fund, BIA	Repairs needed, Pipeline not functioning properly

Project Commitments	Relationship to Conservation Plan Goals and Objectives	Priority by Focus Area	Original Timeline (August 2007)	Responsible Parties & Possible Funding Sources	Status as of October 2013
Conduct winter flights/surveys to identify winter concentration areas and habitats across WRSRCA (using GIS, Wildlife Observation System, other data)	Goal 1E. Winter Habitat and Goal 4. Research	Lower Sweetwater, Badwater, Gas Hills, WRR	Ongoing Weather dependent	WGFD, BLM, WY SG Fund, WWNRTF	Ongoing, Weather dependent
Support inventory of sage-grouse use and habitats, and measurement of ecological condition on Bill Keith Ranch in eastern Fremont County. Data collected is hoped to provide guidance toward a grazing management and habitat improvement plan in order to enhance values for livestock production, sage-grouse, and other wildlife.	Goal 1. All Habitat Types	Gas Hills	2007	NRCS, Private landowners, WRSR LWG	**Completed 2007**
NRCS Programs - Several conservation measures have been implemented as part of NRCS Farm Bill and Sage Grouse Initiative (SGI) programs in various areas of the WRSRCA.	Goal 1. All Habitat Types	ALL		NRCS (EQIP - SGI), Private landowners	**13,232 acres Completed as of 2013** Another ~26,000 acres planned, but not yet contracted
				NRCS (WHIP - Working Lands for Wildlife), Private landowners	**3,992 acres Completed as of 2013**
				NRCS (GRP), Private landowners	**23,809 acres Completed as of 2013**
				NRCS (FRPP), Private landowners	**3,670 acres Completed**

Project Commitments	Relationship to Conservation Plan Goals and Objectives	Priority by Focus Area	Original Timeline (August 2007)	Responsible Parties & Possible Funding Sources	Status as of October 2013
Develop support documentation to submit to Wyoming Office of State Lands and Investments to support land use stipulations similar to those in place on Federal lands to protect sage-grouse and other wildlife	Goal 2. All Influencing Factors	ALL	2007	WRSR LWG (Stan/Pat to draft letter)	**Completed 2007 Now using WY Core Area Strategy**
Sage-grouse hunting seasons are conducted throughout the WRSRCA, set by WGFD and SATFG. a. When populations are stable or increasing (based on lek count information), hunting seasons are 2 to 4 weeks with a 3-bird daily bag limit beginning no earlier than September 15. b. If populations are declining (for 3 or more consecutive years based on lek count information), implement more conservative regulations that might include reduced bag limits and adjusted season dates. c. Populations should not be hunted where less than 300 birds comprise the breeding populations. (i.e. less than 100 males are counted on leks) d. Implement hunting seasons to harvest no more than 10% of the projected fall population. e. Continue using wing barrels to estimate sex and age structure of the harvest. f. Continue to collect hunter harvest data using a hunter survey.	Goal 2B. Hunting	ALL	Ongoing	WGFD	Ongoing - Wyoming Seasons have been more conservative than this in most years.
g. WRR conducts unique hunting seasons, with spring "males only" hunting allowed for cultural purposes.		WRR		WRR	**Discontinued in 2010**

Project Commitments	Relationship to Conservation Plan Goals and Objectives	Priority by Focus Area	Original Timeline (August 2007)	Responsible Parties & Possible Funding Sources	Status as of October 2013
In 2004 and 2005, at least 14,500 used tires were collected in Fremont County to reduce the threat of West Nile Virus, by eliminating small mosquito breeding sites that can exist inside tires.	Goal 2D. Parasites & Diseases (Objective 2)	ALL	2004 & 2005	Fremont County Landfills	**Completed 2004 - 05**
Cities of Lander and Riverton have stocked plains killifish in several ponds to reduce risk of West Nile Virus	Goal 2D. Parasites & Diseases	Lander - South Hudson, Withdrawal Area	2004, Ongoing	Cities of Lander and Riverton	**Completed 2004 (unknown if continued)**
Conservation easement on Twin Creek Ranch (4,970 acres private land; 16,000+ total ranch size) protecting important sage-grouse leks and nesting, brood-rearing and winter habitats.	Goal 2G. Residential Development	Lander - South Hudson	Completed 2005	NRCS (FRPP) WGFD, TNC	**Completed 2005**
Conservation easement on North Fork Ranch (~2,100 acres private land; ~3,600 acre total ranch size) protecting important sage-grouse nesting, brood-rearing and winter habitats.	Goal 2G. Residential Development	Lander - South Hudson	2007	WGFD, TNC, NRCS (FRPP), MDF, RMEF	**Completed 2007**
Conservation easements in the Red Butte area northwest of Lander (~1,100 acres private lands, 6 private owners) protecting important sage-grouse nesting, brood-rearing and potential wintering habitats.	Goal 2G. Residential Development	Lander - South Hudson	2007	WGFD, MDF, RMEF	**Completed 2007**
Conservation easements on the 3 Bar X and Double A Ranches have been completed. Both easements were partially funded with NRCS' Farm and Ranchland Protection Program (FRPP) with sage grouse habitat (core area) as part of the justification.	Goal 2G. Residential Development	Lander - South Hudson		The Nature Conservancy, Jackson Hole Land Trust, NRCS, WGFD	**Completed 2012 - 13**

Project Commitments	Relationship to Conservation Plan Goals and Objectives	Priority by Focus Area	Original Timeline (August 2007)	Responsible Parties & Possible Funding Sources	Status as of October 2013
Design reclamation test projects to prevent noxious and invasive weeds, and improve native vegetation restoration on BLM lands. Possible test projects include watering reclamation sites, varying seeding stages/mixes with grasses & forbs, then sagebrush vs. sagebrush first, then grasses/forbs; trying non-native plant species on BLM, develop mixes with NRCS Plant Materials Center	Goal 2H. Vegetation Management (Objective 2)	WRR, Gas Hills, Badwater, Beaver Creek (Lander - South Hudson)	Ongoing, starting 2007	BLM, WGFD, NRCS, AML, Conservation Districts, Industry, WWNRT	Ongoing - Lysite and Beaver Creek study areas
Design plans and complete a comprehensive weed management project to control invasive weeds along Beaver Creek including Russian knapweed, salt cedar, reed grasses and restoration of the original vegetation community. Hayfields (native or introduced) will be replanted, where desired. Re-seeding of native vegetation will be necessary in some areas.	Goal 2H. Vegetation Management (Objective 2)	Lander - South Hudson	Ongoing, starting 2007	Fremont Co. Weed & Pest, Private landowners, BLM, WGFD, WRR	Some Completed. Ongoing as needed
Design an experimental project targeting a comprehensive approach to invasive weed treatments and restoration of native vegetation in the Badwater area (halogeton, salt cedar)	Goal 2H. Vegetation Management (Objective 2)	Badwater	2008	Fremont Co. Weed & Pest, Private LOs, BLM, WGFD	Ongoing
Since 2003, Fremont County Weed and Pest Dept has spent at least $455,000 on invasive/noxious weed treatments within 3 miles of known leks within the WRSRCA. Total expenditures within 2 miles of known leks were about $246,000.	Goal 2H. Vegetation Management (Objective 2)	ALL	Completed 2003 thru 2006	Fremont County Weed & Pest, Multiple agencies and landowners	**Completed 2003 - 2006**

Project Commitments	Relationship to Conservation Plan Goals and Objectives	Priority by Focus Area	Original Timeline (August 2007)	Responsible Parties & Possible Funding Sources	Status as of October 2013
Incorporate mule deer habitat projects designed by WGFD for the Lander area that can be appropriately modified to benefit sage-grouse habitat. Planned Habitat Projects on North Fork Ranch, Table Mountain, Red Canyon, Twin Creek Area will incorporate these treatments and will have some opportunity to enhance sage-grouse habitat.	Goal 2H. Vegetation Management (Objective 4)	Lander - South Hudson	Ongoing, starting 2007	WGFD, BLM, TNC, Private landowners, NRCS	**> Several projects completed to date - ~9,000 acres, including Spike, Juniper removal, Cheatgrass spray, and sagebrush mowing in Government Draw.** > Additional projects pending
Develop treatments such as those recently completed in Government Draw that encourage regeneration of decadent sagebrush and enhance grass and forb composition and density. (Mechanical, Chemical, Burning, etc.)	Goal 2H. Vegetation Management (Objective 4)	ALL	Ongoing Starting 2007	BLM, WGFD	Ongoing
Government Draw Mechanical Treatments (Mowed about 400 acres and used Lawson Aerator on about 60 acres within a 2,000 acre project boundary)	Goal 2H. Vegetation Management (Objective 4)	Lander - South Hudson	Completed February 2006	BLM, WGFD, Devon Energy, WWF	**Completed February 2006**
Government Draw Phase II Mowing Treatments - (Mowed 830 acres within a 7,500 acre project boundary)	Goal 2H. Vegetation Management (Objective 4)	Lander - South Hudson	Completed February 2007	BLM, WGFD, Devon Energy, WWF	**Completed February 2007**
Government Draw long-term project (~10 year annual treatments similar to those in 2006, such as mowing, aerator, fire, tebuthiuron/ Spike 20P, seed mixes for soil disturbing treatments, etc.)	Goal 2H. Vegetation Management (Objective 4)	Lander - South Hudson	2008 and beyond	BLM, WGFD, WY SG Fund, WY Dept. of Ag.	On Hold, pending results of UW Study

Project Commitments	Relationship to Conservation Plan Goals and Objectives	Priority by Focus Area	Original Timeline (August 2007)	Responsible Parties & Possible Funding Sources	Status as of October 2013
Apply thinning rates of tebuthiuron (Spike 20P) to reduce sagebrush canopy and release understory herbaceous vegetation on private and state lands on Tom Abernathy's ranch, Hansen's North Fork Ranch, and Table Mountain. Develop projects for public lands, realizing some delays for processing NEPA and other clearance issues may occur.	Goal 2H. Vegetation Management (Objective 4)	Lander - South Hudson	2007 and beyond	Private landowners, WGFD, WY SG Fund, WY Dept of Ag.	**> Some projects completed (~3,400 acres total) as part of Mule Deer Habitat Enhancements.** > Additional mule deer habitat projects planned. > Sage grouse habitat work pending results of UW Study
Support NRCS project to apply thinning rates of tebuthiuron (Spike 20P) to reduce sagebrush canopy and release understory herbaceous vegetation on private lands on Ken Persson's property.	Goal 2H. Vegetation Management (Objective 3)	Lander - South Hudson	2007	NRCS, Private landowners, WY Dept. Ag, WGFD, BLM, WY SG Fund	**Completed 2007 (470 acres)**
Implement prescribed vegetation treatments on Wind River Reservation; mowing, Lawson aerator, and/or prescribed burning in the Sandhills, Mule Butte, and Willow Creek areas (about 500 acres in each area), to improve early-brood rearing habitat.	Goal 2H. Vegetation Management (Objective 4)	Wind River Reservation	2008 - 2009	Wind River Reservation, WY SG Fund, BIA, USFWS	**Completed 2008 - 09**
Sandhills Prescribed Burn, intended to improve early-brood rearing habitat (mosaic burn of 209 acres within a 580 project boundary)	Goal 2H. Vegetation Management (Objective 4)	Wind River Front	Completed Fall 2004	BIA, WRR, USFWS	**Completed Fall 2004**

Project Commitments	Relationship to Conservation Plan Goals and Objectives	Priority by Focus Area	Original Timeline (August 2007)	Responsible Parties & Possible Funding Sources	Status as of October 2013
Sandhills Mowing Project, intended to improve early-brood rearing habitat (mosaic treatment of 250 acres with a 504 acre project boundary)	Goal 2H. Vegetation Management (Objective 4)	Wind River Front	Completed Fall 2004	BIA, WRR, USFWS	**Completed Fall 2004**
Big Table Mountain Mowing Project, intended to improve early-brood rearing habitat (mosaic treatment of 177 acres within a 600 acre project boundary)	Goal 2H. Vegetation Management (Objective 4)	Hot Springs County on WRR	Complete Fall 2004	BIA, WRR, USFWS	**Completed Fall 2004**
Cedar Butte Prescribed Burns, intended to improve mule deer winter range and summer sage-grouse foraging habitat (mosaic burn of 611 acres in 6 units within a 2,000 acre project boundary)	Goal 2H. Vegetation Management (Objective 4)	Wind River Front	2005 - 2007	BIA, WRR, USFWS	**Completed Spring 2007**
Spring Creek Mowing Project, intended to improve early-brood rearing habitat (mosaic treatment of 120 acres within a 319 acre project boundary)	Goal 2H. Vegetation Management (Objective 4)	Wind River Front	Spring 2007	BIA, WRR, USFWS	**Completed Fall 2007**
Riverton East Mowing Project, intended to improve early-brood rearing habitat (mosaic treatment of 400 acres within a 1,280 acre project boundary)	Goal 2H. Vegetation Management (Objective 4)	Lander - South Hudson	Spring 2007	BIA, WRR, USFWS	**Completed April 2009**
Bighorn Flat Prescribed Burn, intended to improve early-brood rearing habitat (mosaic burn of 65 acres within a 253 acre project boundary)	Goal 2H. Vegetation Management (Objective 4)	Wind River Front	Spring 2007	BIA, WRR, USFWS	**Completed Spring 2008**
Bighorn Flat Mowing Project, intended to improve early-brood rearing habitat (mosaic treatment of 625 ac of sagebrush steppe within a 1,780 ac project area)	Goal 2H. Vegetation Management (Objective 3)	Wind River Front	2009 - 2010	BIA, WRR, USFWS	**Completed July 2010**

Project Commitments	Relationship to Conservation Plan Goals and Objectives	Priority by Focus Area	Original Timeline (August 2007)	Responsible Parties & Possible Funding Sources	Status as of October 2013
Sharpnose Unit 1 Mowing Project, intended to improve early-brood rearing habitat (mosaic treatment of 127 ac of sagebrush steppe within a 481 ac project area)	Goal 2H. Vegetation Management (Objective 3)	Wind River Front		BIA, WRR, USFWS	**Completed December 2010**
Sharpnose Unit 2 Mowing Project, intended to improve early-brood rearing habitat (mosaic treatment of 800 ac of sagebrush steppe within a 1,776 ac project area)	Goal 2H. Vegetation Management (Objective 3)	Wind River Front		BIA, WRR, USFWS	**Completed March 2012**
Sharpnose Unit 3 Aerating Project, intended to improve early-brood rearing habitat (mosaic treatment of 60 ac of sagebrush steppe within a 157 ac project area)	Goal 2H. Vegetation Management (Objective 3)	Wind River Front		BIA, WRR, USFWS	**Completed February 2011**
Red Basin Juniper Removal Project (mastication of juniper on 600 ac of juniper-encroached sagebrush)	Goal 2H. Vegetation Management (Objective 3)	Wind River Front		BIA, WRR, USFWS	In progress, **170 acres completed as of November 2013**
Mountain Meadows Mowing Project, intended to improve early-brood rearing habitat (mosaic treatment of 301 acres within a 625 acre project boundary)	Goal 2H. Vegetation Management (Objective 4)	Owl Creek Front		BIA, WRR, USFWS	**Completed Fall 2007**
Bull Lake Creek Mowing Project, intended to improve early-brood rearing habitat (mosaic treatment of 160 acres within a 418 acre project boundary)	Goal 2H. Vegetation Management (Objective 4)	Wind River Front		BIA, WRR, USFWS	**Completed Spring 2009**
Conduct juniper removal project on BLM, state and private lands in the Red Canyon and Twin Creek areas.	Goal 2H. Vegetation Management (Objective 4)	Lander - South Hudson	2007	WGFD, BLM, State Land Board, Private landowners	**Completed 2007**

Project Commitments	Relationship to Conservation Plan Goals and Objectives	Priority by Focus Area	Original Timeline (August 2007)	Responsible Parties & Possible Funding Sources	Status as of October 2013
Treat approximately 200 acres in the Bridger Creek area on the Philp Ranch to improve riparian and upland areas.	Goal 2H. Vegetation Management (Objective 4)	Badwater	2008	BLM, State Land, WY SG Fund, WGFD	**Completed 2008**
Incorporate info from Landowner Survey to enhance existing data/information. Follow-up contacts with respondents interested in assisting with sage-grouse monitoring and management.	Goal 3. Monitoring (Objective 1 Populations)	ALL	2007	WRSR LWG	Need to update with SGI options.
Develop methods to collect landowner sage-grouse observations such as field notebooks and/or web-based reporting. Sponsor/develop volunteer programs to collect data.	Goal 3. Monitoring (Objective 1 Populations)	ALL	2007	WGFD, BLM, Conservation Districts	Need to update with SGI options.
Support Animal Damage Management Board (ADMB) nest predator study in Gas Hills/Muskrat area.	Goal 3. Monitoring (Objective 3 Predators)	Gas Hills	2007	WGFD, BLM, USDA Wildlife Services	See Predation section - page 19
Study raven activity related to nesting season in the Government Draw area using a systematic approach to identify if ravens are impacting nesting success. If desired, attempt raven control. (Recent changes in trash unloading at Lander and Sand Draw landfills to balefill operations may be serving to reduce raven use of "flyway" between these sites.)	Goal 3. Monitoring (Objective 4 Predators)	Lander - South Hudson (Gov't Draw)	2007 - 2008	WGFD, BLM, USDA Wildlife Services	2013 Raven Control pilot project started. See Predation Section - page 19
Assimilate weather monitoring from NOAA and other weather bureaus and vegetation data to assess past and existing conditions to evaluate effects on sage-grouse populations.	Goal 3. Monitoring (Objective 5 Weather)	ALL	2005	WGFD JCR & Conservation Assessments	**Included in annual Reports**
Analyze effects of habitat improvement projects in Government Draw.	Goal 3. Monitoring	Lander - South Hudson	Ongoing	BLM, WGFD	Awaiting BLM Monitoring Data

Project Commitments	Relationship to Conservation Plan Goals and Objectives	Priority by Focus Area	Original Timeline (August 2007)	Responsible Parties & Possible Funding Sources	Status as of October 2013
Continue sage-grouse movement study on Wind River Reservation - delineating seasonal ranges.	Goal 4. Research	Wind River Front	Ongoing	WRR, USFWS, BIA, Tribal Fish & Game, WY SG Fund	**Completed in 2008**. Future studies to be included in Actions table
Establish and maintain a small number of public lek viewing sites and minimize viewing impacts on these sites. Viewing sage-grouse on leks (and monitoring leks) should be conducted so that disturbance to birds is minimized or preferably eliminated.	Goal 5. I&E Outreach	Lander - South Hudson (Twin Creek Lek)	Completed 2007	WGFD	**Completed 2007 - Twin Creek Lek**
Develop and distribute appropriate literature about sage-grouse and their habitats to land developers and county planners.	Goal 5. I&E Outreach	ALL	Ongoing	WRSR LWG, WGFD	Ongoing
Develop sage-grouse section on agency websites to disseminate information. (WRSR LWG and/or other sage grouse info available at the following) **Wyoming Game & Fish Department (Sagebrush/Sage grouse page**) http://wgfd.wyo.gov/web2011/wildlife-1000817.aspx **Bureau of Land Management (BLM) Sage Grouse page** http://www.blm.gov/wo/st/en/prog/more/sagegrouse.html **SageMap Site** http://sagemap.wr.usgs.gov/ **Natural Resource Conservation Service (NRCS) Sage Grouse Initiative (SGI)** http://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/programs/farmbill/initiatives/?cid=steldevb1027671	Goal #5A. Objective 1.	ALL	Completed for WGFD, Others 2007	WGFD, BLM	Ongoing

Project Commitments	Relationship to Conservation Plan Goals and Objectives	Priority by Focus Area	Original Timeline (August 2007)	Responsible Parties & Possible Funding Sources	Status as of October 2013
Present the final WRSRCA plan to agencies and organizations involved with land management. (i.e.. NRCS, BLM, BIA, BOR, WGFD, WYDOT, USFWS, County Planning, Conservation Districts, Weed & Pest Depts., City & County Landfills, Energy Industry, TNC, Wyoming Wildlife Federation, RMEF, Mule Deer Foundation, North American Grouse Partnership, etc.).	Goal 5. I&E Outreach	ALL	2007	WRSR LWG	**Completed 2007.** Plan Update to be presented in 2013 via public meeting/news release
Audubon Wyoming has designated the Ninemile Draw Important Bird Area to signify the importance of this area for sage-grouse.	Goal 5. I&E Outreach	Lander-South Hudson	Completed 2005	Audubon Wyoming	**Completed 2005**
Presented at the Fremont County Farm and Ranch Days – *Agriculture and Sage Grouse* o Introduced the SGI program o Discussed why agriculture is so important to wildlife. o Discussed cost share programs and options.	Goal 5. I&E Outreach	ALL		NRCS - SGI	**Completed 2013**
Presented to the Fremont County Cattlemen- *Sage Grouse 101* o Discussed the numerous different types of habitat sage grouse need during different times of the year. o Discussed how to manage rangelands for both livestock and sage grouse. o Discussed a few monitoring tips and techniques producers could use.	Goal 5. I&E Outreach	ALL		NRCS - SGI, WGFD	**Completed 2013**
Presented to 300 3rd graders at the Riverton Ag Day (our goal was to get younger generations involved in local issues) - *Agriculture & Wildlife Go Hand-in-Hand* o Discussed why agriculture is important and how wildlife and ag benefit from one another. o Discussed sage grouse physiology, habitat, diet and other needs. o Discussed issues and concerns that agricultural and wildlife alike are facing and possible solutions.	Goal 5. I&E Outreach	ALL		NRCS - SGI	**Completed 2013**

Project Commitments	Relationship to Conservation Plan Goals and Objectives	Priority by Focus Area	Original Timeline (August 2007)	Responsible Parties & Possible Funding Sources	Status as of October 2013
Future Projects to be conducted in WRSRCA					
South Pass Aspen Regeneration	Goal 2H. Vegetation Management (Objective 3)	Lander-South Hudson	2014 - 2024	WGFD, USFS, BLM, Private Lands, OSLI	Still in initial planning phase
Green Mountain Aspen Regeneration	Goal 2H. Vegetation Management (Objective 3)	Lower Sweetwater	Ongoing	BLM, WGFD, OSLI	Ongoing
Bridger Mountain Juniper Removal	Goal 2H. Vegetation Management (Objective 3)	Badwater	2014?	BLM, WGFD	Still in initial planning phase
Reservoir upgrades	Goal 1. All Habitat Types	ALL	Ongoing	BLM, USFS, NRCS, Private Lands, WRR, USFWS	Ongoing
SGI Projects (at least 2, maybe a 3rd)	Goal 1. All Habitat Types	ALL		NRCS (SGI), Private Lands	Ongoing

Table 3. WRSR LWG Recommended Actions and Status

Recommended Actions Potential Projects and Activities Without Current Commitments	Relationship to Conservation Strategy	Responsible Parties & Possible Funding	Current Status
Habitat			
Recommend that the BLM designate a special management area (e.g. ACEC) for sage-grouse in the Government Draw/Cottonwood Divide/Sweetwater River area. This area contains important sage-grouse habitat and falls within the South Hudson - Lander and Upper Sweetwater Focus areas. The area is recognized as one of the highest density sage-grouse areas in the state of Wyoming, as well as in the west and contributes significantly to the conservation of sage-grouse throughout its range. Encourage the BLM to focus on sage-grouse needs when managing public land uses and resources in the area and develop protection measures that are compatible with maintaining quality sage-grouse habitat and populations.	Goal 1. All Habitats	WRSR LWG, BLM, WGFD	Completed. Recommendation letter was sent to BLM on 12/3/2007. With the development of the Core Area Strategy, the State of Wyoming requested an ACEC not be designated.
Recommend to the Shoshone and Arapaho Tribes and BIA that the Sharpnose Sage Grouse area (~40,000 ac) be awarded special management status to ensure that other uses of the landscape are compatible with the needs of sage grouse and to protect important sage grouse habitats. The area, contiguous with the proposed BLM Special Management Area for sage grouse in the Hudson/Government Draw area, is encroached by human development. The BIA and Tribes have currently adopted the Core Area strategy for this area.	Goal 1. All Habitats	WRSR LWG, BIA, WRR, USFWS	Core Area Strategy has been adopted by the Tribes, with Core Areas designated on WRR
Recommend to the Shoshone and Arapaho Tribes and BIA that portions of the foothills/montane interface in the Wind River Mountains and Owl Creek Mountains be awarded special management status with no surface development related to energy or minerals. Areas targeted for this designation include select crucial winter ranges for big game. These areas provide important summer and winter habitats for sage-grouse as well.	Goal 1. All Habitats	BIA, WRR, USFWS	Core Area Strategy has been adopted by the Tribes, with Core Areas designated on WRR
Where possible, identify leks where sagebrush has encroached into lek sites, and design treatments to restore historical conditions (tying lek attendance data with photographs, etc to determine the best treatment)	Goal 1A. Breeding Habitat (Objective 2)	BLM, WGFD, WRR, Private landowners	Ongoing. Need to follow Core Area Strategy

Recommended Actions Potential Projects and Activities Without Current Commitments	Relationship to Conservation Strategy	Responsible Parties & Possible Funding	Current Status
Identify vegetation enhancement projects to improve nesting and early brood-rearing habitats.	Goal 1B & 1C. Nesting and Early Brood Rearing Habitat.	BLM, WGFD, WRR, NRCS, Private landowners	Future use of vegetation treatments to improve habitat will be evaluated as part of the University of Wyoming's research project "Response of Greater Sage-grouse to Treatments in Wyoming Big Sagebrush Habitat"
Design bird waterers or guzzlers associated with livestock water systems to improve water availability to wildlife. (Create fenced wet meadows, etc.)	Goal 1D. Late Brood Rearing Habitat	BLM, WGFD, Water for Wildlife	Ongoing
Identify viable stock water reservoirs in need of repair/cleanout, and rebuild reservoirs for livestock/wildlife. Enhance water availability to all wildlife by providing offsite wildlife water troughs in fenced areas to protect from livestock trampling.	Goal 1D. Late Brood Rearing Habitat	BLM, WGFD, Water for Wildlife, WY Water Development Comm., Small Watershed Comms.	Ongoing
Fence the riparian area along the South Fork of the Little Wind River on the Wind River Reservation (Unsure of when this can occur).	Goal 1D. Late Brood Rearing Habitat	WRR, WY SG Fund, BIA, USFWS	UWFWS (Hogan) still interested in doing this
Develop riparian restoration and wet meadow enhancement projects in conjunction with grazing management planning and upcoming Coal Bed Natural Gas projects, and include fencing to protect these projects.	Goal 1D. Late Brood Rearing Habitat	BLM, Industry, Private Lands, WRR	Ongoing

Recommended Actions Potential Projects and Activities Without Current Commitments	Relationship to Conservation Strategy	Responsible Parties & Possible Funding	Current Status
Where sagebrush in wintering areas is in poor condition, design projects that would improve sagebrush health.	Goal 1E. Winter Concentration Areas	WGFD, BLM, WRR, USFWS	Ongoing
Create residential and energy development guidelines in brochure format to be available for the public, then incorporate this into Goal #5 (I&E efforts).	Goal 1F. Migration Habitat; Goal 5.	WGFD, BLM, Industry, WRR	Ongoing
Work with private landowners to prepare maps that identify seasonal habitats for sage-grouse and to develop a voluntary site-specific management program.	Goal 1. All Habitats	WGFD, NRCS, Private Lands, Conservation Districts	Ongoing
Complete seasonal habitat mapping efforts, then direct efforts to maintain, identify, rank, and monitor sage-grouse populations within the WRSRCA.	Goal 1. All Habitats	WGFD, BLM	
Mineral and Energy Development			
Look at ways to increase bonding amount to ensure adequate funding is available for effective reclamation. Develop a method of providing funding for reclamation that comes from all companies that have had ownership in the field over time. This will ensure that funds are available for reclamation when the field is dry.	Goal 2C. Mineral & Energy Development	BLM, WY DEQ	Bonding requirements are regulatory controlled, thus there is little the LWG can do. The BLM has identified reclamation standards that must be met before bonds are released. These standards address reclamation in sage-grouse habitat. If operators default their reclamation requirements, the bond is used to reclaim the site and reclamation must meet the same standards.

Recommended Actions Potential Projects and Activities Without Current Commitments	Relationship to Conservation Strategy	Responsible Parties & Possible Funding	Current Status
Parasites and Diseases			
Investigate and document sage-grouse deaths attributed to parasites or disease.	Goal 2D.	WGFD	West Nile Virus (wNV) was detected in 2006 - 08 in a few sage grouse from Wind River Reservation. Ongoing
Develop and implement strategies, including public education, to deal with avian disease outbreaks, when appropriate.	Goal 2D.	WGFD, University of Wyoming	Ongoing
Implement pond design standards to minimize mosquito breeding habitat to reduce risks of West Nile Virus (Naugle 2006d).	Goal 2D.	BLM, WRR, Energy Industry, Dept of Ag	The BLM has incorporated required Design Features and Best Management Practices addressing pond design in the Final EIS for the Lander RMP.
Predation			
Use a systematic approach to assess predation and determine whether actions are needed (see Idaho Sage-grouse State Plan).	Goal 2E. Objective 1.	WGFD, USDA APHIS	Ongoing
Develop and distribute educational materials regarding human practices that may allow establishment/expansion of predator populations. Examples of these activities include landfills and other garbage/waste disposal that may provide artificial food sources for a variety of predators, and buildings/structures that provide nesting/roosting habitat for ravens/raptors.	Goal 2E and Goal 5.	WGFD, University of Wyoming, USDA APHIS	Ongoing

Recommended Actions Potential Projects and Activities Without Current Commitments	Relationship to Conservation Strategy	Responsible Parties & Possible Funding	Current Status
Recreation			
Develop travel management plans and enforce existing plans.	Goal 2F. Recreation	BLM, WGFD, WRR	Travel management planning for BLM lands is ongoing. Management plans will be developed as part of RMP implementation with priority given to areas having high quality sage-grouse habitat.
Restrict organized recreational activities within 2 miles (3.4 km) of a lek between March 1 and July 15.	Goal 2F. Recreation	BLM, WRR	Recreational activities are managed in compliance with the Core Area Strategy. Dates have been modified to between March 15 and June 30 in accordance with the EO.
Vegetation Management			
Design comprehensive plans and complete one weed management project to control invasive weed treatments. Where desired, weed-free hayfields (native or introduced) will be the end-goal. Re-seeding of native or introduced vegetation may be necessary.	Goal 2H. Vegetation Management (Objective 2).	BLM, WGFD, NRCS, Fremont County Weed & Pest, Private landowners	Ongoing, as opportunities arise. Although not major sage grouse habitat, a wildfire in Sinks Canyon in 2013 has had a multiple agency committee review and implement some invasive plant prevention techniques.

Recommended Actions Potential Projects and Activities Without Current Commitments	Relationship to Conservation Strategy	Responsible Parties & Possible Funding	Current Status
Utilize experimental grazing systems to evaluate benefits for sage-grouse and livestock production.	Goal 2H. Vegetation Management (Obj. 3) and Goal 4.	BLM, NRCS, WRR, BIA, Private Landowners	Kaiser study
Recommend the BLM complete the required Rangeland Health assessments on public rangelands throughout the WRSW LWG area as soon as possible. These assessments will help classify rangeland conditions in important sage-grouse habitats and identify potential habitat enhancement projects.	Goal 2H. Vegetation Management (Obj. 3)	WRSR LWG, BLM	On-going. Rangeland Health Assessments have been or are in the process of being completed in all or parts of the Badwater, Gas Hills, Upper Sweetwater, Lower Sweetwater, and S.Hudson/Lander Focus Areas.
Investigate the possibility of developing forage banks for use during periods of drought to alleviate excessive use by grazing animals on sage-grouse habitat.	Goal 2H. Vegetation Management (Obj. 3)	BLM, NRCS, BIA, WRR, Private Landowners	Ongoing
Recommend to BIA and the Shoshone and Arapaho Tribes that forage-banks be created on the Wind River Reservation by retaining select grazing permits when Tribal allotments become vacant. Allotments could be used in a rest-rotational system on a large scale to lessen the effects of 9-month grazing that currently occurs on 1,116,000 acres across nearly 70% of Tribal grazing lands on Wind River.	Goal 2H. Vegetation Management (Obj. 3)	BIA, WRR, USFWS	Ongoing
Investigate opportunities for grass banks to facilitate resting areas following prescribed vegetation treatments, such as fire.	Goal 2H. Vegetation Management (Obj. 3)	BLM, NRCS, BIA, WRR, Private Landowners	Ongoing

Recommended Actions Potential Projects and Activities Without Current Commitments	Relationship to Conservation Strategy	Responsible Parties & Possible Funding	Current Status
When specific needs are identified in Riparian CRP areas, recommend the Farm Services Agency (FSA) allow short-term grazing as a tool for riparian system recovery.	Goal 2H. Vegetation Management (Obj. 3)	WRSR LWG, NRCS	Ongoing, pending Farm Bill programs being continued. No known projects have been implemented for this action.
Apply thinning rates of tebuthiuron (Spike 20P) to reduce sagebrush canopy and release understory herbaceous vegetation on private lands.	Goal 2H. Vegetation Management (Obj. 4)	Private landowners, WGFD, WY SG Fund, WY Dept of Ag.	On-going. Approximately 2,400 private land acres have been treated with Spike 20P in mule deer winter range in the S.Hudson/Lander Focus Area and overlapping sage-grouse habitat.
Develop projects for use of tebuthiuron (Spike 20P) public lands, realizing some delays may be required for processing NEPA and other clearance issues.	Goal 2H. Vegetation Management (Obj. 4)	BLM, WGFD, WY SG Fund, WY Dept of Ag.	About 1,000 acres of BLM lands have been treated with Spike 20P in mule deer winter range in the S.Hudson/Lander Focus Area and overlapping sage-grouse habitat.
Monitoring			
Develop methods to utilize and consolidate G&F, BLM, NRCS, WRR and landowner ongoing activities to collect data, such as lek monitoring, brood surveys, and winter observations.	Goal 3. Monitoring (Objective 1 Populations)	WGFD, BLM, NRCS, WRR	Ongoing
Catalogue existing habitat data in the area to identify how different management practices affect habitat, i.e. forbs, insects, sagebrush, riparian habitat, etc.	Goal 3. Monitoring (Objective 2 Vegetation)	Fremont County Weed & Pest, NRCS, WGFD, WRR	Ongoing

Recommended Actions Potential Projects and Activities Without Current Commitments	Relationship to Conservation Strategy	Responsible Parties & Possible Funding	Current Status
Create multi-agency vegetation and habitat maps to be used in conjunction with all planning efforts, including all 8 geographic focus areas of the WRSRCA, to be used in all phases of our efforts and would help with monitoring of loss or expansion of the habitat.	Goal 3. Monitoring (Objective 2 Vegetation)	WGFD & BLM GIS	Ongoing
Use aerial and satellite photography and GIS mapping to evaluate past development expansion and other activity into known sage-grouse habitats. Monitor future expansion for impacts. (Development includes residential, O&G, roads, etc.) (Activity includes recreation, hunting, grazing, mineral exploration and energy field monitoring)	Goal 3. Monitoring (Objective 5 Development and Activities)	WGFD, BLM, Industry, County, others	Ongoing
Monitor all vegetation/habitat treatments for vegetation and sage-grouse responses.	Goal 3. Monitoring & Goal 2B. Veg. Mgmt	WGFD, BLM, WRR	Ongoing
Research			
Determine migratory and non-migratory populations (definitions found in Connelly guidelines) through movement studies.	Goal 4. Research (Objective 1 Habitat)	WGFD	Ongoing
Summarize prior research projects and identify needs to expand throughout the WRSRCA.	Goal 4. Research (Objective 1 Habitat)	WGFD, BLM, WRR, NRCS	Ongoing
Identify how habitat and other factors influence chick survival (early brood rearing period).	Goal 4. Research (Objective 1 Habitat)	WGFD	Ongoing
Since insect abundance and diversity is a key component of early brood-rearing habitat, identify practices that enhance insect production.	Goal 4. Research (Objective 1 Habitat)	BLM, NRCS, WGFD, WY Dept of Ag	Ongoing
Study what different grass and forb heights do for nesting success.	Goal 4. Research Needs (Obj. 1 Habitat)	WGFD, University of Wyoming	Ongoing

Recommended Actions Potential Projects and Activities Without Current Commitments	Relationship to Conservation Strategy	Responsible Parties & Possible Funding	Current Status
Compile and make available existing sage-grouse data applicable to the area from agencies, universities, researchers, etc. to identify how different management practices affect habitat components i.e. forbs, insects, sagebrush, riparian habitat, etc.	Goal 4. Research Needs (Objective 2 Land Use)	Fremont County Weed & Pest, NRCS, WGFD, WRR, USFWS	Ongoing
Develop research to determine grazing management practices that have potential to benefit sage-grouse habitats. Review previous research conducted, literature reviews, grazing BMPs, and range-wide sage-grouse conservation strategy.	Goal 4. Research Needs (Objective 3 Grazing)	BLM, NRCS, WGFD, WRR, WY Dept of Ag, University of Wyoming	Ongoing
Develop research to determine the best reclamation practices to improve sage-grouse habitat. Focus on plant species mixes, application methods, and timing.	Goal 4. Research Needs (Objective 4 Reclamation)	BLM, Energy Industry, WRR	Ongoing
Design additional research to identify, modify, or develop anti-raptor perching systems on powerlines.	Goal 4. Research Needs	Energy Industry, WGFD, BLM	Ongoing
Information and Education Outreach			
Develop presentations and materials for sage-grouse education purposes, such as traveling education trunks, videos focusing on WRSRCA, sage-grouse issues, tribal dances, etc. Presentations could be used at civic groups such as Lions Club, Rotary Club, Audubon, Elks Clubs, Boy and Girls Scouts, etc.	Goal #5A. Objective 1	WGFD, WRR, USFWS	Ongoing
Develop brochures, handouts, and other "literature" about sage-grouse and their habitat and distribute to license selling agents, hunters, schools, landowners, and any other interested public.	Goal #5A. Objective 1	WGFD, Conservation Districts	Ongoing
Train Audubon and other conservation group members about sage-grouse habitat and encourage them to conduct tours.	Goal #5A. Objective 1	WGFD	Ongoing

Recommended Actions Potential Projects and Activities Without Current Commitments	Relationship to Conservation Strategy	Responsible Parties & Possible Funding	Current Status
Actively educate stakeholders about grazing strategies that can be used to improve or maintain sage-grouse habitats.	Goal #5A. Objective 1	BLM, NRCS, WY Dept of Ag, WRR, USFWS	Ongoing
Create a media information network to enhance public knowledge of local sage-grouse conservation efforts. (Enhanced new releases, feature articles, public service announcements, TV, Radio, Farm Bureau News, PAW, Wyoming Livestock Roundup, local news)	Goal #5A. Objective 1	WRSR LWG	Ongoing
Incorporate a calendar of events where the WRSR LWG could provide sage-grouse conservation updates (i.e.. Farm/Ranch Days, Fremont County Fair, Winter Fair, EXPO in Casper, Schools)	Goal #5A. Objective 1	WRSR LWG	Ongoing
Organize field trips and volunteer education programs for schools and civic groups.	Goal #5A. Objective 1	WGFD, BLM, WRR, USFWS	Ongoing
Create a training program for data collection and monitoring for volunteers and others.	Goal #5A. Objective 1	WGFD, BLM, WRR	Ongoing
Promote Farm Bill and other landowner incentive programs to maximize benefits to sage-grouse and their habitats on private lands.	Goal 5. I & E & Goal 2B. Vegetation Mgmt	LIP w/ WGFD, NRCS -WHIP, GRP, CRP, etc.	Ongoing

Wind River/Sweetwater River Local Sage-Grouse Conservation Plan

Photo by Dave Lieb

August 3, 2007

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Wind River/Sweetwater River Local Sage-grouse Working Group Members

Tom Abernathy	Agriculture
Mickey Asbell	Sportsman
Stan Harter	WY Game & Fish Department
Jim Haverkamp	Natural Resource Cons. Service
Pat Hnilicka	U.S. Fish & Wildlife Service (Chairperson October 2005 to present)
Dave Lieb	Sportsman (Chairperson from September 2004 to October 2005)
Tony Malmberg	Member At-Large
Sue Oberlie	Bureau of Land Management
Rob Philp	Agriculture
Steve Platt	Sportsman/Falconer
Bill Skelton	Industry
Western Thayer	Eastern Shoshone and Northern Arapaho Tribes
Dave Vaughan	Fremont County Natural Resource Planning Commission
Jack Welch	Conservation

Brad Meyer	*Facilitator (September 2004 to October 2006)
Barbara Hauge	*Facilitator (November 2006 to present)

Evette Meyer and Shawonda Lewis assisted by recording meeting minutes, as needed.

Tom Ryder served as a member from September 2004 until April 2005.
Bob Budd served as a member from September 2004 until early 2006.

INTRODUCTION

In 2004, the Wyoming Game and Fish Department established eight local working groups within Wyoming in order to develop local conservation plans, 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.

The Wind River/Sweetwater River Local Sage-grouse Working Group (WRSR LWG) was organized in September 2004 to develop and implement a local conservation plan to benefit sage-grouse and other species that use sagebrush habitats. This conservation plan identifies management practices to improve sage-grouse habitat and populations. The mission statement of the Wind River/Sweetwater River Local Sage-grouse Working Group is "to identify issues and implement strategies to enhance sage-grouse and their habitats". Due to the dynamics of range-wide sage-grouse conservation efforts, this plan is intended to be a "living" document and will be updated with new data and information as needed. The WRSR LWG will reconvene periodically to review new data and incorporate findings into plan revisions, and to review, evaluate, and rank project proposals, and appropriate funds, when available, toward conservation efforts.

The group includes 14 members representing major interests within the Wind River/Sweetwater River Conservation Area (WRSRCA). Working Group representation includes the Wyoming Game and Fish Department (WGFD), the Bureau of Land Management (BLM), the USDA Natural Resources Conservation Service (NRCS), U.S. Fish and Wildlife Service (USFWS), Eastern Shoshone and Northern Arapaho tribes of the Wind River Reservation (WRR), Fremont County Planning Commission, agriculture, oil and gas industry, conservation groups, hunters and falconers. Working Group members represent their particular interests and provide liaison with the groups they represent.

Significant activities of the WRSR LWG during the first two years included gathering information regarding sage-grouse populations, trends, habitat use, and current status; field trips to learn more about sagebrush-grassland habitats; publication of an informational brochure; development of a landowner questionnaire to gather information regarding landowner knowledge of sage-grouse on their lands (owned or leased) as shown in Appendix D; meetings with other affected interests; seminars to learn more about the potential for sage-grouse management within the WRSRCA; development and planning of a habitat improvement project in Government Draw; and the endorsement of several ongoing Wyoming Game and Fish Department projects including the Lander Front Mule Deer Habitat Project; support of "Migration, Transition Range And Landscape Use By Greater Sage-Grouse" research project, and the noise research project initiated by the University of California-Davis. Working Group meetings are conducted about every month, typically last a day, and always include opportunity to hear public comment regarding the program.

EXECUTIVE SUMMARY

MISSION STATEMENT

The mission of the Wind River/Sweetwater River Local Sage-grouse Working Group is to identify issues and implement strategies to enhance sage-grouse and their habitats.

LOCAL WORKING GROUP PURPOSE

The purpose of Local Sage-grouse Working Groups (LWGs) is to develop and facilitate implementation of local conservation plans for the benefit of sage-grouse and, whenever feasible, other species that use sagebrush habitats. The plan identifies management practices and the financial and personnel means to accomplish these practices, within an explicit time frame, for the purpose of improving sage-grouse numbers and sagebrush communities.

GROUP STRUCTURE

The Wyoming Greater Sage-grouse Conservation Plan (June 2003) provides guidance to local working groups for several distinct geographic areas of Wyoming. The Wind River/Sweetwater River LWG is one of eight groups dealing with sage-grouse conservation at the local level in Wyoming. The Wind River/Sweetwater River LWG has 14 members representing diverse local interests including agriculture, conservation, industry, the public-at-large, and federal, state, tribal, and local governments.

RESPONSIBILITIES

- Identify and prioritize issues affecting sage-grouse in the planning area.
- Identify actions that address problems affecting sage-grouse in the planning area.
- Develop an action plan geared toward addressing these problems with an emphasis on benefiting as many species as possible within a multiple-use context.
- Identify priority areas for implementation of conservation actions. Identify funding (amounts/sources) and personnel resources necessary to implement conservation actions.
- Recommend at least one project to private, State, or Federal land managers.
- Provide annual written updates of progress to the WGF Commission and other affected agencies.
- Conduct public information efforts that will both inform the public of the LWG's goals, efforts, and accomplishments and build support for those actions.

SAGE-GROUSE ECOLOGY

Sage-grouse are a large upland game bird considered a "landscape species", annually using large areas of sagebrush. Sage-grouse are common throughout Wyoming because sage-grouse habitat remains relatively intact compared to other states.

Sagebrush and sagebrush/grassland communities are essential for sage-grouse survival. Suitable habitat consists of plant communities dominated by sagebrush with 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. Sagebrush makes up the bulk of the diet for sage-grouse, and insects are a vital food source for young chicks during brood rearing.

Seasonal habitats must occur in a patchwork or mosaic across the landscape. Their spatial arrangement, the amount of each seasonal habitat, and the vegetative condition determine the landscape's potential for

sage-grouse. This arrangement is an important factor in determining if a population is migratory or non-migratory in nature. Both quantity and quality of the sagebrush environment determines suitability for and productivity of sage-grouse.

There are at least 212 strutting grounds, known as leks, within the Wind River/Sweetwater River Conservation Area, including the Wind River Reservation. Each spring, sage-grouse gather on these leks to strut and perform their mating ritual. This lek activity occurs during early morning hours from mid-March to mid-May. After strutting and mating occurs, females begin building nests in nearby sagebrush, usually within 3 miles of the lek. Chicks hatch in late-May and early-June and stay with the hens for several months. By late summer, hens move their broods to wet meadows and riparian areas along perennial streams without substantial tree cover.

Many sage-grouse within the planning area occupy the same habitat year-round (resident populations). In order to find food and shelter, some groups of birds at higher elevations must seek out areas of sagebrush not covered by winter snowpack requiring movements of 15 miles or more (migratory populations). In fact, most of the birds that winter in the Government Draw area south of Hudson stay there until after the breeding and nesting seasons. When newly hatched chicks are a few weeks old, hens begin moving their broods southwesterly to higher elevations near Beaver Creek and as far as the Sweetwater River. Ongoing research in this area with radio collared hens shows movements of between 20 and 40 miles, with a few hens moving up to 60 miles.

The Eastern Shoshone and Northern Arapaho Tribes historically hunted sage-grouse in spring from pits dug next to leks. Consumption of the male air sac was and is considered a delicacy. Eastern Shoshone tribal members perform the Round Tail Feather Dance, in which male tail feathers are used. The dance is done to honor the bird and mimics the shoulder shake of a displaying male.

Artwork by Bob Raup

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GLOSSARY

Avoid – The term "avoid" in this document means that there is flexibility to allow an activity consistent with goals and objectives of this plan.

Crucial Habitat – Any particular seasonal range or habitat that has been documented as the determining factor in a population's ability to maintain and reproduce itself at a certain level over the long term.

Degraded Habitat – Habitat that is reduced in quality as a result of fragmentation, invasive plants, overgrazing/browsing and/or shrub decadence or lack of understory due to advanced succession.

Drought – A prolonged chronic shortage of water, as compared to the norm, often associated with high temperatures and winds during spring, summer and fall or a period without precipitation during which the soil water content is reduced to such an extent that plants suffer from lack of water. (Society for Range Management)

Federal Lands – The WRSR LWG uses this term to apply to all lands owned by the United States and managed by agencies within the United States Departments of Agriculture and Interior. This definition typically deals with surface ownership; however, the Federal Government may also own the subsurface minerals under private and state lands. This definition is not intended to imply that all lands owned and managed by these agencies are open for all public uses and does not imply public ownership of private and state lands where the Federal Government owns the mineral rights.

Forb – Any broad-leafed herbaceous plant, other than grasses, sedges and rushes. These are generally flowering plants with taproots, broad leaves, netlike veins and solid non-joint stems.

Habitat Fragmentation – The emergence of discontinuities (fragmentation) in an animal's preferred environment (habitat). Habitat fragmentation can be caused by geological processes that slowly alter the layout of the physical environment or by human activity such as land conversion, which can alter the environment on a much faster time scale.

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 1) primarily a non-native to the ecosystem under consideration and 2) whose introduction causes or is likely to cause economic or environmental harm or harm to human health.

Landscape – 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 (Knight, 1994).

Monitor – To systematically and repeatedly watch, observe or measure environmental conditions to track changes.

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

"Newcomer" Predator – Predators that did not occur or have expanded their range in Wyoming in recent times as the result of changes in management practices and other human activities (e.g. red fox, raccoon, etc.). "Newcomer" predators may also apply to native species, such as ravens, which have increased in number (as opposed to range) due to human activity.

Sagebrush Obligate – Species dependent on sagebrush habitat for all or part of its life and is therefore considered to serve as an indicator of the condition and trend of this habitat type.

Seral Stage – The relatively transitory communities that develop under plant succession generally described as early, mid and late seral stages. The mix of seral or successional stages on the landscape can be the result of disturbances, topography and soil, climate, uses of the land, management prescriptions, vegetation classification categories and evaluation procedures.

Site Potential – The potential plant community that a particular area (ecological site) is capable of producing as a climax plant community.

State Lands – The WRSR LWG uses this term to apply to all lands owned or managed by the State of Wyoming, including Game & Fish Commission, Office of State Lands and Investments, and the Department of State Parks and Cultural Resources. The WRSR LWG recognizes that some lands are not truly "public", but are held in the public trust (such as Wyoming State Lands held in public trust for the benefit of public schools).

Tribal Lands – The WRSR LWG uses this term to apply to all lands within the Wind River Reservation owned or managed by the Eastern Shoshone and Northern Arapaho Tribes, in conjunction with the United States Bureau of Indian Affairs (BIA).

Wyoming Sage-Grouse Definitions:
(Revised 12/08/06 by WGFD Sage-Grouse Working Group)

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

Lek – A traditional courtship display area attended by male 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.

LIST OF ACRONYMS AND ABBREVIATIONS

AML – Appropriate Management Level (when dealing with wild horses)
AML – Abandoned Mined Land program (when dealing with mine reclamation)
BIA – Bureau of Indian Affairs
BEHAVE – Behavioral Education for Human, Animal, Vegetation, and Ecosystems
BLM – Bureau of Land Management
BLM RMP – Bureau of Land Management Resource Management Plan
BMP – Best Management Practice
BOR – Bureau of Reclamation
CBNG – Coal Bed Natural Gas
CRM – Coordinated Resource Management
CSU – Colorado State University
FSA – Farm Services Agency
CRP – Conservation Reserve Program
GAP – Gap Analysis Program
GIS – Geographic Information System
GRI – Grazing Response Index
HMA – Herd Management Area
LIP – Landowner Incentive Program
LQD – Land Quality Division
LWG – Local Working Group
MDF – Mule Deer Foundation
MOU – Memorandum of Understanding
NCDC – National Climatic Data Center
NOAA – National Oceanic and Atmospheric Administration
NRCS – Natural Resource Conservation Service
FRPP – Farm and Ranch Lands Protection Program
GRP – Grassland Reserve Program
WHIP – Wildlife Habitat Incentives Program
PAW – Petroleum Association of Wyoming
RMP – Recommended Management Practice
RMEF – Rocky Mountain Elk Foundation
SATFG – Shoshone and Arapaho Tribal Fish & Game Department
TNC – The Nature Conservancy
USDA – United States Department of Agriculture
US DOE – United States Department of Energy
USFWS – United States Fish and Wildlife Service
USGS – United States Geological Survey
WDEQ – Wyoming Department of Environmental Quality
WGF Commission – Wyoming Game & Fish Commission
WGFD - Wyoming Game & Fish Department
WGSGCP – Wyoming Greater Sage-grouse Conservation Plan
WNV – West Nile Virus
WRR – Wind River Reservation
WRSRCA – Wind River/Sweetwater River Conservation Area
WRSR LWG – Wind River/Sweetwater River Local Working Group
WWF – Wyoming Wildlife Federation
WWNRTF – Wyoming Wildlife & Natural Resource Trust Fund
WYDOT – Wyoming Department of Transportation
WYGISC – Wyoming Geographic Information Science Center
WY SG Fund – Wyoming Sage-grouse Conservation Fund

CONSERVATION ASSESSMENT

Background

The Wind River/Sweetwater River Conservation Area (WRSRCA) encompasses about 10,163 mi^2, including a diverse array of vegetation communities in central Wyoming (Figure 1). Greater sage-grouse (*Centrocercus urophasianus*) are found throughout the sagebrush/grassland habitats of Wind River and Sweetwater River drainages. Occupied habitat is fairly contiguous throughout much of the conservation area, with principal differences in sagebrush species and associated plant communities related to elevation, precipitation, and soil type diversity. Migrant populations of sage-grouse occur within portions of the conservation area, with some overlap among more stationary resident populations. Large, contiguous blocks of sagebrush/grassland communities have been eliminated in most of the Bureau of Reclamation's (BOR) Withdrawal Area near Riverton and converted into agricultural croplands, as well as near most developed urban areas.

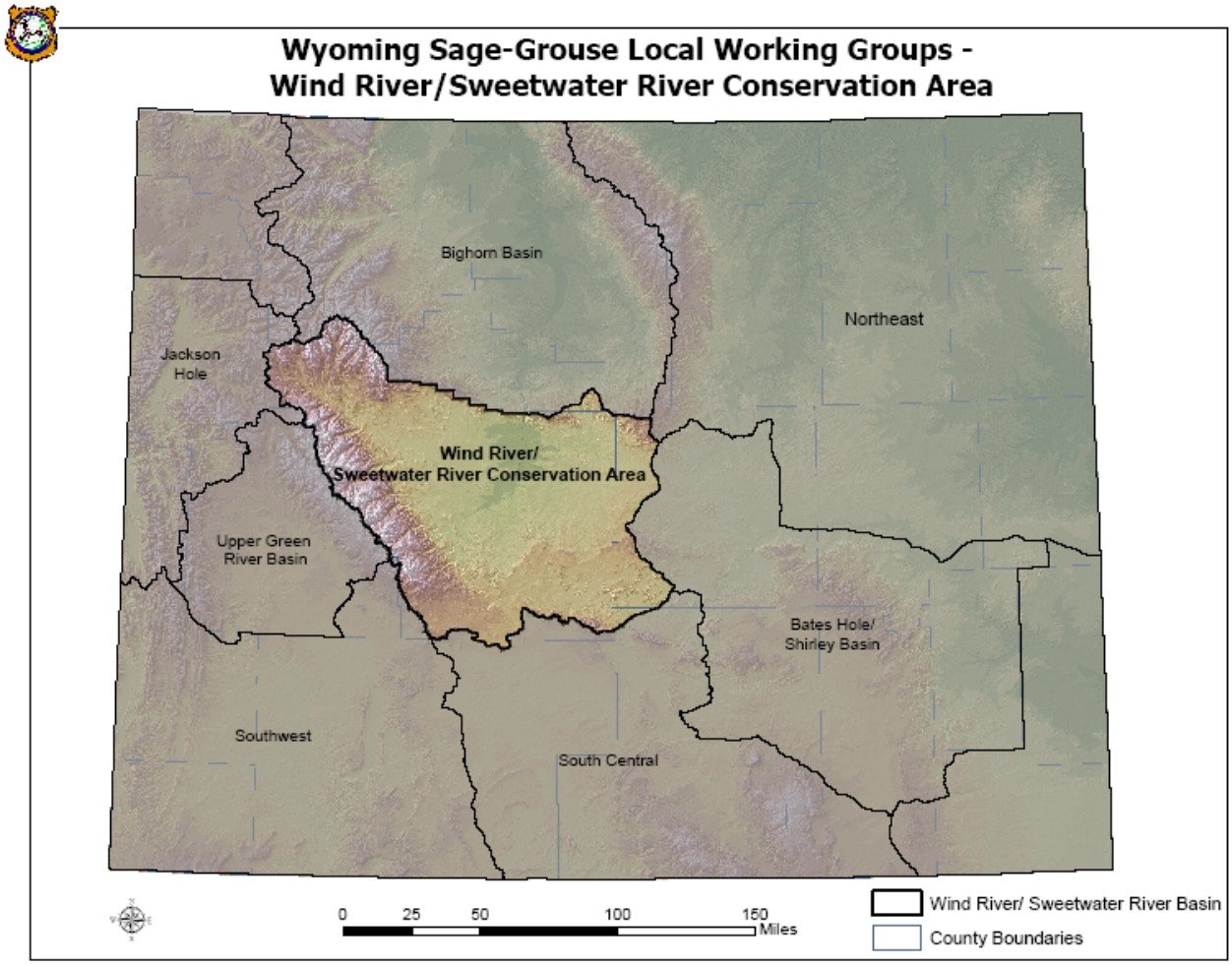


Figure 1. The Wind River/Sweetwater River Conservation Area.

Known occupied sage-grouse leks within the WRSRCA are predominantly located on public lands (54% Bureau of Land Management and BOR) or tribal lands on the Wind River Reservation (WRR – 30%). Approximately 11% of known leks are found on private land with the remaining 5% found on Wyoming State Trust lands.

Management data collected by the WGFD for sage-grouse have focused on lek counts and surveys, harvest statistics, and data derived from wings collected from harvested birds. Lek surveys and/or counts have been conducted within the WRSRCA since the 1960s. Lek counts are conducted annually in April and early May at 7-10 day intervals over a 3-4 week period after the peak of mating activity. Lek counts are conducted to estimate trends in the population based on the average peak male attendance. Lek surveys are also conducted each spring, but normally only one visit per lek to determine general lek status. Sage-grouse brood data have also been collected, primarily in July and August. These brood counts provide some indication of productivity; however, their use is limited in estimating recruitment because surveys are not conducted in either a systematic or consistent manner and sample sizes are small. Emphasis on brood counts has decreased over the past few years because of their limited use as an indicator of recruitment. When available, wing data collected during hunting season provide a more reliable indicator of recruitment.

Past management of sage-grouse within the WRSRCA focused mainly on protection and/or enhancement of their habitats and protection of leks from surface disturbing activities during the breeding season. Protection efforts have primarily occurred through the project review process conducted by State and Federal agency personnel and through the BLM's Resource Management Plans. Sage-grouse have been given increasing consideration through the project review process with emphasis on minimizing disturbance during the breeding season within and around lek sites and protections for sage-grouse nesting and early brood rearing habitats.

Most sage-grouse populations in Wyoming are hunted, although some areas of the state have been closed to hunting to protect small, isolated populations in the southeast and northwest portions of the state. Hunting in the WRSRCA is allowed through WGFD hunting seasons, with unique seasons set on WRR by the Shoshone and Arapaho Tribal Fish and Game Department (SATFG). Most hunting seasons occur in fall, but a limited spring hunt is allowed on WRR, principally for cultural reasons. Historically, sage-grouse hunting seasons opened in early September. Research into the potential impact of hunting on sage-grouse indicated a late September opener had less negative impact on hen survival and may increase recruitment compared to an early September season (Braun and Beck 1996; Heath et al. 1997; Connelly et al. 2000). Sage-grouse seasons in Wyoming currently open in late September and close in early October. Current bag and possession limits are 2 and 4, respectively.

Conservation Area

The Wind River/Sweetwater River Conservation Area features the Wind and Sweetwater River drainages. The area extends from Dubois in the west to Muddy Gap and Waltman at the east, and from South Pass and Cyclone Rim on the south to the Owl Creek Mountains and Badwater area on the north. The Wind River Reservation is also included in the local planning area. Political jurisdictions include Fremont, Hot Springs, Natrona, and very small portions of Carbon, Sublette and Sweetwater counties (Figure 1). Figure 2 indicates land ownership within the WRSRCA, which are managed by the U.S. Bureau of Land Management (Lander, Rock Springs, Casper and Rawlins Resource Areas), the U.S. Bureau of Reclamation, the U.S. Forest Service (Shoshone and Bridger National Forests), the State of Wyoming, and private landowners. The Eastern Shoshone and Northern Arapaho Tribal Business Councils manage lands within the WRR, in association with the U.S. Bureau of Indian Affairs and U.S. Fish and Wildlife Service. Major habitat types within the plan area include: sagebrush/grassland, salt desert shrub, mixed mountain shrub, grasslands, mixed forests (conifers and aspen), agricultural crops, riparian corridors, and urban areas. Primary land uses in the WRSRCA include: livestock grazing, oil/gas development, mining, dryland and irrigated crop production, recreation, and urban expansion.

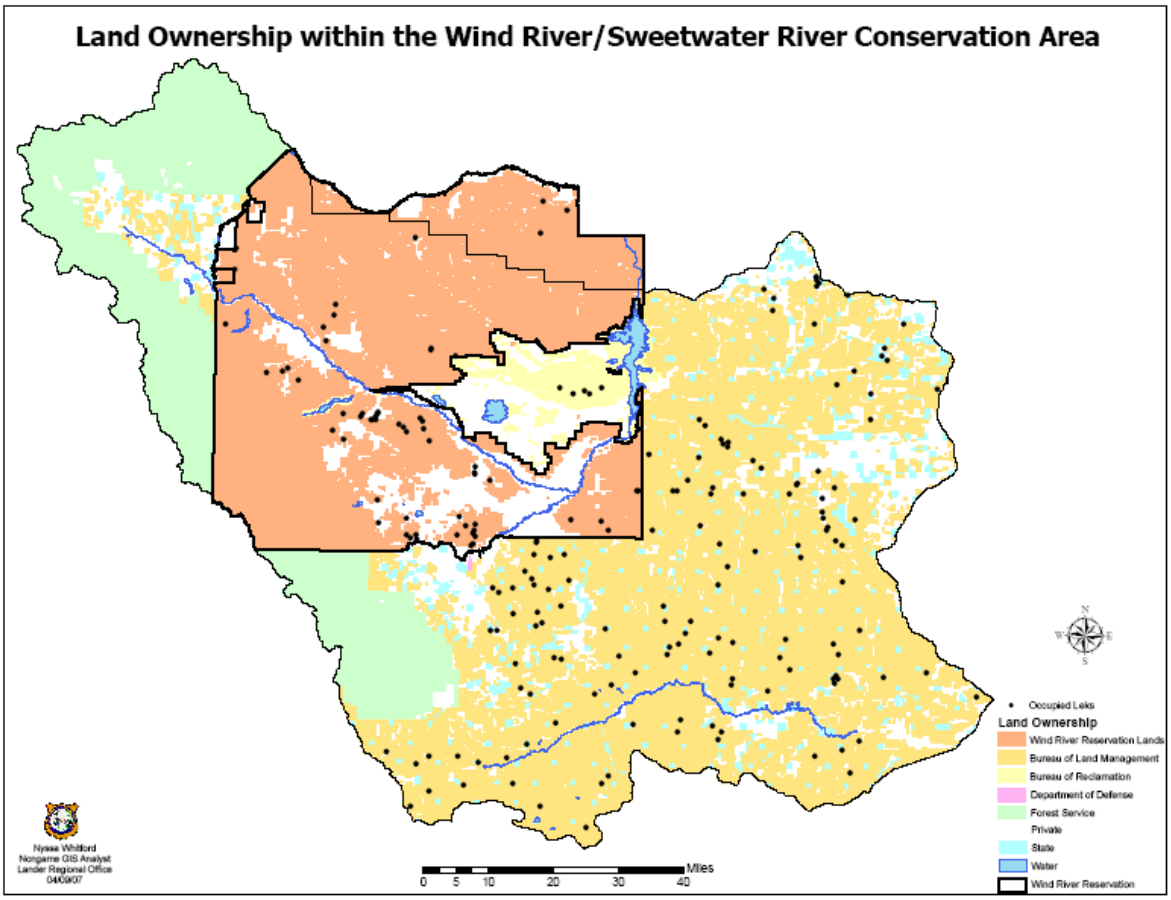


Figure 2. Land ownership within the WRSRCA (dots = leks). Source: WGFD GIS coordinator, Cheyenne, WY.

The WRSRCA encompasses all of the WGFD's Small/Upland Game Management Areas 8, 14, 18, and the WRR (Figure 3). Management recommendations and conservation efforts apply to all tribal lands within the WRR in both Fremont and Hot Springs Counties. The management areas do not correspond to sage-grouse population boundaries, but are used for general data collection and reporting for all small and upland game species.

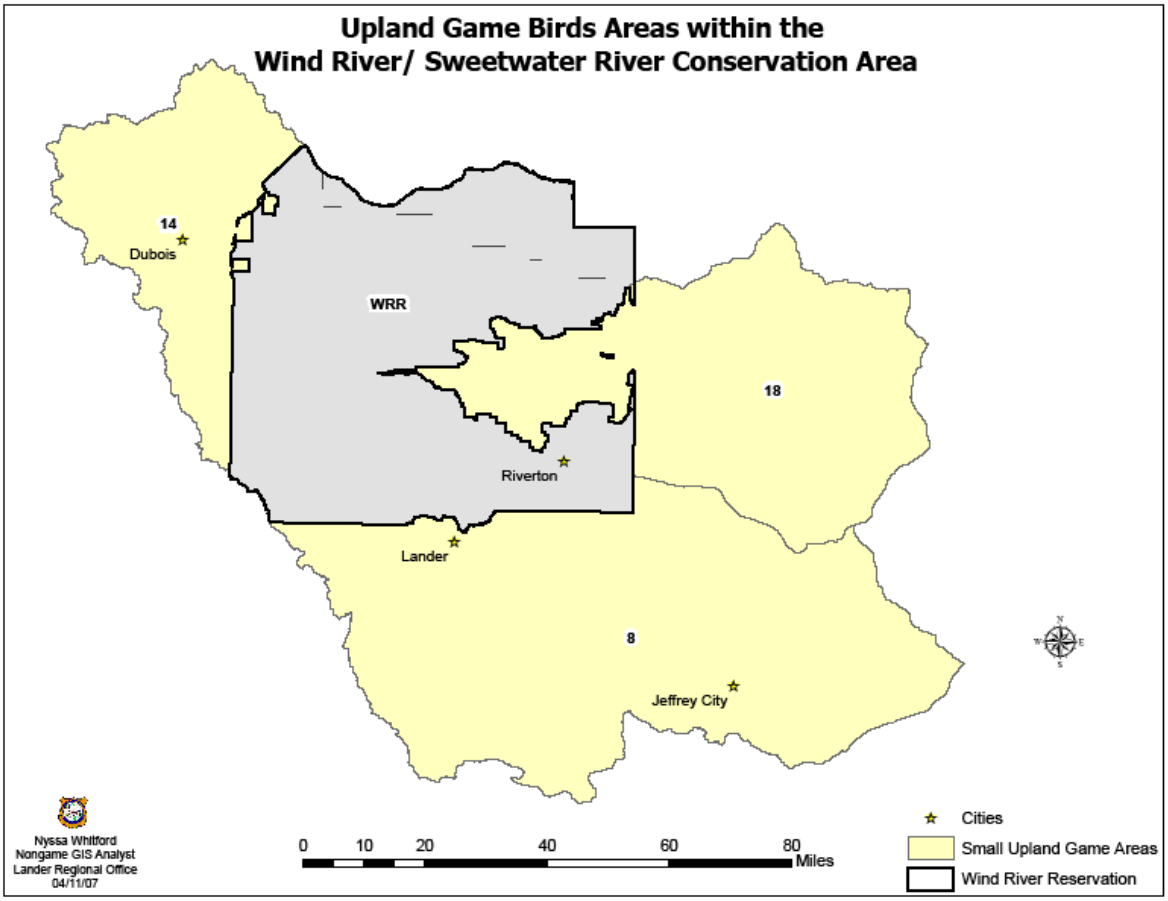


Figure 3. WGFD small game-upland game bird management areas and the WRSRCA. Source WGFD.

Lek Monitoring

WGFD, federal agencies, and volunteers have conducted lek counts and surveys each spring within the WRSRCA for over forty years, providing some of the best long-term management data currently available for sage-grouse. Lek counts include those lek observations conducted three to four times each spring, about a week to 10 days apart. Lek counts are conducted to provide trends in the population based on the average peak male attendance. Lek surveys typically consist of only one spring visit and are intended to determine general lek status. Occupied leks and sage-grouse distribution within the WRSRCA are represented in Figure 4.

Some sage-grouse brood data have been collected and documented during July and early August. Brood data provide some indication of population trend based on production. In some years, brood data are limited because of low sample sizes, due to low populations or conflicting work schedule demands. When available, harvest wing data provide a much more reliable indicator of recruitment than do brood data. Seven or 8 wing barrels placed in along major hunting area exit roads in Upland Game Bird Management Area 8 have typically provided significant wing data, due to relatively high numbers of sage-grouse hunters in the Lander area.

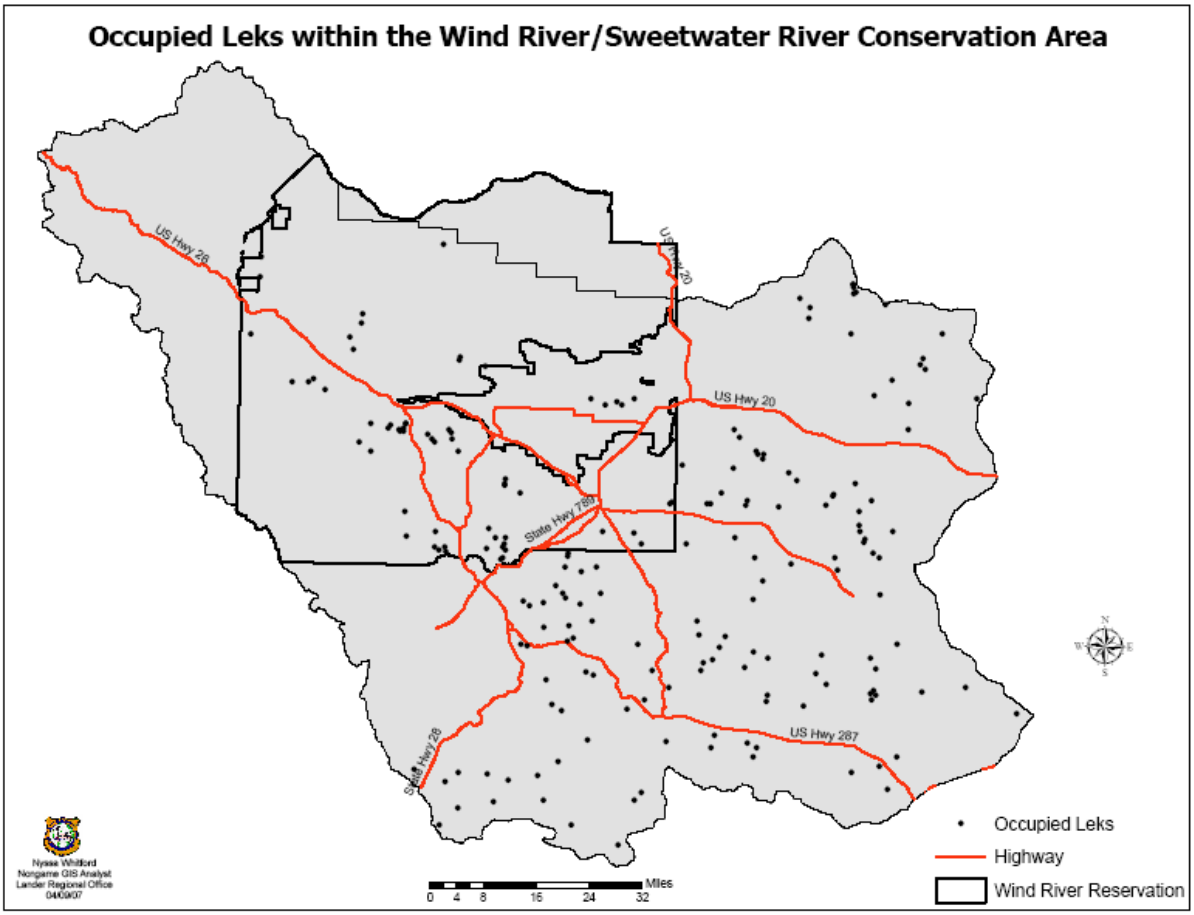


Figure 4. Locations of occupied sage-grouse leks within the WRSRCA, May 2006. Source WGFD Lander.

Sage-grouse Biology and Habitats

The following information on sage-grouse biology and habitats was derived from the Wyoming Greater Sage-grouse Conservation Plan (2003), which has summarized sage-grouse ecology based on a large volume of research.

Sagebrush habitat is essential for sage-grouse survival. Suitable habitat consists of plant communities dominated by sagebrush and a diverse understory of native grasses and forbs (flowering herbaceous plants). 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. Spatial arrangement, the amount of each seasonal habitat, and the vegetative condition determine the landscape's potential for sage-grouse. This arrangement is an important factor in determining if a population is migratory or non-migratory in nature. Both quantity and quality of the sagebrush environment determines suitability for and productivity of sage-grouse.

Winter Habitat

During winter, sage-grouse feed almost exclusively on sagebrush leaves and buds. Suitable winter habitat requires exposed sagebrush above snow. Sage-grouse tend to select wintering sites where sagebrush is 10-14 inches above the snow. Above-snow sagebrush canopy cover selected for by sage-grouse may range from 10 to 30 percent. Sage-grouse generally return to traditional wintering areas before heavy snowfall.

Movements to wintering areas vary widely ranging from a few miles to over 50 miles, depending on the area and population. Foraging areas tend to be gentle southwest facing slopes and windswept ridges. Sage-grouse roost in open, low sagebrush sites on clear, calm nights. During windy periods or during snowstorms sage-grouse seek taller shrubs with greater canopy cover. Sage-grouse will fly considerable distances (>5 miles) and elevations (>1,000 feet) between winter feeding sites and suitable snow roosting sites. Sage-grouse will burrow in deep powdery snow to conserve energy.

During severe winters, the amount of suitable available habitat is greatly reduced. Severe winter habitat may be considered crucial habitat. Some severe winter habitat may be essential and extensively used during severe winters, while others may only be used occasionally.

Winter habitat is increasingly being recognized as an important sage-grouse habitat. Until recently, identifying winter habitat at the landscape scale has not been possible. Doherty et al. (2006) used spatial analysis of habitat components including vegetation and topography along with sage-grouse wintering locations to assess factors comprising winter habitat. Three factors were identified which contribute to suitable winter habitat – sagebrush, lack of conifer cover, and terrain. Sage-grouse select large flat areas of non-forested sagebrush habitat to winter. Currently, no sage-grouse winter habitat has been formally delineated within the WRSRCA, although a substantial amount of sage-grouse winter habitat appears to exist based on the winter habitat needs of sage-grouse.

Breeding Habitat (Leks) - Early Spring

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

There are migratory and non-migratory populations of sage-grouse. In some areas both migratory and non-migratory birds may use the same lek. If all of the components of their seasonal habitat needs 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. There is evidence that sage-grouse hens exhibit fidelity to lek and nesting areas, and males return to leks where they have achieved stature in the breeding hierarchy. As populations decrease, leks can be abandoned. Conversely, as populations increase and expand, leks can become active again or new leks may be established.

Lek-Associated Habitat

Stands of sagebrush surrounding leks are used extensively by sage-grouse. During breeding, sage-grouse use the habitat surrounding a lek for foraging, loafing, and protection from weather and predators. Pre-nesting habitats should contain areas of early-to-mid seral stage vegetative communities at fine scales with relatively open sagebrush canopies and a robust, leafy forb understory. These areas should be interspersed throughout potential nesting habitats. A small-scale mosaic (meaning small interspersed patches of varying seral stage habitats should occur across the area) of early-to-late seral stages of sagebrush communities is desired.

Plant composition in early spring habitat contributes 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, and improve hatch success as well as early chick survival. Low growing leafy forbs, especially milky-stemmed composites (e.g. dandelion), represent potential food forbs. Commonly identified important food species include common dandelion (*Taraxacum officinale*),

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

Nesting Habitat - Late Spring

Approximately two-thirds of hens nest within three miles of the lek where they were bred (WGFD 2003). The remainder of the birds usually nest within 15 miles of the lek, but one radio-collared bird in western Wyoming ranged 60 miles.

Sage-grouse typically nest under sagebrush, but may use other large shrubs. Sage-grouse select mid-height, denser sagebrush stands for nesting. Studies conducted in southern and southwestern Wyoming indicate nest shrub heights for Wyoming big sage (*Artemisia tridentata wyomingensis*) ranged between 8 to 18 inches for sage-grouse, but individual plants (all subspecies of *Artemisia tridentata*) utilized range-wide by sage-grouse may reach 32 inches in height. Sagebrush canopy cover at nesting sites ranged between 6% and 40%.

Wyoming studies indicate greater total shrub and dead sagebrush canopy cover and residual grass cover are vegetative attributes sage-grouse choose in the nest selection process, when compared to surrounding vegetation. These sagebrush stands should have sagebrush of varying heights with good residual grass under the sagebrush canopy, and the areas between the sagebrush should have good forb cover while maintaining some grass and litter cover. 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 quite variable and ranged between 1% and 85%. Although dead sagebrush canopy cover has been shown to be statistically significant in nest selection, it represented only 12% to 21% of the overall canopy cover in the stand. Dead sagebrush may provide screening cover while allowing for increased amounts of herbaceous understory.

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

Early Brood-Rearing Habitat – Late May to Mid-July

Early brood-rearing habitats are used during the brood's first month of life. Immediately upon hatching, hens move their brood from the nest site to early brood-rearing areas. Sites used during the first 10-14 days after hatching are typically within 1.5 miles of the nest. The vast majority of chick mortality (87% of total brood loss in four studies occurring in Wyoming) occurs during this period. After the first 10 days, broods may disperse five or more miles from the nest.

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

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

As summer progresses and food plants mature and dry, sage-grouse move to areas still supporting succulent herbaceous vegetation. They continue to rely on adjacent sagebrush for protection from weather and predators, and for roosting and loafing. These areas may be lower elevation native or irrigated meadows where uplands lack green vegetation. Sage-grouse will also migrate to higher elevations, seeking habitats where succulent forbs are still available in sagebrush habitats or select sites such as moist grassy areas or upland meadows. Delayed maturation of forbs has a noticeable effect on bird movements. In years with above-normal summer precipitation, sage-grouse may find succulent forbs on upland sites all summer. In more arid areas, riparian meadows become more important to survival of broods in the late summer.

From mid to late summer, wet meadows, springs, and riparian areas are the primary sites for forb and insect production necessary for juvenile birds. In general, the drier the summer, the more sage-grouse are attracted to remaining green areas.

Fall Habitat - Mid-September to First Major Snow

Time spent in fall habitat is highly dependent upon weather conditions. Sage-grouse normally move off late brood-rearing habitat onto transitional fall habitat before moving onto winter range. As fall precipitation increases and temperatures decrease, sage-grouse move into mixed sagebrush-grassland habitats in moist upland and mid-slope draws where fall green-up of cool-season grasses and some forbs 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.

Landscape Context

Providing for all habitat needs on the scale required by sage-grouse may be the most challenging element of managing the landscape. The value of the various successional stages and the effect of livestock grazing on sage-grouse habitats are not completely understood, although some generalizations may be made (Table 1). Thus, there is debate about how sagebrush communities should be managed to maximize benefits to sage-grouse. However, there is also a need to identify structure and cover components. These challenges are greatest in breeding (pre-nesting, nesting, and early brood-rearing) habitats. These habitats have to be in proximity to one another and constitute a small-grained mosaic of seral stages and vegetation structure (height and cover).

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

Because leks have been shown to be reliable indicators of nesting habitat and sage-grouse chicks have limited mobility during the critical first two weeks post-hatch, habitat assessment should focus on nesting and early brood-rearing habitat associated with leks. Landscape scale is highly variable because the landscape may contain migratory or resident populations, or both.

If upland vegetation is managed at 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 annually. Issues relating to landscape-scale habitat needs of sage-grouse must consider seasonal habitat (pre-nesting, nesting, early brood-rearing, late brood-rearing, fall, and winter), juxtaposition, seral stages of vegetation, site potential, vegetative structure, and past and future management. The ideal or required percentages of each seasonal habitat and the juxtaposition of these habitats on the landscape are not well understood.

Sage-grouse Seasonal Habitat Type	Approx. Dates	Relative Nutritional Requirement	Potentially Limiting Nutrient(s)	Vegetation to Meet Nutritional Requirements Within Sagebrush Communities	Desired Vegetation Structure	Effect of Season of Livestock Use
Nesting	late April - early May	moderate	energy	grasses with overhead cover (shrubs, leaves, etc.)	15-25% sagebrush canopy cover w/ grass understory	heavy fall use detrimental
Early Brood Rearing	late May - mid July	high	protein	lush grasses, young forbs, and insects	open stands of sagebrush w/ good understory	grazing can enhance availability of forbs; long-term heavy use detrimental
Late Brood Rearing	mid July - mid September	moderate	energy	quality herbaceous riparian meadows	riparian and wet meadows; forbs and grasses adjacent to sagebrush	grazing can enhance availability of forbs; long-term heavy use detrimental
Wintering	Nov - March	low (site dependant)	energy	mature sagebrush	sagebrush exposed above snow	little to moderate livestock affect

Table 1. Habitat check sheet for sage-grouse seasonal habitat requirements and associated livestock grazing recommendations (*Source: WRSR LWG*).

Sage-grouse in the Plan Area

Sage-grouse are generally found throughout the WRSRCA, except in heavily forested, agriculturally developed, or urbanized areas. Sage-grouse leks in the WRSRCA are located within the Lander and Cody WGFD Regions, 2 Biologist and 5 Game Warden Districts, 4 BLM Field Offices, and 5 Wyoming counties (Table 2). Currently there are 212 known occupied leks within the conservation area. Information exists indicating the possible existence of another 6 leks on the Wind River Reservation; however no data are available for lek attendance. In addition, there are almost certainly leks within the WRSRCA that have not yet been documented. Similarly, there are leks that have been abandoned or destroyed that are undocumented. Lek attendance has increased since 1995, when sage-grouse numbers had declined dramatically. Since 1995, 70 leks have been discovered in the WRSRCA, likely the result of increased observation efforts, rather than new lek establishment.

Of the 212 known occupied leks in the WRSRCA, 171 were checked in 2006 by WGFD, BLM, USFWS, Shoshone and Arapaho Tribal Fish and Game Department (SATFG), and University of California-Davis researchers, along with several volunteers. Of those checked, 66 were counted and 105 were surveyed. Of the 137 leks where status was confirmed, 126 (92%) were active and 11 (8%) were inactive. Four leks were discovered in 2006, mainly in areas where prior searches had not been conducted. Average peak male attendance at count leks was 63.3, which is 19% higher than in 2005 (53.1) and 209% above the average since 1995 (30.3).

Category	Number of Leks	Percent of Category	Category	Number of Leks	Percent of Category
WGFD Region			**Working Group**		
Lander	212	100	Wind River/Sweetwater River	212	100
Classification			**BLM Office**		
Occupied	207	98	Casper	8	3.8
Unoccupied	5	2	Lander	196	92.5
			Rock Springs	5	2.4
			Worland	3	1.4
Unoccupied Leks					
Abandoned	5				
N/A	1				
			Game Warden District		
Biologist District			East Rawlins	1	0.5
Wind River Reservation	63	29.7	Lander	51	24.1
North Lander	61	28.8	North Riverton	23	10.8
South Lander	88	41.5	South Riverton	67	31.6
			West Rawlins	9	4.2
County			**Land Status**		
Carbon	1	0.5	Bureau of Land Management	110	51.9
Fremont	191	90.1	Bureau of Reclamation	5	2.4
Hot Springs	6	2.8	Private	23	10.8
Natrona	13	6.1	Wind River Reservation	63	29.7
Sweetwater	1	0.5	State	11	5.2
Management Area					
18	54	25.5			
8	95	44.8			
WRR	63	29.7			

Table 2. Sage-grouse lek demographics by various categories within the WRSRCA (Spring 2006). Source WGFD.

The number of count leks increased dramatically in 2006, largely due to efforts put forth by researchers from the University of California-Davis, who monitored most of the leks in the Government Draw area south of Hudson. These researchers monitored 16 leks on a nearly daily basis from early March through the end of April, allowing personnel to whom these leks were previously assigned to monitor and search for leks elsewhere. Sage-grouse attendance at leks varies daily, as is illustrated at the Monument Draw lek (Figure 5), where counts were conducted on all but 4 mornings from March 3 through April 30, 2006.

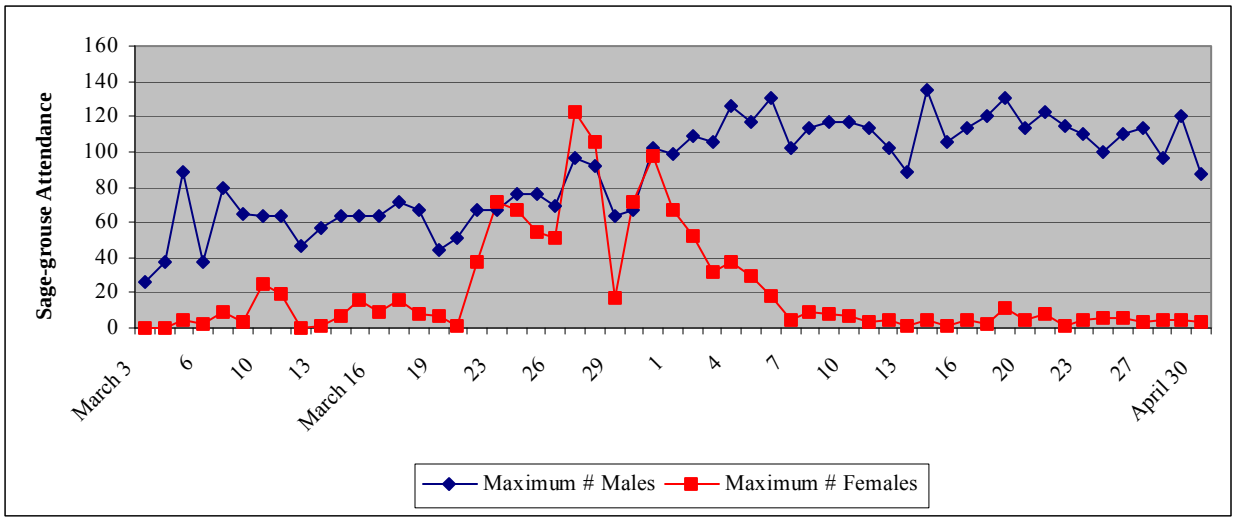


Figure 5. Daily variation in sage-grouse attendance on Monument Draw lek, 2006. Source WGFD & UC-Davis

A set of 18 leks in the Lander area have been continuously counted since 1995, and data trends show little difference between these intensive lek counts and those counted intermittently or all leks checked throughout the WRSRCA in the same time period (Figure 6).

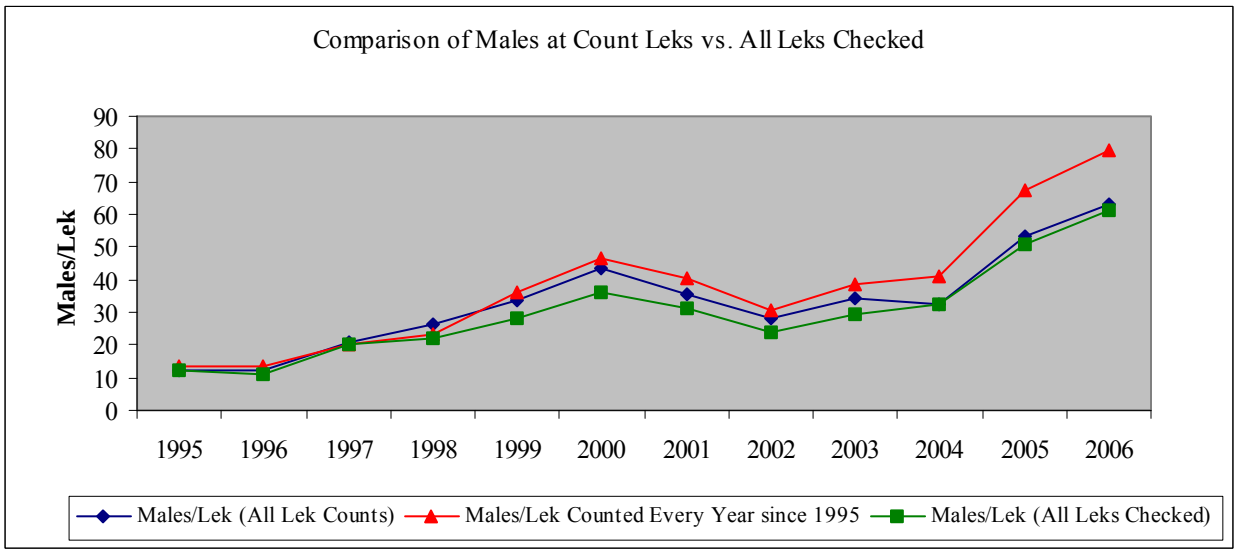


Figure 6. Male attendance trends for lek counts since 1995. Source WGFD

Habitat

Sage-grouse habitat quality has been affected by recent drought throughout the WRSRCA, and conditions have probably declined significantly over the past several decades. Disturbance (i.e., oil/gas, season-long grazing by livestock and wildlife, etc.) combined with lengthy drought periods and sagebrush eradication programs in many areas have negatively impacted sage-grouse and their habitats. With recently elevated concerns for sage-grouse, habitat improvement projects are being planned and/or implemented throughout the WRSRCA to address declining sage-grouse habitat condition. In addition, research projects in the Lander area are continuing to provide more insight to sage-grouse movements and habitat use. Habitat conditions vary greatly within the WRSRCA, due to climatic differences, soil types, land use, and elevation.

Habitat Monitoring

Sagebrush transects have been established by WGFD in the WRSRCA and are monitored for production and to estimate over-winter utilization by big game. One transect is located along Yellowstone Ridge on the west side of Beaver Creek, with a similar transect located near Moneta. Although these transects were established to monitor big game winter range conditions, they are located in areas containing habitats suitable for sage-grouse and future transects may be established to monitor conditions in other key sage-grouse habitats.

Fifty Wyoming big sagebrush (*Artemisia tridentata wyomingensis*) plants were tagged along each transect. In fall, 10 measurements of current annual leader growth were recorded randomly on each tagged plant. An assessment of age and hedge class was also recorded for each plant. In 2006, current annual leader growth averaged 10.2 mm (0.40") at the Moneta transect and 6.2 mm (0.22") at the Yellowstone Ridge transect. Sagebrush leader production was 61% and 53% lower in 2006 than in 2004 at Moneta and Yellowstone Ridge, respectively (Figure 7).

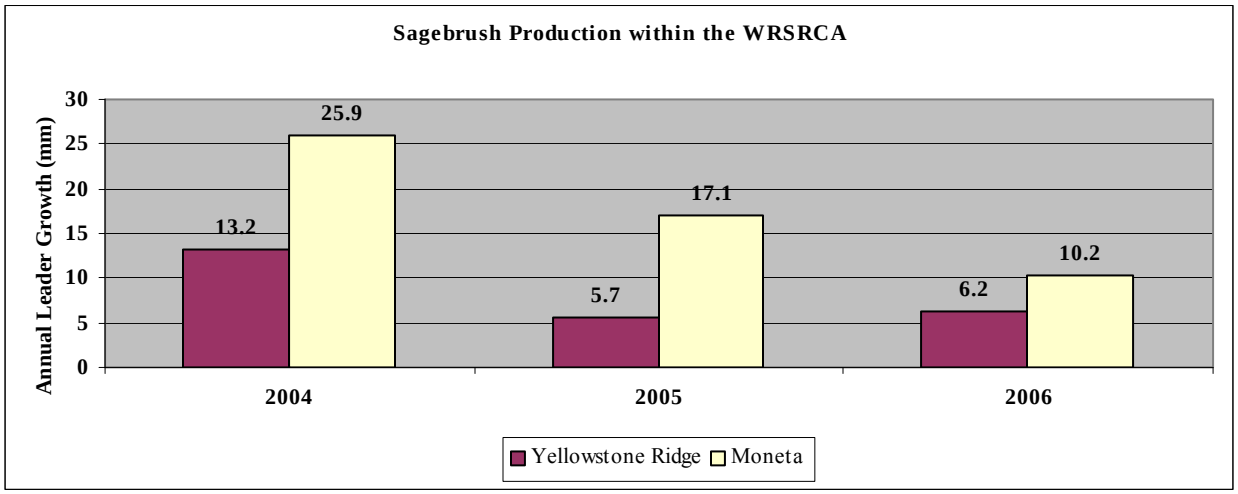


Figure 7. Sagebrush production at Yellowstone Ridge and Moneta transects 2004 – 2006. Source WGFD.

Range monitoring for big game winter ranges on the Wind River Reservation in 2005 indicated range production and condition was similar to 2004 and vastly improved from the previous drought years. In fact, average grass, sedge, forb and fringed sage production in 2005 was 448% higher than in 2002 at the same monitoring sites. According to the Modified Palmer Drought Severity Index, a measure of the degree of long-term wetness or drought, the Wind River Basin experienced 3 consecutive years of "severe" or "extreme" drought between 2000 and 2002, followed by "mild" drought in 2003, and mild to no drought in 2004 or 2005. Consequently, forage production was adversely affected in the past, especially in the Owl Creek Mountains. Higher levels of precipitation in 2005 resulted in a good forage growth and normal forage production. While these sites were monitored with respect to big game winter forage, the results indicated improved herbaceous cover was likely available for sage-grouse nesting habitat.

The BLM has established various types of long-term upland and riparian habitat monitoring studies on public lands within the WRSRCA. Information collected is used to monitor vegetative changes in important wildlife habitats. There are over 200 Condition and Trend transects, which are typically read every 5 years, and are used to ascertain changes in plant species composition, plant diversity, ground cover and vegetative production on rangelands. Sagebrush canopy cover is monitored on 75+ permanent

browse transects located in key wildlife habitats. In addition, cross-section transects, greenline and permanent photo-points are used to monitor important riparian systems. Although the data obtained from these site-specific monitoring sites are not conducive to trend generalizations, it does indicate that drought has affected herbaceous and browse production.

Habitat Inventory

An extensive habitat mapping project was recently completed in southwestern portions of the WRSRCA to delineate and evaluate crucial winter and yearlong ranges associated with the South Wind River Mule Deer Herd Unit. Maps delineating specific browse communities including, sagebrush/bitterbrush (*Purshia tridentata*), silver sagebrush (*Artemisia cana*), three tip sagebrush (*Artemisia tripartita*), and mixed stands that include skunkbush sumac (*Rhus aromatica*), chokecherry (*Prunus virginiana*), snowberry (*Symphoricarpos albus*), etc. have been completed by hand, with a contractor hired to digitize these maps into GIS layers. In total, nearly 170,000 acres of habitats were mapped, with more than 200 sites identified for potential habitat improvement projects. Much of the habitat contained in this project also supports sage-grouse, and projects restoring sagebrush health should improve habitat conditions for sage-grouse.

WGFD partnered with The Nature Conservancy in acquiring a conservation easement on the 16,000 acre (4,970 acres deeded) Twin Creek Ranch in 2005. Owners of the Twin Creek Ranch place a high value on sage-grouse and their livestock management utilizes a rest-rotation system that favors sage-grouse habitat.

WGFD is nearing completion of transactions with several property owners northwest of Lander to acquire conservation easements that would prevent fragmentation of wildlife habitat on approximately 3,300 acres of deeded land. In addition to these conservation easements, the landowners have a strong desire to implement habitat improvement projects for the enhancement of wildlife on these properties.

Knowledge of sage-grouse habitat use is limited throughout much of the WRSRCA outside the Lander - South Hudson focus area. As such, inventory and mapping of sagebrush and associated sage-grouse habitat should be a priority for the Wind River/Sweetwater River Local Working Group in ongoing planning efforts. Winter habitat use should also be documented when conditions and budgets allow.

In late-2005, a questionnaire was mailed to over 260 landowners within the WRSRCA in an effort to obtain additional information from private lands and associated public land permit areas. This information may provide insight and focus toward which future habitat mapping, inventory, monitoring and treatments may be targeted.

Government Draw Habitat Improvement Project

Phase I of the Government Draw Habitat Improvement Project was completed in February 2006. The project area provides sage-grouse wintering, breeding, nesting, and early brood-rearing habitat south of Hudson, Wyoming. The area has experienced season-long cattle grazing since the early 1900s in conjunction with a long-term lack of disturbance that has resulted in older age-class sagebrush stands with little regeneration and limited herbaceous understory. Recent sage-grouse studies indicate that hens with their chicks are leaving shortly after hatching to migrate to higher elevation habitats having greater vegetation diversity. Chick mortality can be high as these young birds must navigate across a highway and travel 20+ miles to reach these preferred habitats. Increasing herbaceous plant abundance, species diversity, and the overall nutrient quality of the vegetation community may encourage birds to remain longer on their nesting and early brood-rearing habitats. Larger chicks would be better able to make the arduous trip and the end result should be increased chick survival.

Goals:

1. Improve sage-grouse nesting and early brood-rearing habitat.
2. Lengthen time spent by sage-grouse in nesting and early brood-rearing habitats.
3. Increase chick survival.
4. Utilize knowledge gained for additional treatments throughout the Lander – South Hudson focus area.

Objectives:

1. Increase forb density and diversity within treated areas.
2. Increase sage-brush recruitment and age-class diversity within treated areas.
3. Increase perennial grass plant density and diversity within treated areas.
4. Create a mosaic of vegetation communities.

The project entailed conducting different vegetation treatment methods on sagebrush/grass rangeland to determine each method's effectiveness in improving sage-grouse habitat. Prescribed fire was planned for a part of the project area having deep soils covered predominantly by Basin big sagebrush (*Artemisia tridentata tridentata*). Due to poor herbaceous cover (fine fuels) and limited time of opportunity, burning was not successful in 2006, and will be delayed until prescribed burning conditions are met and grazing deferment may be achieved. Timing of the treatment would take into consideration grass, forb, and sagebrush recruitment goals and prevention of cheatgrass (*Bromus tectorum*) establishment and/or expansion. Mechanical treatments were employed and included using a mower on nearly 400 acres and Lawson pasture aerator on about 70 acres on sites with shallow soils and covered by Wyoming big sagebrush. Treated zones consisted of irregular mosaic patterns, alternating with a mosaic of untreated zones. Approximately 25% of the initial mechanical unit area was treated. Treatment areas were deferred from livestock grazing for the first growing season. Initial monitoring indicated a 3-4 fold increase in hawksbeard *(Crepis spp.)*, a forb utilized by sage-grouse, in the aerated treatment zone. Sagebrush cover was reduced by 60-80% in most of the treated sites. However, stems remaining after treatment indicate a rapid response to the removal of surrounding sagebrush. Some stems grew as much as 4 inches of new leader growth in the first year following treatment, even during one of the driest summers on record for the Lander area. Several sagebrush plants in the treatment zones produced seed stalks, which were not observed in virtually any of the untreated sites.

Phase II was completed in February 2007, with 860 acres mowed inside a 7,000 acre project boundary. Potential exists for expansion for several years, pending results of Phases I and II. There are several thousand acres of important sage-grouse habitat within the South Hudson area that could benefit from vegetation manipulation treatments. Results of this project can be used to determine additional treatment areas and treatment methods in the South Hudson area, in other sage-grouse habitat within the BLM's Lander Field Office, and elsewhere in Wyoming. The project should also improve forage conditions for pronghorn antelope and mule deer, which utilize the area yearlong. Livestock are expected to benefit from an increase in herbaceous vegetation.

Productivity

Observations of late summer broods yield limited information on population productivity. Historically, there has been no set brood count protocol throughout the WRSRCA. Annual pronghorn classifications are conducted via ground observations and allow personnel to observe broods in August. Wings collected from harvested birds (Table 3) in wing barrels at strategic entry/exit points during hunting season provides more reliable data for assessing productivity than the limited brood data collected in summer. Sample sizes include only wings from hens and chicks collected annually. Precipitation was 65% below average during March – June 2006, and record heat and dry weather continued throughout the summer. July's average high temperatures in at 3 weather stations in the WRSRCA were as much as 6^0F above the 30 year average from 1971 – 2005, and were the 2nd highest since 1892 in Lander.

Table 3. Brood data from harvest wing barrels for Upland Bird Management Area 8 for 1995 - 2006.

Year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Chicks/Hen	2.0	2.6	2.8	2.4	2.1	1.1	2.3	1.3	1.8	5.0	1.5	1.3
Sample Size	124	283	110	218	491	479	419	201	208	325	515	254

Although comparisons of brood data (from wing data or summer brood surveys) and spring precipitation are not closely tied, there is reason to believe chick production is linked to precipitation (Figure 8). This link may be related to the timing of the precipitation and resultant vegetation growth, rather than the amount of precipitation alone. For example, total precipitation from March through June 2005 was similar to precipitation during same period in 2004. However, the precipitation in 2004 came in a late-April snowstorm followed by warming temperatures, which resulted in vigorous herbaceous growth and probably enhanced nesting habitat by providing additional hiding cover and enhanced brood-rearing habitat by providing better cover and forage for newly hatched chicks. Similar late-April snows fell in 2006, but nearly no precipitation fell again until September, resulting in a slight decrease in chick/hen ratio in harvested wings. Differences in the precipitation/brood size pattern may again be related to other factors, such as temperature, conflicting land uses, and other disturbances.

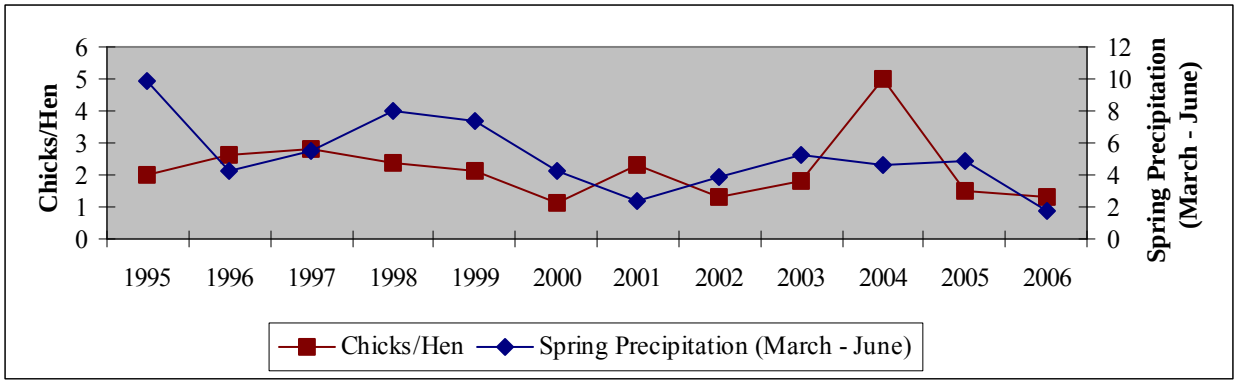


Figure 8. Average brood size from wing barrel data and spring (March - June) precipitation in the WRSRCA.

Population Trend

Monitoring male attendance on leks provides a reasonable index of relative change in abundance in response to prevailing environmental conditions over time. Nevertheless, these data must be viewed and interpreted with caution for several reasons described in the Wyoming Greater Sage-Grouse Conservation Plan, 2003.

Lek monitoring within the WRSRCA began in the early 1960s, with the most consistent data collection beginning in 1995. From 1966 to 1977, all 13 known leks in the WRSRCA were surveyed annually, with peak male attendance (92.3 males/lek) occurring in 1968. Lek counts were initiated in the WRSRCA in 1986 with 4 of 113 known leks being counted. The number of leks counted has increased markedly to 66 count leks being monitored in 2006. Male attendance at count leks from 1995 – 2006 was previously shown in Figure 6, along with male attendance at all leks checked. Concurrent with increased monitoring effort, the number of sage-grouse (total males observed) has also increased (Figure 9), but the increase has been more dramatic since 2004, with 8,130 total males observed in 2006. Although the number of known leks continued to increase steadily, the number of male sage-grouse observed declined dramatically in the mid-1990s, but has rebounded rapidly in the early 21st century. The average number of males observed/all leks checked increased from 50.6 in 2005 to 61.1 in 2006 (a 21% increase). This is an increase of 27.5 males/lek (82%) compared to the previous 5-year average, representing the highest level since the 1960s.

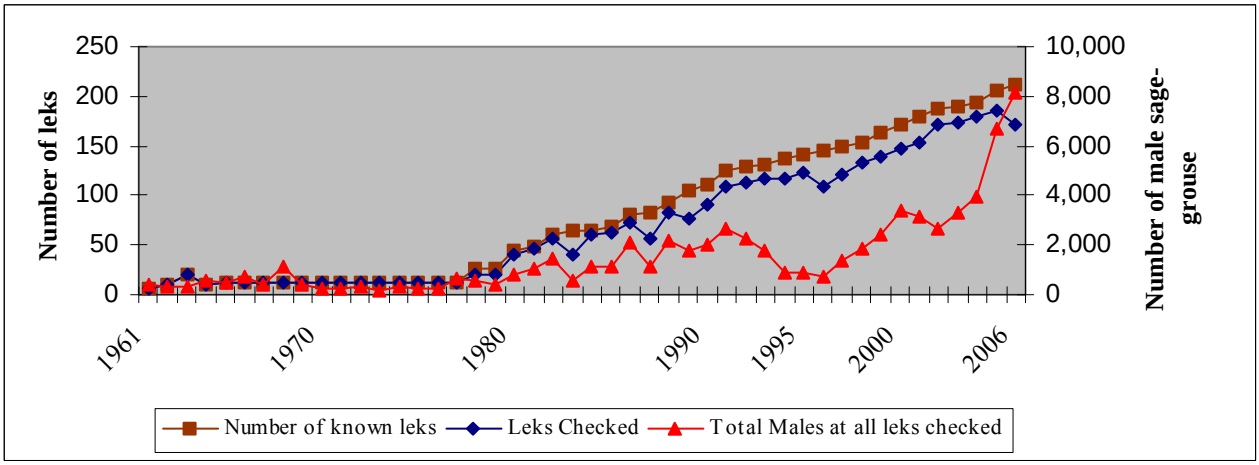


Figure 9. Lek numbers and total male attendance in WRSRCA, 1961 – 2006. WGFD

Harvest

Hunter and harvest statistics provide insight into the status or trends in wildlife populations. Harvest data within the WRSRCA are available since 1982, and indicate total harvest is closely associated with the number of hunters (Figure 10). Harvest peaked in 1984 at 12,568 birds and steadily and dramatically declined to a low of 307 in 2003. Fluctuations in the number of hunters and total harvest appear to be generally related to bird populations, as long as season regulations remain consistent over time. In 1995, hunting seasons were changed across Wyoming with a later opening date, at which time the number of hunters dropped by about half in comparison to the previous 5 years. Harvest levels remained near 600 birds until 2000, when harvest increased to nearly 1,100 birds following a brief peak in grouse populations. Hunting seasons were changed again in 2002, with reduced bag and possession limits. Hunter numbers and harvest again dropped following this change. With increased numbers of grouse in 2005, harvest increased over 2004 levels with a slightly smaller increase in hunter numbers. Hunter effort (days/bird) and birds/hunter has not changed significantly since 1995 (Figure 11).

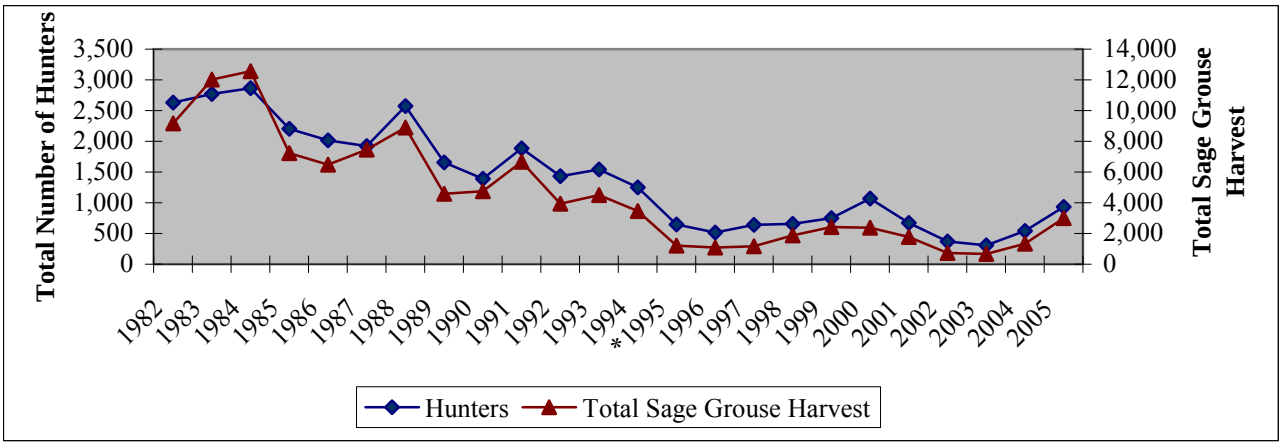


Figure 10. Total hunters and total sage-grouse harvested within the WRSRCA, 1982 – 2005. Source WGFD

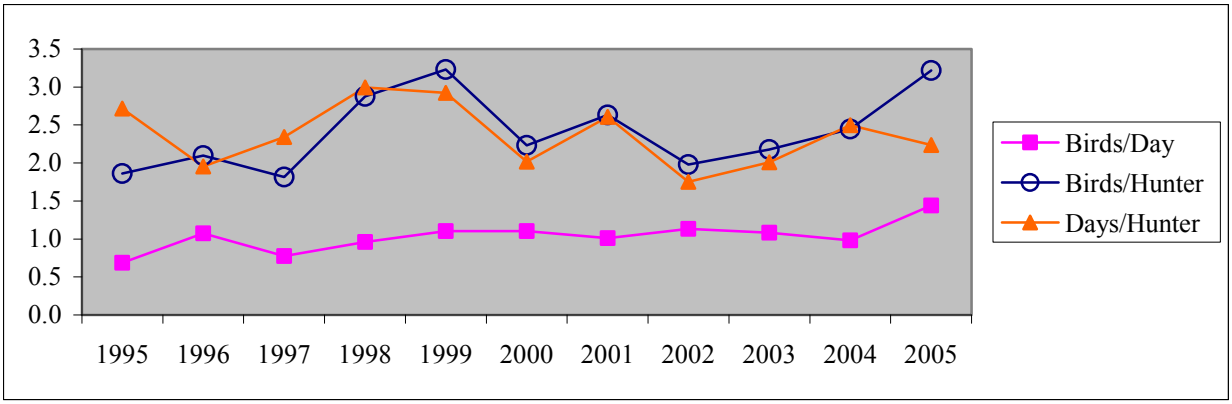


Figure 11. Hunter effort statistics for the WRSRCA from 1995 – 2005. Source WGFD.

Special Studies

South Hudson Coal Bed Methane Study

The South Hudson Coal Bed Methane Study ended early-summer 2003. In response to a proposal to drill for coalbed natural gas (CBNG) within core sage-grouse habitat south of Hudson, WGFD and BLM embarked on a telemetry study. To gather pre-disturbance data, 6 males and 16 females were trapped from 4 leks near the proposed wells in spring 2001, and an additional 17 birds were trapped in spring 2002. These birds were equipped with radio transmitters and monitored until 2003. Although the CBNG test wells proved to be infeasible for commercial field development, the results of the telemetry study provided some valuable insight regarding sage-grouse habitat use in this area. Prior to this study, it was known that sage-grouse left the study area in June each year, but direction and distance of the emigration was unknown. The results of this study found that birds that nested in the Government Draw area south of Hudson moved south and southwest up to 65 air miles from the leks where captured. The findings of this study provided baseline data and information that was incorporated into the study design of future research conducted by Jarren Kuipers and Brian Jensen in cooperation with the University of Wyoming Cooperative Fishery and Wildlife Research Unit from 2003 through 2006. Complete results for this project were published in the Wyoming Game and Fish Department's 2002 Lander Region upland game completion report. (Ryder, WGFD 2003).

McGraw Flats/South Pass Cattle Grazing Study by Jarren Kuipers

University of Wyoming Graduate Student Jarren Kuipers finished his Master of Science Thesis in Spring 2004 detailing results of field research conducted in the McGraw Flats/South Pass study area. The purpose of this research was to A.) Provide scientifically credible data that would assist wildlife and land management agencies and private land owners in ascertaining the impacts grazing has on sage-grouse population sustainability, and B.) Determine livestock grazing practices that will lead to overall sagebrush steppe ecosystem health and thus provide sage-grouse habitat conducive to sustainable populations. A copy of this thesis is available for review at the University of Wyoming's Science Library and in the Wyoming Game and Fish Department's Lander Regional Office. (Kuipers 2004)

Migration, Transition Range And Landscape Use By Greater Sage-Grouse by Brian Jensen

University of Wyoming Graduate Student Brian Jensen began field operations for a new Master of Science study during Spring 2004 and published his thesis in May 2006. His study attempted to identify important facets of late brood-rearing habitat in western portions of Management Area 8. Data collected

during Jarren Kuipers' research and the South Hudson Coal Bed Methane Study provided a starting point for habitat measurements and was supplemented by radio telemetry data collected during this new project. A copy of this thesis is available for review at the University of Wyoming's Science Library and in the Wyoming Game and Fish Department's Lander Regional Office. (Jensen 2006)

Abstract: Greater sage-grouse (*Centrocercus urophasianus*) populations have shown noticeable declines in the past 50 years, due largely to habitat degradation and loss. To provide insight into population differences, I studied two populations. One population near Hudson, Wyoming was believed to be migratory and the second population on McGraw Flats about 25 km south of Hudson, Wyoming was believed to be non-migratory. Bird locations were monitored by radio-telemetry to determine migration distances and timing, productivity of each population, sites used seasonally, and sites used as stop-over locations when migrating between nesting or early brood-rearing sites and summer sites. Productivity appeared to be high during the study for the Hudson population while low sample sizes and high standard errors prevented conclusions regarding the McGraw population. Variation in nesting habitat was observed between the two populations. The birds in the non-migratory McGraw population selected nest sites with greater grass height and less residual grass height. In contrast, the Hudson birds selected sites with greater dead sagebrush (*Artemisia spp.*) density, residual grass height, and less Wyoming sagebrush (*Artemisia tridentata ssp. wyomingensis*) cover. No differences in habitat use were observed between transition sites and paired random sites for the Hudson population although differences were noted between sites used by brooding and non-brooding females. A nesting, terrain-use model using nests from four past studies in western Wyoming (i.e. Pinedale, Farson, Lander, Kemmerer) was also developed. This exercise showed increased use of sites with low-to-moderate variation in terrain although much variability existed among sites, apparently due to different elevations. Aspect did not appear to influence nest site selection. However, it seems likely that terrain is considered by nesting greater sage-grouse. This study emphasized the need to manage greater sage-grouse and their habitats on the landscape scale given the large home ranges and distinct seasonal habitats of migratory populations.

Examining the effects of noise from energy exploration and development on the breeding biology of the greater sage-grouse by University of California – Davis

A multi-year, multi-location study began in February 2006 to study the effects of noise produced by energy development on sage-grouse. The study area included the Government Draw area south of Hudson as a principal location for the research on introduced noise, combined with an area south of Pinedale where researchers are collecting measurements of noise actually produced by natural gas field energy development. Project goals and objectives follow and a progress report is provided in Appendix B.

Goals:

1. To determine whether noise from energy development impacts reproduction in sage-grouse
2. Ultimately, to develop a model that managers can use to evaluate means of mitigating any impact.

Objectives:

1. Measurement of noise production and propagation in the sagebrush habitat:
2. Measurement of sounds produced by energy development
3. Long-term measurement of noise at leks
4. Measurement of sounds produced by grouse and grouse leks
5. Measurement of the propagation of sound through the environment
6. Experiment to test the effects of noise on grouse behaviors

Sage-grouse movements and survival study on the Wind River Reservation

The Wind River Reservation initiated a radio telemetry study in 2006 to provide baseline information on movements, seasonal ranges, and survival that will assist in managing the sage-grouse population at sustainable levels. In April 2006, 31 sage-grouse were captured from 3 different leks and equipped with radio transmitter necklaces to facilitate telemetry tracking. Telemetry data so far has provided insightful movement data, documented nesting attempt and nest success rates, and mortality rates. A progress report is provided in Appendix C.

Diseases

West Nile Virus (WNV) was detected in one juvenile male sage-grouse just south of Lander during August 2003. In 2006, Fremont County experienced dozens of cases of West Nile Virus in humans and horses, and 3 radio collared sage-grouse possibly died from WNV on the Wind River Reservation, but confirmation was not possible. WNV has been detected in 2 dead sage-grouse and was suspected in 2 others from the Wind River Reservation as of August 1, 2007.

Sage grouse chicks – Photo by Stan Harter

FACTORS INFLUENCING SAGE-GROUSE POPULATIONS AND HABITATS

Sage-grouse are influenced by many factors, both individually and cumulatively. Habitat loss and fragmentation, direct mortality, weather, range conditions, and disturbance are examples of various factors affecting sage-grouse populations. Factors presented in the Wyoming Greater Sage-grouse Conservation Plan (WGFD 2003) are presented below with the addition of some information specific to the WRSRCA. The factors are presented alphabetically, since the LWG lacked adequate information or data to fully support ranking them in any order of priority.

Within the WRSRCA, the WRSR LWG further divided the conservation area into eight unique geographic "focus" areas. Utilizing these separate "focus" areas, the group identified those factors believed to have the greatest influence on sage-grouse (positive or negative), as well as those factors that may be most effectively addressed to provide the greatest benefit for sage-grouse conservation. A description of these "focus" areas and the relative degree of influence the following factors are believed to have on sage-grouse is included in the section entitled Focus Areas for Planning Sage-grouse Conservation Efforts in WRSRCA, beginning on page 58.

In general, half of the influencing factors occur throughout the WRSRCA; conflicting wildlife management, hunting, mineral and energy development, vegetation management, predation, and weather. The remaining factors are either not present in all of the eight "focus" areas, or are very localized; wild horses are only present in 3 of the focus areas, recreation is deemed significant in 4 of the focus areas, residential development is significant in only 2 of the focus areas, and pesticides important in 6 focus areas. One factor, parasites and diseases, is not presently believed to be significant in any of the focus areas, but could become significant with the emergence of West Nile Virus in any of the areas.

Conflicting Wildlife and Wild Horse Management

Conflicting Wildlife Management

Management goals for other wildlife species utilizing sagebrush ecosystems can conflict with sage-grouse population and habitat management goals. Managing a single sagebrush site for all wildlife species that may inhabit sagebrush communities is impractical and often undesirable because practices benefiting some species can be detrimental to others.

Approximately 100 bird species, 70 mammalian species, and several reptiles are found in sagebrush habitats including many sagebrush obligates or near-obligates such as the sage-grouse, sage sparrow, Brewer's sparrow, sage thrasher, sagebrush vole, sagebrush lizard, and pronghorn. A number of other priority or sensitive wildlife species are dependent upon or inhabit the sagebrush ecosystem including the black-tailed prairie dog, white-tailed prairie dog, ferruginous hawk, mountain plover, and swift fox. Each has specific micro-site habitat requirements that often 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 inhabiting sagebrush ecosystems can be accommodated.

Mule deer, pronghorn, and elk are the primary wild ungulates occurring 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 and the sage-grouse habitat it supports. As with livestock, these grazing/browsing effects may be positive, negative, or neutral depending on site-specific conditions. Areas of concern may be where there is annual heavy sagebrush

browsing by large winter concentrations of mule deer and pronghorn. Heavy concentrations of wintering elk may damage sagebrush/grassland systems. Habitat management to improve winter ranges for big game may conflict with sage-grouse habitat needs, and may be the most probable management action of concern. Crucial big game winter ranges for elk, moose, mule deer and pronghorn are widespread throughout sage-grouse habitat in the WRSRCA (Figure 12).

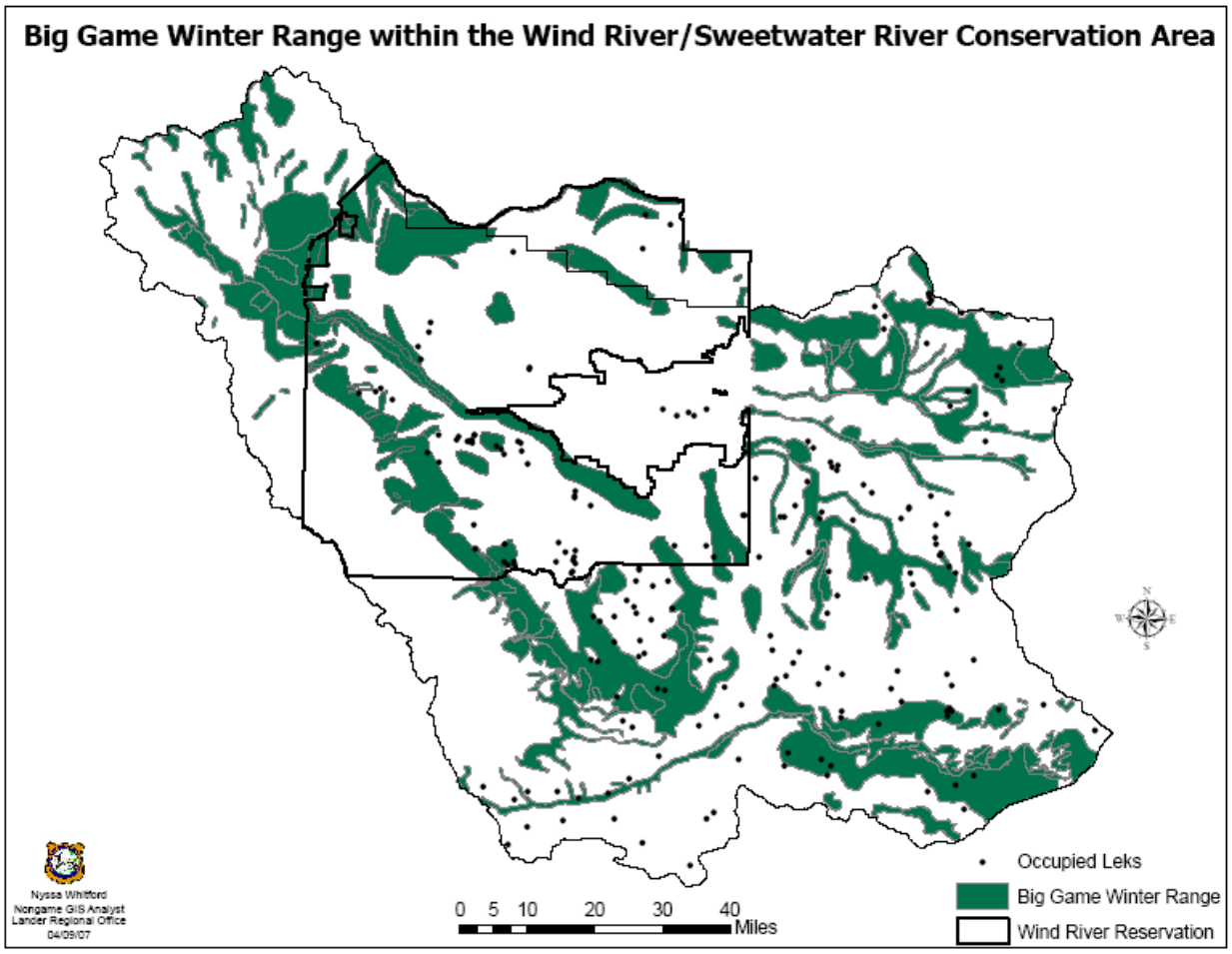


Figure 12. Crucial Big Game Winter Range within the WRSRCA (dots = sage-grouse leks). Source WGFD & WRR

Habitat improvement projects to benefit other wildlife need to consider the needs of sage-grouse and other sagebrush obligates, and improve habitat conditions for these species, if possible. To be certain, plans should avoid large-scale removal of sagebrush in occupied sage-grouse habitats. A long-term habitat improvement project is underway to rejuvenate winter range habitat for the South Wind River Mule Deer Herd Unit (Figure 13). Many of these projects will occur within occupied sage-grouse habitat and will be carefully scrutinized to include proper treatment design to benefit sage-grouse.

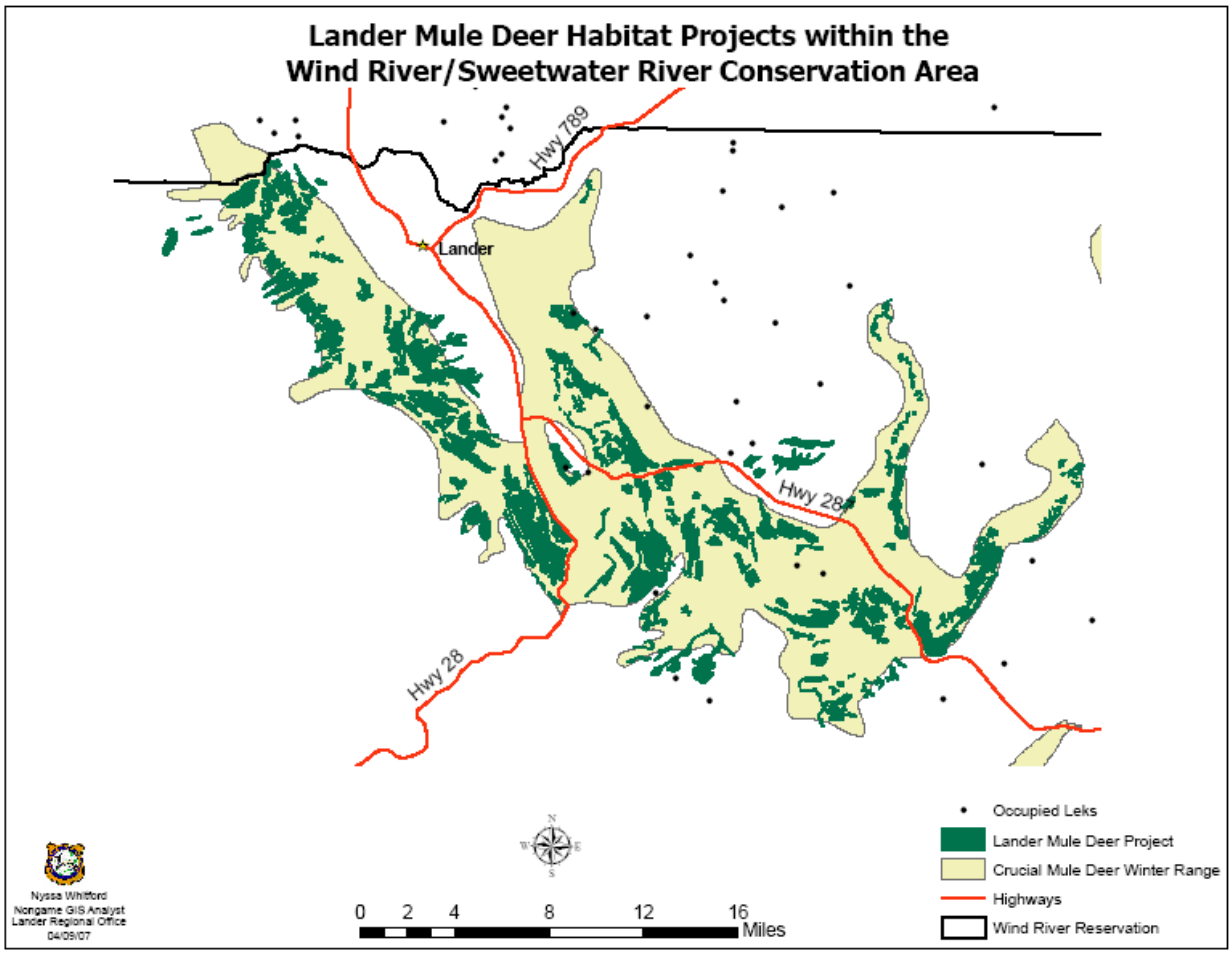


Figure 13. Map showing identified long-term mule deer winter range habitat improvement projects for the South Wind River Mule Deer herd. Source WGFD.

Federal and state laws, rules and regulations have been enacted that limit management options for various wildlife and plants, such as the prohibition to aerially spray Plateau® Herbicide on BLM lands to control cheatgrass infestations. Some regulations may conflict with sage-grouse management goals. Some threatened, endangered or candidate species have habitat requirements or other needs that directly conflict with sage-grouse habitat requirements or preferences.

Conflicting Wild Horse Management

Wild horses are present in portions of the WRSRCA (Figure 14). The Bureau of Land Management maintains and manages wild horses or burros in "herd management areas" (HMAs). The BLM establishes an "appropriate management level" (AML) for each HMA. The AML is the population objective for the HMA that will ensure a thriving ecological balance among all the users and resources of the HMA–for example, wildlife, livestock, wild horses, vegetation, water, and soil. Wyoming has no wild burros. Roundups to remove horses from HMAs that are above AMLs occur approximately every 3 years. As of January 2007, all HMAs are within their established AML. The Green Mountain and Antelope Hills/Cyclone Rim HMAs have undergone fertility control treatments to slow population growth. This treatment is estimated to last approximately 3 years.

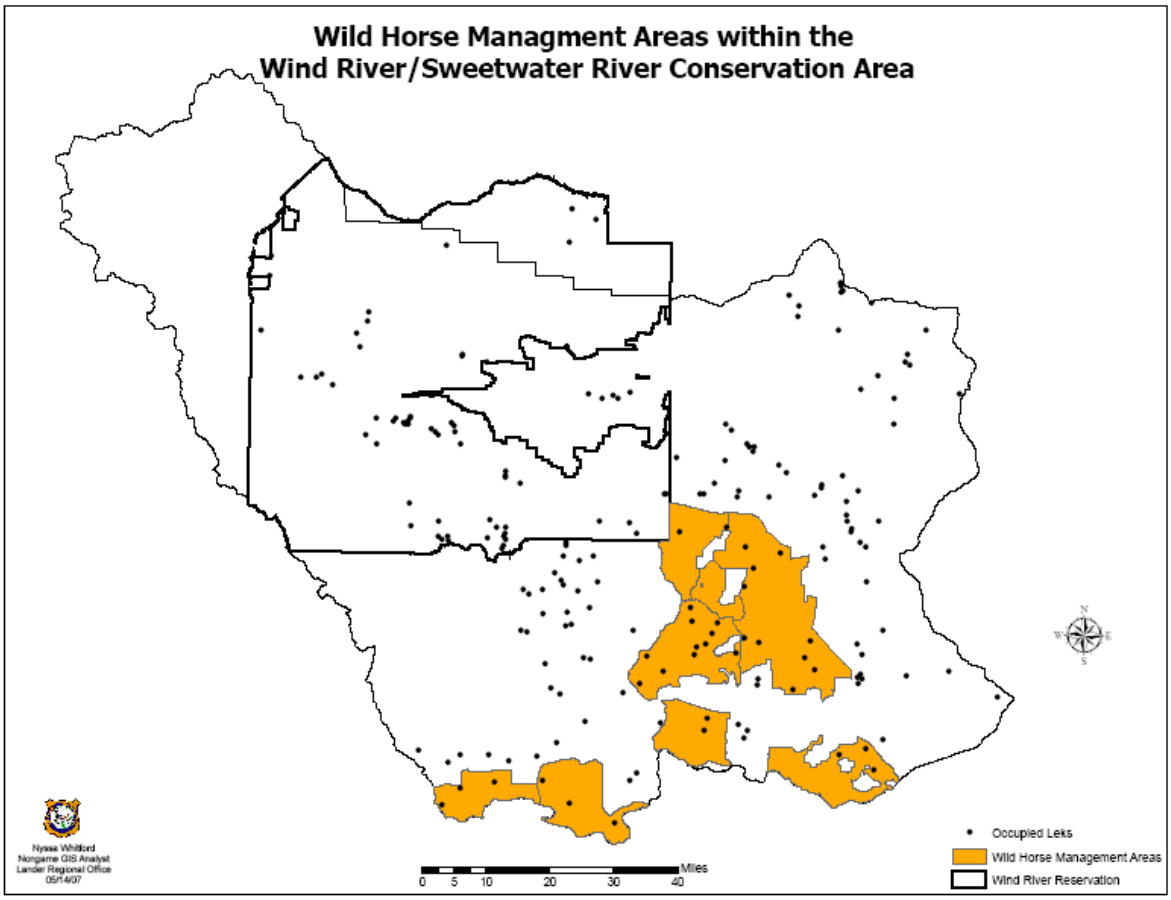


Figure 14. Wild horse management areas within the WRSRCA (dots = sage-grouse leks). Source BLM & WGFD

Antelope Hills/Cyclone Rim HMA

The Antelope Hills HMA encompasses 57,000 acres, of which 54,600 are BLM-administered public lands. The AML for this HMA is 60-82 adult horses. The area is located approximately 15 miles south/southeast of Atlantic, City, Wyoming. The HMA is bisected by the Continental Divide National Scenic Trail.

Crooks Mountain HMA

The Crooks Mountain HMA is located in generally rolling hills and slopes to the north and south of Crooks Mountain, directly southeast of Sweetwater Station, Wyoming, and encompasses about 51,000 acres. The AML for this HMA is 65-100 adult horses.

Muskrat Basin, Conant Creek, Rock Creek, and Dishpan Butte HMAs

These four HMAs are located in southeast Fremont County. They encompass about 375,000 acres of land, of which about 90% are BLM-administered public lands. While the four HMAs are managed with recognized individual populations, there is no geographic separation of the HMAs and the gates between them remain open a significant part of the year. As a result, the horses move regularly among the HMAs, helping to ensure the overall genetic health of the horses. The AML for these HMAs is 320 horses.

Green Mountain HMA

The Green Mountain HMA encompasses 88,000 acres, of which 74,000 acres are BLM-administered public lands. The AML for this HMA is 300 horses.

Hunting

Sage-grouse hunting in Wyoming is a traditional recreation activity of the modern era and was a prehistoric means of human subsistence. Sage-grouse have been hunted annually under regulation of the WGFD since 1948. From 1937 to 1947 the hunting season was closed because of concern regarding low sage-grouse populations. Sage-grouse hunting provides recreational, cultural, and economic values.

Sage-grouse hunting seasons within the WRSRCA are managed concurrently with other open areas in the state, except on WRR. The Shoshone and Arapaho Tribal Fish and Game Department (SATFG) sets unique seasons on WRR, with a limited spring "males only" hunt allowed there, principally for cultural reasons.

It appears heavy harvest of adult hens by hunters may be detrimental to sage-grouse populations. Hunting seasons in Wyoming were traditionally held in late August or early September for many years. However, data indicates hunting during this period makes adult hens more susceptible to harvest, since hens with chicks are still concentrated on late brood-rearing habitats. 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. As a result, maintaining a higher proportion of adult hens in the population allows the population to grow faster under favorable habitat conditions. Research into the potential impact of hunting on sage-grouse indicated a late September opener had less negative impact on hen survival and may increase recruitment compared to an early September season (Braun and Beck 1996; Heath et al. 1997; Connelly et al. 2000).

Concerns about decreasing sage-grouse populations and the negative impact of hunting adult hens in early September brought about changes to more conservative hunting seasons. In order to relieve harvest pressure on adult hens, hunting seasons were changed to late-September when typically cooler, wetter weather, along with the fact that chicks are more independent, results in dispersal of these family groups. This dispersal makes adult hens less vulnerable to harvest, since they are more scattered throughout their habitat and mixed with barren hens and males. Harvest rates of successfully nesting hens have declined since the hunting season dates were changed in 1995. Overall harvest declined as well due to a dramatic decrease in hunter participation since other hunting seasons, especially pronghorn, begin in mid-September within the WRSRCA.

Until 1995, the statewide hunting season opened September 1 and closed September 30. Beginning in 1995, the opening date was moved to the third Saturday in September, with a 14 – 17 day hunting season. Bag and possession limits were 3 birds per day and 6 birds in possession. More conservative hunting seasons were enacted in 2002, when opening day was moved to the fourth Saturday in September and the closing date to the first Sunday in October resulting in an approximate season length of 9 days. The bag and possession limits were reduced to 2 and 4 birds, respectively. From 2004 – 2006 hunting season opened on September 23 and closed on October 3. The latest available harvest survey report indicated 2,994 sage-grouse were harvested in 2005, the highest total for the WRSRCA since 1995, but well below harvests that reached more than 12,000 birds in 1983 and 1984. In 2005, 930 hunters spent 2,080 days hunting sage-grouse in the WRSRCA (not including the WRR).

Wyoming also offers a falconry season for hunting sage-grouse, which are a challenging quarry for falcons because of their size and speed. In 2005-06, the season was open September 1st through March 1st with a bag limit of 1 grouse per day and 2 grouse in possession. The Wyoming Game and Fish Department falconry harvest survey estimates falconers in Wyoming (both resident and nonresident) harvested 145 sage-grouse in the 2005-06 season. Falconers spent 859 days in the field, averaging 5.9 days/grouse harvested.

Closing hunting seasons has not resulted in subsequent increases in breeding populations (WGFD 2003). However, two areas in Wyoming have been closed to hunting, southeast Wyoming and northwest Wyoming in Jackson Hole. 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 increasing populations. A Wyoming Game and Fish Commission Emergency Order was approved in 2003 to close the hunting season in Sheridan, Johnson and Campbell Counties due to documented loss of sage-grouse to West Nile Virus. Such an emergency order may again be implemented should significant mortality result from West Nile Virus.

Recently, concerns have been raised regarding the potential additive impacts of recreational hunting to sage-grouse populations in Wyoming, prompting requests to close hunting seasons. Research to document the impact of closing hunting seasons on local bird populations was recently conducted in Idaho (Connelly 2003). The results of this research suggests 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. No studies have shown sage-grouse population declines are caused solely by hunting (Connelly et al. 2004). However, because sage-grouse have low productivity rates, high over-winter survival, and are long-lived, managers should strive for low harvest rates. Low harvest provides for population increases when weather is favorable and habitat quality is not a limiting factor.

Acceptable harvest rates can vary by geographical area and population depending on habitat quality and productivity of the population. Recommended harvest rates should be <10% of the fall population (Connelly et al. 2000). However, determining fall population size for a given area can be difficult considering the uncertainty of determining breeding population estimates as well as annual production. Biological data gathered from harvested birds via harvest surveys (harvest, hunter numbers, hunter success, and hunter effort) and wing collections serve as important indicators of population status.

Mineral and Energy Development

Energy development impacts on sage-grouse are being recognized and increasingly quantified. Some potential impacts of energy development to sage-grouse include: (1) direct loss and fragmentation of habitat from construction of mines, wells, roads (including from seismic exploration), pipelines, and transmission and power lines; (2) alteration of plant and animal communities; (3) increased human activity which could cause animals to avoid the area; (4) increased noise which could cause animals to avoid an area or reduce their breeding efficiency; (5) increased motorized access by the public leading to increased disturbance and legal/illegal harvest and incidental mortality from vehicle collisions; (6) direct mortality associated with water evaporation ponds and production pits; and (7) increased predation. Many of these impacts can be minimized by proper planning (i.e. centralization of development), mitigation, and reclamation for sage-grouse needs. Some of these impacts are short-term related to specific periods of activity while some impacts may be long-term (30 years or more), and rehabilitation of impacted habitats may take many years to complete.

Roads built to accommodate energy exploration and development activities often result in the establishment of permanent travel routes, improved public access, increased long-term traffic related disturbance, indirect noise impacts, and direct mortality to sage-grouse. Research suggests that road-related disturbances during the breeding season may cause sage-grouse leks to become inactive over time, reduce the number of nest-initiating hens which are bred on disturbed leks, and increases the distance from the lek hens will move to selected nesting habitat (WGFD 2003). Dust from roads and other surface disturbances can adversely affect plants and animals.

Transmission and power line construction does not cause extensive habitat loss, but sage-grouse tend to avoid areas associated with these lines (since they provide potential raptor perch sites), consequently resulting in an indirect loss of habitat in the vicinity of overhead lines. The potential effects of noise on sage-grouse include masking sounds that influence courtship, mate selection, grouping, escape, etc. A major research project is underway in the Government Draw area south of Hudson to study the effects of noise produced by energy development on sage-grouse, paralleled with similar research in the Jonah and Pinedale Anticline Gas Fields in Sublette County.

Coal and Other Mineral Development (Mining)

Mineral exploration, development, and production activities within the WRSRCA exist in limited locations, primarily for uranium, coal, bentonite, and sand and gravel. Mining activities vary for these products, but generally involve a process whereby mining and reclamation occur concurrently within the lease hold or mineral reserve area. The duration of the mining process varies from a few months to many years. Disturbance levels vary by the size and duration of the mining activity, dependant on the quantity and quality of the mineral resource reserve. The Wyoming Department of Environmental Quality's Land Quality Division (WDEQ/LQD) permits all mines, quarries, and gravel pits, with the exception of Wyoming Department of Transportation pits, which are regulated by BLM. BLM also administers federal mineral operations. Private minerals operations are subject to WDEQ/LQD regulations.

Bentonite

Bentonite is another mineable resource in central Wyoming, although the extent is limited and its effects on sage-grouse are similarly limited. However, bentonite mining has significantly increased since 2001 due to the substantial increase of oil and gas, CBNG, and uranium development that is occurring throughout Wyoming. These industries require bentonite for drilling mud. This increased demand will likely continue given the current expansion of natural resource extraction in Wyoming. Within the WRSRCA, significant deposits of bentonite resources are found along the foothills on the east slope of the Wind River Mountains and in the Owl Creek Mountains (Figure 15). Small bentonite mines occur in the Gas Hills and Wind River Front focus areas. Areas with bentonite generally feature sparse vegetation because of the physical characteristics of the mineral. These open areas may provide lek sites, if adequate nesting cover is nearby. BLM and WDEQ/LQD work together under a Memorandum of Understanding (MOU) to regulate extraction activities for quarrying activities on public lands, including bentonite.

Coal

As mentioned previously for CBNG, coal formations with high development potential are found in the Lander – South Hudson focus area and southern portions of the WRR, with low to moderate potential for coal resources throughout the remainder of the WRSRCA (Figure 16). Currently the majority of these resources have limited development potential, due to relatively poor coal seam quality, thickness, and depth considerations. As economic conditions change, the development potential for these lower priority resources may increase.

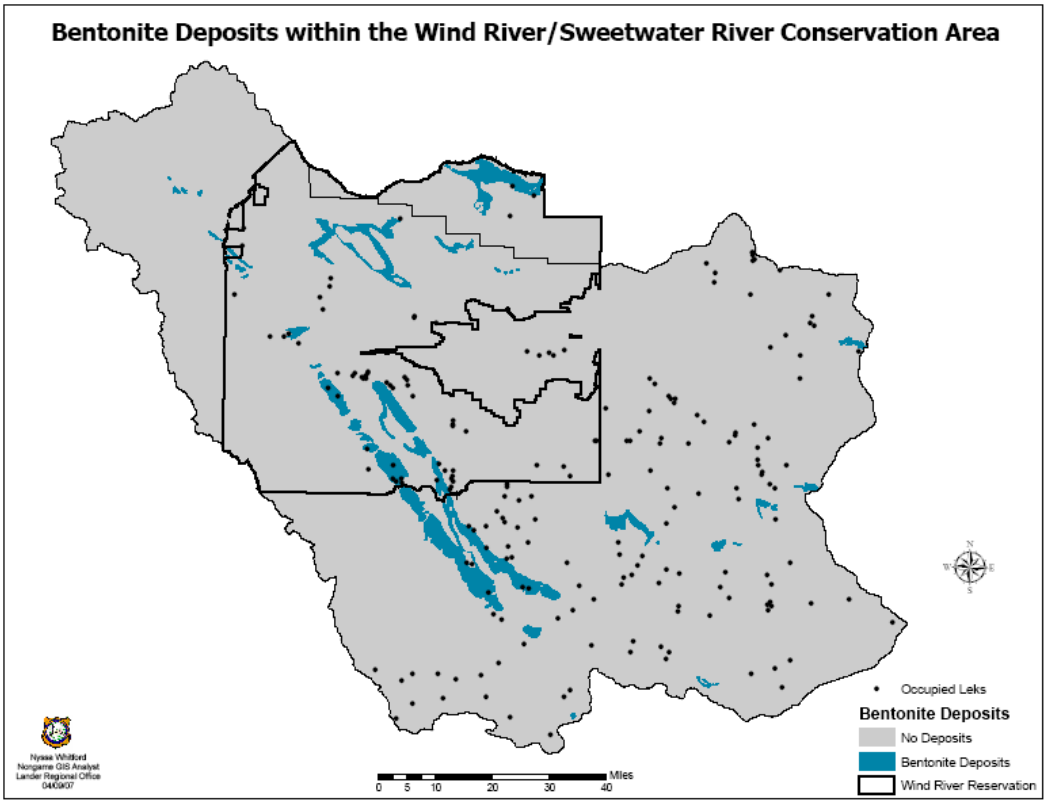


Figure 15. Bentonite deposits within the WRSRCA (dots = sage-grouse leks). Source WYGISC, WGFD.

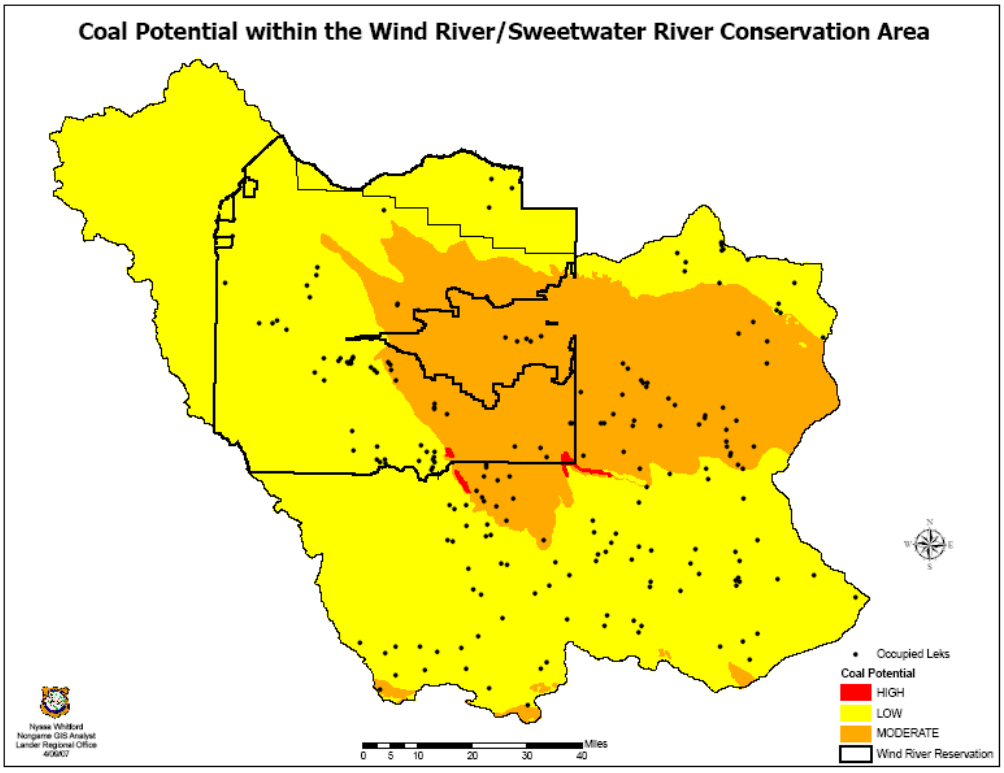


Figure 16. Potential coal resources within the WRSRCA (dots = sage-grouse leks). Source WYGISC, WGFD.

Limestone Quarries & Gravel Pits

Limestone deposits located within the WRSRCA (Figure 17) are typically not located in sage-grouse habitat. Mining operations for various construction and road surfacing materials within the WRSRCA include extraction pits for sand, gravel, and rock. Mining operations are normally small, with limited permitting requirements, but larger operations require more substantial permitting and compliance activities. Approximately 50 small gravel pits are scattered throughout the WRSRCA.

BLM and WDEQ/LQD work together under an MOU to regulate extraction activities for quarrying activities on public lands. The WDEQ/LQD regulates/registers all mining permits with the exception of Wyoming Department of Transportation (WYDOT) road surfacing quarries. When registered pits involve federal minerals, BLM administers stipulations to protect sage-grouse, where appropriate. Where mining operations do not fall under the 10-acre exemption, the WGFD provides information on whether sage-grouse will be affected by the operation.

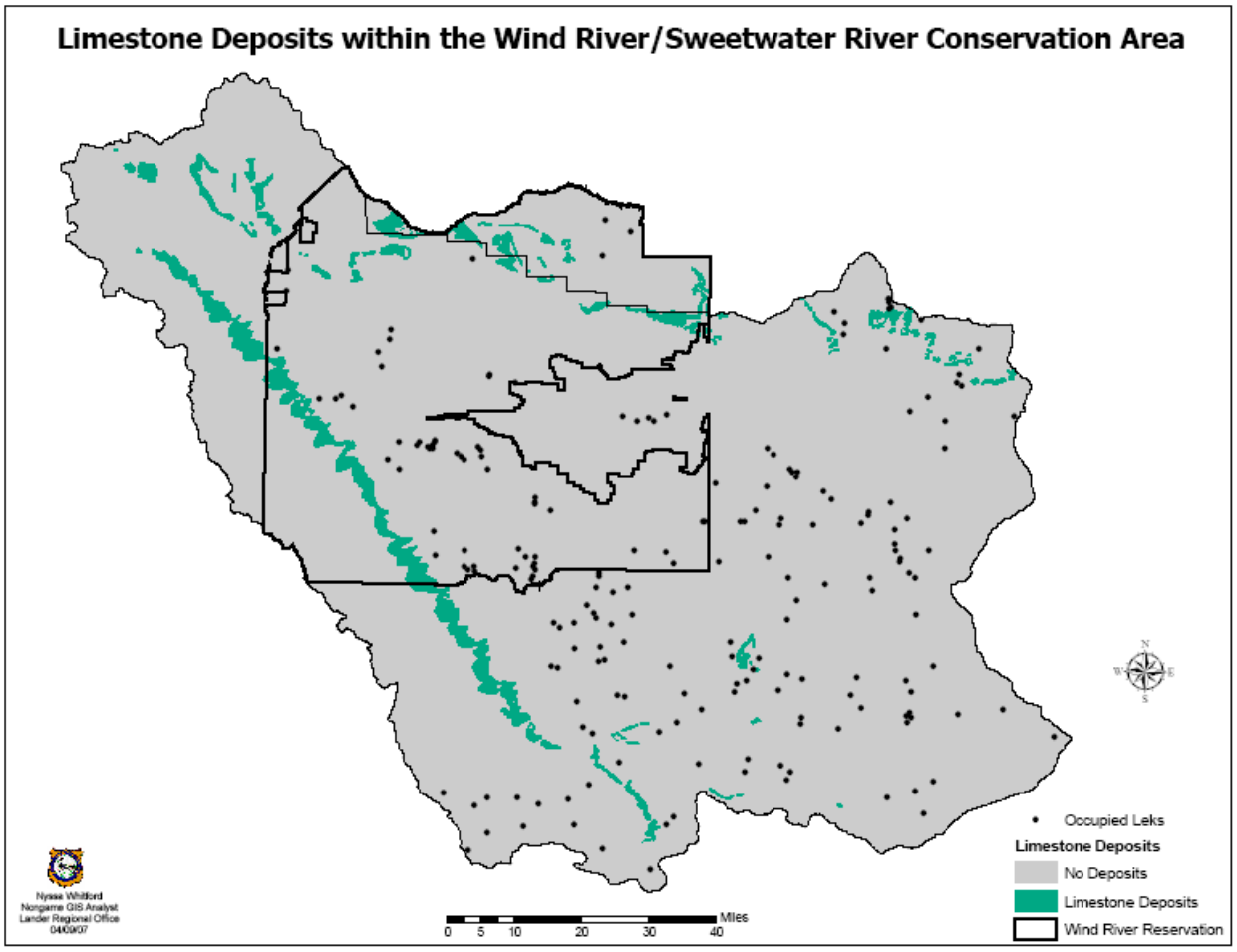


Figure 17. Limestone deposits within the WRSRCA (dots = sage-grouse leks). Source WYGISC, WGFD.

Uranium

Uranium has been mined from eastern portions of the WRSRCA (Figure 18), with most mines currently undergoing reclamation operations. However, currently elevated uranium prices have revived interest in mining in the WRSRCA. Uranium resources are rather limited within this portion of Wyoming but do occur in sagebrush habitats and could potentially impact some sage-grouse leks. Significant amounts of uranium have been mined from the Gas Hills and Green Mountain, and the potential exists for additional uranium resources to be developed there in the future. There are currently in-situ (solution) uranium mines being pursued in the Gas Hills area and near Green Mountain. New activity has been documented in the Long Creek and Sagehen Creek drainages north of Jeffrey City; with survey stakes indicating new or re-activated claims are being explored.

Demand for uranium production is market driven and has recently become a more profitable industry in Wyoming, which will likely result in increased development in the future. Impacts to sage-grouse associated with uranium development would be increased human presence, roads, vehicular traffic, and direct habitat loss. In-situ uranium mining may have less of an impact than open pit mining, since less surface area is disturbed. However, in-situ mining may occur over a larger area, thereby increasing cumulative impacts.

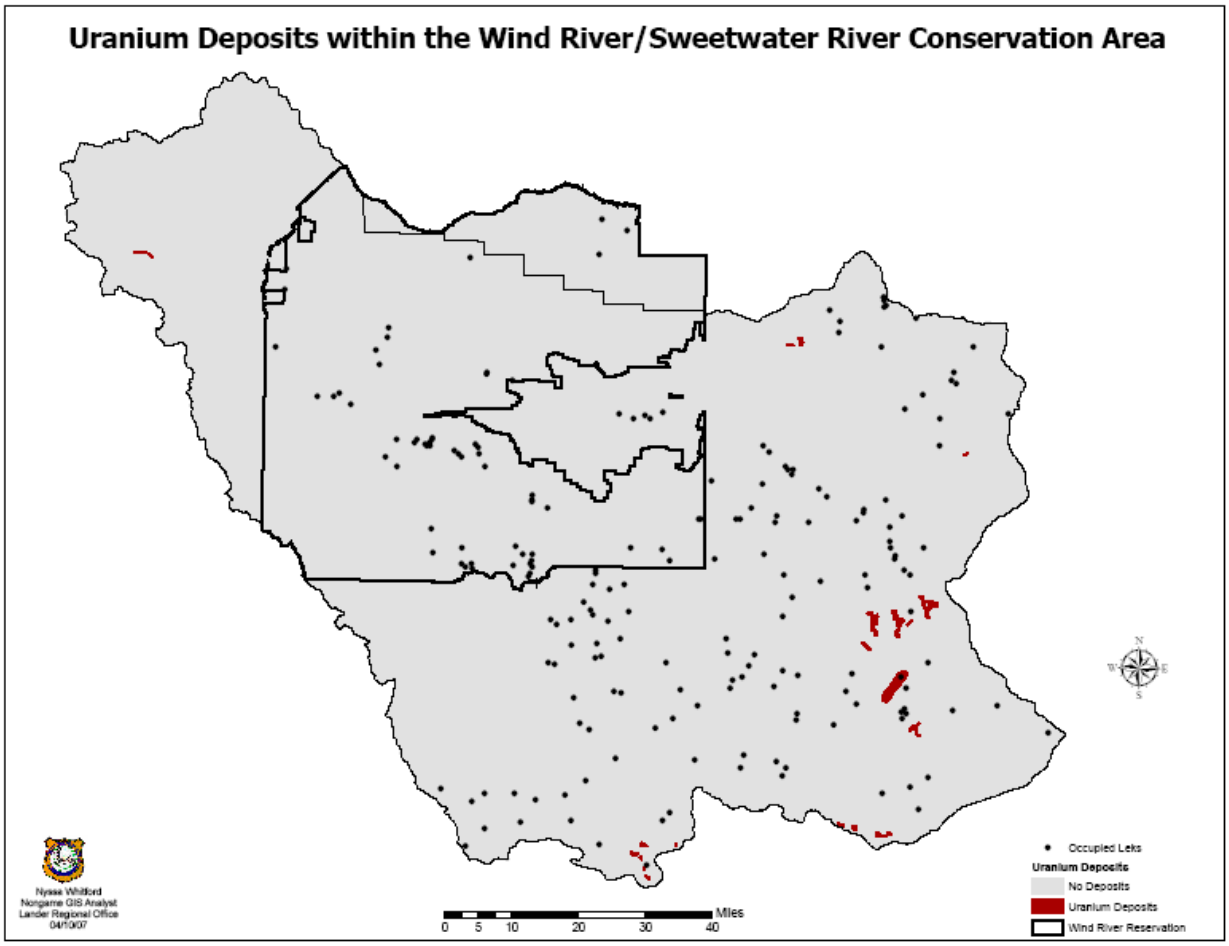


Figure 18. Uranium deposits within the WRSRCA (dots = sage-grouse leks). Source WYGISC, WGFD.

Oil, Natural Gas, and Coalbed Natural Gas Industry

The discovery and development of natural gas, oil, and coalbed methane throughout the western United States has impacted habitat and has been identified as a potential causative agent in declining sage-grouse populations (WGFD 2003). There is increasing demand for fuels and energy sources provided by the energy industry. For example, according to the American Gas Association (WGFD 2003), 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. The various types of energy operations are managed pursuant to a wide array of state and federal statutes and regulations, each with specific provisions that may or may not be flexible.

Significant portions of the WRSRCA contain vast energy resources, including oil, natural gas, and coalbed natural gas (CBNG) (Figure 19). As of Spring 2006, 2 occupied sage-grouse leks were located within the High potential zone illustrated, with 130 in the Moderate zone, and 73 in the Low zone. The majority of natural gas development within the WRSRCA consists of natural gas extraction in the Badwater, Gas Hills, Lander/South Hudson, and Riverton Reclamation Withdrawal areas, but is scattered throughout the remainder of the area. Oil fields are scattered throughout the WRSRCA, such as the Beaver Creek, Winkelman Dome, Circle Ridge, Maverick Springs, Dallas Dome, and Derby Dome fields. The primary potential for coalbed natural gas (CBNG) development within the WRSRCA occurs in the Beaver Creek area south of Riverton, where exploratory drilling has occurred on the WRR and a test project has been proposed within the Beaver Creek Oil/Gas Field. Coal formations are found in this area, with moderate potential for coal resources throughout the remainder of the Wind River Basin. Because these coal deposits exist, there is a possibility CBNG development may take place in the future, although the development potential is currently low.

As of December 2006, at least 4,660 oil and gas wells had been drilled within the WRSRCA, with approximately 1,450 actually producing (Figure 20). Oil and gas development is increasing in central Wyoming due to increased demand and is expected to continue to do so over the near term. The detection of new resources, superior extraction technology, or a long-term increase in energy prices typically results in increased development activity. Auxiliary facilities associated with oil and gas development also affecting sage-grouse habitat include, CO_2 pipelines to enhance oil recovery, gas pipelines to transport product to processing facilities and markets.

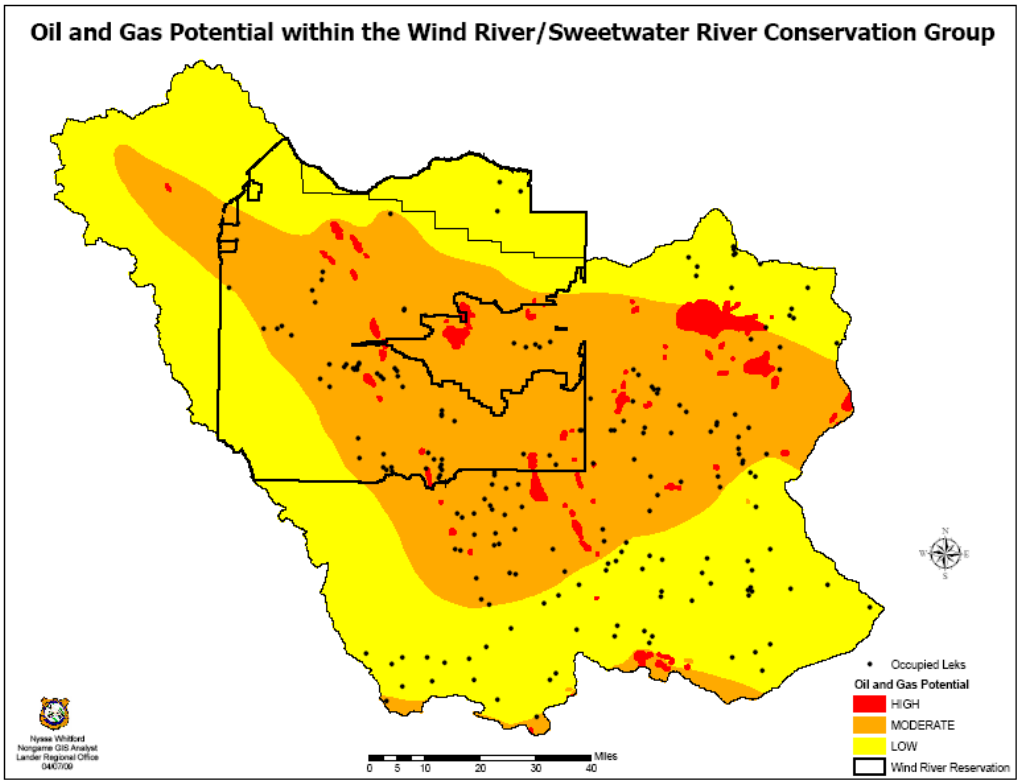


Figure 19. Potential oil and natural gas resources within the WRSRCA (dots = sage-grouse leks). Source WYGISC.

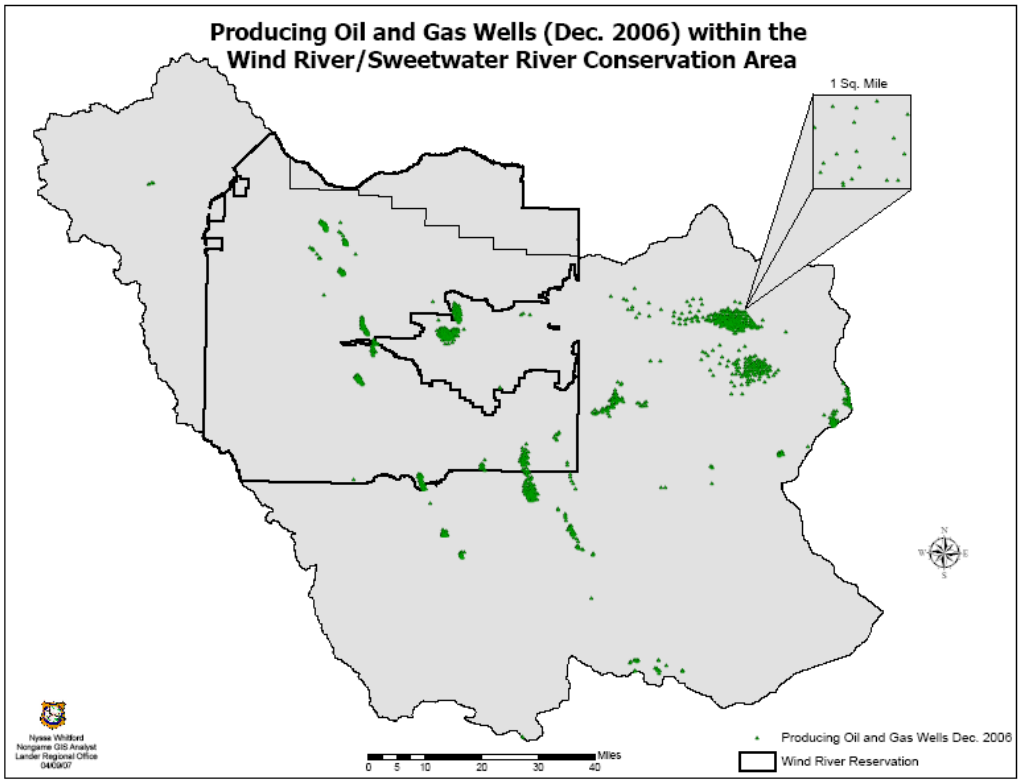


Figure 20. Producing oil and natural gas wells within the WRSRCA as of December 2006. Source Oil/Gas Comm.

Recently completed research (Holloran 2005) in and adjacent to the Pinedale Anticline and Jonah gas fields in western Wyoming documented negative impacts to sage-grouse populations from conventional natural gas development. Holloran found minimal levels of development within 1.9 miles of leks influenced breeding behavior. Lek attendance was directly influenced by distance to wells, densities of wells, associated traffic volume, and distance to roads. Gas field-related noise sources at distances of three miles from leks had negative effects on breeding birds. Young nesting females avoided gas fields with high well densities, as did females with broods. Data suggested long-term response of nesting sage-grouse is avoidance of areas of natural gas development and increased mortality to those sage-grouse remaining within the development. An increase in avian nest predation was also documented in association with natural gas development, suggesting gas development attracts corvids (i.e. ravens, crows, magpies, jays, etc.) due to increased food or perch availability. Holloran concluded current development stipulations are inadequate to maintain sage-grouse breeding populations affected by high levels of gas development. He suggested management of adjacent habitats to increase sage-grouse carrying capacity could benefit population segments supplemented by grouse dispersing from nearby gas fields.

Naugle et al. (2006) also reported preliminary analysis results suggesting sage-grouse in the Powder River Basin are impacted by intensive CBNG development based on lek monitoring data from 2000 to 2005. Leks within CBNG development had lower population indices than leks outside CBNG development. Furthermore, leks along the edge of CBNG development had higher population indices than those further away; suggesting sage-grouse avoid intensive CBNG development and disperse to adjacent unaffected habitats. This finding is supported by the fact that active leks and leks with moderate to large numbers of males were often found adjacent to CBNG fields. Inactive leks and leks with lower male counts were usually found within CBNG development. Leks within CBNG fields surveyed during the 2004 and 2005 breeding seasons had 20 males or less while leks adjacent to CBNG tended to have >20 males. Additional analysis of wells, powerlines and leks showed that active leks were twice as far from wells and were 1.5 times as far from power lines when compared to inactive leks. Areas with active leks had one-third the density of wells, one-half the density of power lines, and generally have fewer wells and power lines within 2.0 miles of the lek complex than inactive leks.

CBNG-produced water can provide benefits to sage-grouse, but also creates habitat for mosquito species that carry West Nile Virus. Sage-grouse are extremely susceptible to West Nile Virus. Montana State University research (Doherty and Johnson 2005) found that “mature” ponds holding discharged water provide excellent habitat for the mosquitoes that carry West Nile Virus. Mature ponds are defined as ponds at least four years old with more than 50% of the shoreline vegetated. Mosquito larvae are produced at both the pond shoreline and the pond outlet, with pond outlets or seeps below earthen dams producing greater numbers of larva per sample. Ponds with flooded shoreline vegetation provide excellent breeding habitat. Properly constructed CBNG ponds and an effective mosquito larva control program could play a role in reducing the prevalence of mosquitoes and resulting West Nile Virus.

Wind Power

Substantial potential for wind power development exists in several locations within the WRSRCA, mostly at higher elevations (Figure 21). Future wind power development is most likely to be proposed for areas on South Pass, Beaver Rim, Green Mountain, western portions of WRR near Dubois, and along the northern end of the conservation area near the Wind River Canyon and Copper Mountain. Potential impacts to sage-grouse include direct loss of habitat, noise associated with turbine power generation, death or injury from flying into turbine blades, and associated power poles that may provide perches for avian predators.

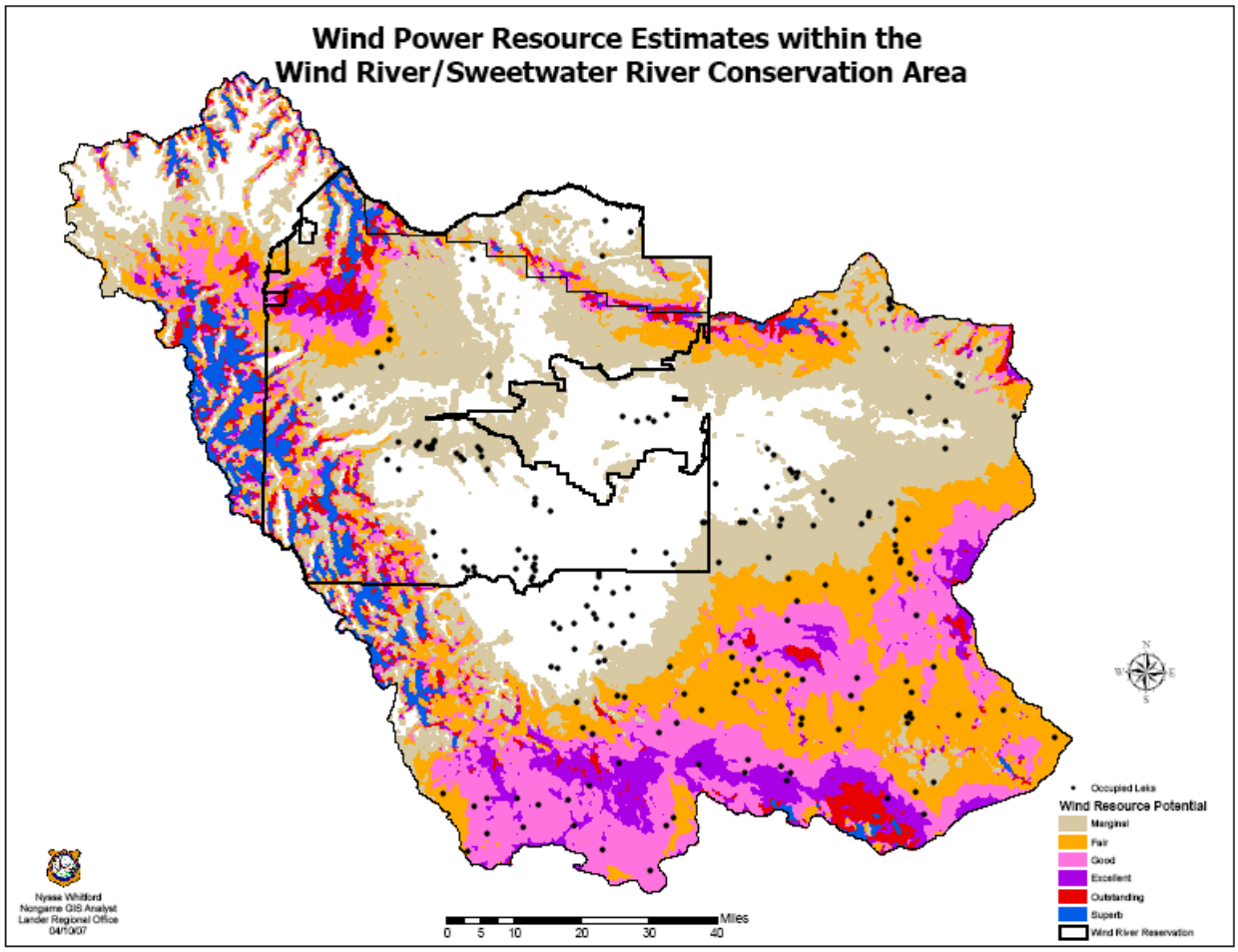


Figure 21. Potential for wind power development within the WRSRCA (dots = sage-grouse leks). Source US DOE.

Parasites and Diseases

Sage-grouse are vulnerable to a number of different parasites and diseases. Most diseases and parasites have evolved with sage-grouse over time and normally are not a serious concern. 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 which are stressed or concentrated. The implications of diseases and parasites with respect to sage-grouse populations at a range-wide level are unknown (Connelly et al. 2004). There is also potential for diseases and parasites to become an issue if sage-grouse come into contact with captive-raised birds released into the wild.

Coccidiosis is an infectious protozoal disease that has been identified as a cause of sage-grouse mortality. Coccidiosis is also important to cattle producers in the conservation plan area as it can increase calf mortality.

The potential effects of the newly emergent West Nile Virus on sage-grouse are not fully understood. West Nile Virus has been identified as a cause of significant mortality at a local scale (Naugle 2005). In 2003, the disease was shown to have a serious impact on a local sage-grouse sub-population near Recluse in northeastern Wyoming (Walker et. al. 2004). Fourteen sage-grouse were confirmed positive for disease

that year. One of the birds had died in 2002 and had been collected and frozen for later analysis. In 2004 and 2005, four and two additional mortalities were confirmed positive for West Nile Virus, respectively. In 2006, five sage-grouse mortalities in the Powder River Basin were attributed to West Nile Virus, with test results from six additional dead sage-grouse still pending. The summer of 2003 was one of the hottest on record, which likely contributed to higher mosquito populations and increased West Nile Virus activity. Naugle et. al. (2004) found that West Nile Virus contributed to a 25% decline in the survival of four populations of marked sage-grouse in 2003. In the Recluse Wyoming sub-population, Walker et. al. (2004) determined survival of marked sage-grouse was only 25%. In 2004, late summer female survival was found to be 10% lower in four populations with confirmed West Nile Virus than in eight populations without confirmed West Nile Virus (Naugle 2005).

The mosquito *Culex tarsalus* is believed to be the primary vector for West Nile Virus transmission. Such transmission may be exacerbated by further proliferation of reservoirs and water impoundments associated with both traditional and coalbed natural gas development, which may serve as breeding grounds for *Culex tarsalus* and other mosquito species known to harbor West Nile Virus.

No evidence of survival by sage-grouse exposed to the West Nile Virus was found until 2005. Six female sage-grouse captured in the Powder River Basin in fall 2004 and spring 2005 had antibodies indicating they survived exposure (Walker 2005). However, the full impact of this disease has yet to be understood and more research is needed to monitor sage-grouse exposure and survival, identify species that serve as reservoir hosts, and identify options to mitigate the effects of the disease. The lone case of West Nile Virus in sage-grouse from the WRSRCA was detected in one juvenile male just south of Lander in August 2003. In 2006, Fremont County experienced dozens of cases of West Nile Virus in humans and horses, and 3 radio collared sage-grouse possibly died from WNV on the Wind River Reservation, but confirmation was not possible. WNV has been detected in 2 dead sage-grouse and was suspected in 2 others from the Wind River Reservation as of August 1, 2007.

Pesticides

Pesticides (mostly herbicides and insecticides) are used in Wyoming for a variety of purposes and have been identified as a possible influence on sage-grouse (WGFD 2003). However, pesticides are not considered to be a major issue for sage-grouse under existing application practices. No direct research on the effects of current pesticide applications on sage-grouse has been conducted in Wyoming. Toxicity under laboratory conditions does not equate well to wildlife hazards under field conditions. Sage-grouse exposure and potential risk are dependent on numerous factors, such as application rate, pesticide formulation, and timing of treatment. Pesticide impacts on sage-grouse in the field are difficult to quantify. The difficulty in quantifying such impacts is further exacerbated by the notion that these effects are believed to be sub-lethal, such as predisposing animals to predation or reducing reproductive success.

Herbicides have generally been tested to ensure their direct impacts to animals are insignificant. Other herbicide treatments can result in a reduction of forbs and may be locally significant, but not widespread. Sagebrush treatments to promote forage for livestock are less common today than in the past when large acreages were treated, although remain a concern for sage-grouse management.

Insecticides have been utilized for grasshopper and cricket control on agricultural and rangelands. Most Wyoming communities have implemented the use of insecticides for mosquito control (using aerial spraying targeting adult mosquitoes and larvaecide applications in water sources targeting larval mosquitoes). The results of these applications may be beneficial in reducing the threat of West Nile Virus, or potentially detrimental by removing food sources for young sage-grouse.

Predation

Predation is the major cause of direct sage-grouse mortality (WGFD 2003). Predation during nesting and early brood-rearing has long been thought to have the greatest direct influence on sage-grouse populations. However, recent research has suggested adult female survival may have a significant influence on sage-grouse populations (Johnson and Braun 1999). Nest predators identified in Wyoming studies include badgers (*Taxidea taxus*), red foxes (*Vulpes vulpes*), ravens (*Corvus corax*) and ground squirrels (*Spermophilus spp.*). In addition, golden eagles (*Aquila chrysaetos*), red foxes, ravens, coyotes (*Canis latrans*), various hawks (*Buteo spp.*), bobcats (*Felis rufus*), striped skunk (*Mephitis mephitis*), and weasels (*Mustela spp.*) all prey on sage-grouse throughout the year. Humans have altered the landscape and influenced predator-prey relationships that evolved between sage-grouse and native predators. These activities have led to a change in the number, distribution, and type of predators that prey on sage-grouse.

Sage-grouse face predation pressures from many sources. Each winter, thousands of crows migrate into the WRSRCA, with major concentrations in and near Riverton. Large numbers of ravens, hawks and eagles also migrate to the area during winter. Ravens, whose populations are increasing throughout much of Wyoming, are known sage-grouse nest predators. "Newcomer" predators such as red fox and raccoons are well established. Landfills, litter, and roadkills along roadways provide supplemental forage to support these species. Some expanding rural subdivisions bring domestic pets such as cats to areas in or adjacent to sage-grouse habitat. Likewise, expanding energy development brings powerlines and other infrastructure that may serve as raptor perches. The abundance of other prey species, such as jackrabbits and cottontails may relieve predation pressures on sage-grouse, and may have contributed to recent increases in sage-grouse that appeared to be simultaneous with a rabbit population boom. Predator control efforts could be helpful in reducing the impact of non-native predators by eliminating feral animals, illegal dumping, and roadside litter.

As habitats are altered, and/or where predators dramatically increase in number or in type, impacts of predation may be magnified. "Newcomer" predators such as red fox and raccoons have expanded their range into sage-grouse habitats and may represent an additive source of predation where they were not previously a factor. In some areas, these newcomer and traditional sage-grouse predators have increased in numbers due to human activities such as newly available food sources or travel corridors. Migratory bird protection has also allowed avian predator populations to expand. Lethal predator control to increase production and recruitment in bird populations has only been shown to be effective on small, intensively managed areas where efforts are continual (WGFD 2003). Management of predators may be necessary in localized situations to maintain and/or improve a sage-grouse population. Predator management may mean lethal control, but may also include removing key elements that attract predators (e.g. perches, food sources) and/or increasing the quality of habitat for sage-grouse. As with many issues surrounding sage-grouse management, predator-prey relationships are complex and difficult to quantify. It is important to identify potential unintended consequences of predator control as it relates to sage-grouse, such as the potential for cascade effect (i.e. coyote control resulting in increased red fox populations). Large-scale predator removal is not indicated as a statewide objective. Where predation is proven to be of significant concern in select areas, planning groups should consider site-specific localized predator management.

Recreation

Recreational impacts to sage-grouse populations include potential disturbance of breeding and nesting activities, and habitat fragmentation due to road usage. Research suggests road-related disturbances during the breeding season may cause sage-grouse leks to become inactive over time, cause fewer hens which do breed on disturbed leks to initiate nests, and increase the distance from the lek hens will move to selected nesting habitat (WGFD 2003). Dust from roads and other surface disturbances can adversely affect plants and animals.

Recreational viewing of leks can disrupt breeding activities, especially when conducted from close proximity, outside of a vehicle, and/or on a long-term basis. The Twin Creek lek southeast of Lander has been designated as a public viewing for the WRSRCA. This lek has a long history of public viewing and the birds seem to be tolerant of this disturbance, as well as the proximity of this lek to U.S. Highway 287.

The increased use of off-road vehicles and other outdoor recreational activities may result in greater disturbance of sage-grouse and degradation of habitats. These impacts are more likely to occur on public lands, or on leks adjacent to public roads. Recreation is most likely to influence sage-grouse in the Lander-South Hudson focus area, along with Historical Trail visitors and Handcart Re-enactments in the Upper Sweetwater focus area, with localized influences elsewhere in the WRSRCA.

Residential Development

Little or no research is available directly addressing the effects of residential development on sage-grouse, although some effects are obvious. Residential development can cause direct loss of lek sites and seasonal habitats or fragment those habitats. Increased roads, fencing, power lines, human activity, landfills and garbage facilities (which may increase predator populations), and density of cats and dogs are additional factors which may impact sage-grouse populations. Unlike impacts associated with many forms of energy/natural resource development, most impacts from residential development are permanent and cannot be reclaimed.

Research suggests road-related disturbances during the breeding season may cause sage-grouse leks to become inactive over time, cause fewer hens bred on disturbed leks to initiate nests, and increases the distance from the lek hens will move to selected nesting habitat (WGFD 2003). Dust from roads and other surface disturbances can adversely affect plants and animals. Transmission and power line construction often results in indirect habitat loss because sage-grouse tend to avoid areas associated with these lines due to potential perching by avian predators. The potential effects of human-generated noise on sage-grouse include masking sounds that influence courtship/lek attendance, mate selection, grouping, and escape from predators.

Lander, Riverton and Dubois are the primary population centers within the WRSRCA. These towns are experiencing relatively significant residential development beyond city limits, resulting from an influx of people in recent years, due in part to work force demands of the energy industry, as well as people generally moving to the western United States. Much of this urban sprawl occurs because of people's desire to live outside of town to distance themselves from neighbors and/or have enough property for domestic animals. Intense herbivory from domestic livestock associated with ranchette developments/rural subdivisions is a growing concern within the WRSRCA, due to the scale at which they occur across the landscape and the potential for invasive species establishment as native vegetation is often completely denuded, especially with horse properties. Because Wyoming's subdivision law does not regulate subdivisions greater than 35 acres, county governments vary in their regulation of subdivisions depending on local zoning laws or lack thereof. The combined effects of energy development, recreation,

and local residential land use are similar and synergistic. Careful consideration should be given to ways in which the effects of these activities can be managed and mitigated.

Residential and commercial development is rapidly expanding into rural portions of Fremont County. Of particular concern to sage-grouse is the ongoing and probable residential expansion into the Lander Foothills between the WRR and Red Canyon. Sage-grouse are known to utilize much of this area for nesting and brood-rearing habitat. It is the intention of the working group to provide recommendations to encourage developers and city/county planning authorities to consider the needs of these sage-grouse when planning or permitting development and to mitigate development-related impacts to sage-grouse.

Vegetation Management

Sage-grouse are dependent on sagebrush habitat. Sagebrush communities are found throughout the WRSRCA with the exception of higher elevation mountain ranges, croplands, and salt-shrub deserts. Figure 21 depicts BLM data based on a refined Wyoming GAP Analysis Land Cover Map showing sagebrush occurring at 5% or greater canopy cover in sagebrush/grassland habitat. Sagebrush habitats are estimated to occur on 50 – 60 % of the WRSRCA. The close relationship between sage-grouse and sagebrush is demonstrated by the lek locations associated with the sagebrush in Figure 22. The exact amount of sagebrush habitat lost or altered due to environmental variables or human-caused disturbance is undetermined for the WRSRCA, but may be significant in localized areas.

The primary sagebrush subspecies of significant importance to sage-grouse found in the majority of the WRSRCA are Wyoming big sagebrush (*Artemisia tridentata wyomingensis*), mountain big sagebrush (*Artemisia tridentata vaseyana*), and low sagebrush (*Artemisia arbuscula).* Wyoming big sagebrush is found throughout the WRSRCA, providing the majority of sage-grouse habitat. Mountain big sagebrush is typically found along the foothills of each mountain range, as well as in draws throughout much of the Sweetwater River drainage, and is utilized during summer when sage-grouse often move to higher elevations. Silver sagebrush (*Artemisia cana cana*) is scattered in mixed densities throughout the WRSRCA and is of particular importance to sage-grouse where it is the principal sagebrush type. Appendix E provides a more thorough review of the identification features and brief management considerations for the most common sagebrush species/subspecies found in Wyoming sage-grouse habitats.

Sagebrush-grassland communities evolved as diverse landscapes with variation due to climate, elevation, and soil-types. Such variation drives changes in fire frequencies and adaptive development of different sagebrush species. These sagebrush communities commonly occur in tracts occupying hundreds or thousands of acres. Historic Wyoming big sagebrush communities were a mosaic of seral shrub age classes created and maintained by fire cycles ranging in frequency from 100 to 240 years, depending on the ecological site (Baker 2006). Patchy fires appear to have been the norm in most sagebrush communities, while larger fires at lower frequencies occurred in other areas depending on climate, topography, plant composition and aridity of the site. The combination of active fire suppression and season-long livestock grazing management practices are believed to have contributed to dense, old, monotypic stands of sagebrush, reduction of herbaceous understory, and simplification of community diversity. Habitat conversion, sagebrush habitat treatments, and the introduction of invasive species have also affected these sagebrush communities. Drought and grasshopper infestations have also been reported to change the dynamics of sagebrush communities in Wyoming (Allred 1924). Management strategies that protect dense sagebrush stands and enhance residual grass cover and height within those stands should be used to maintain nesting habitat and increase nesting success of greater sage-grouse (Holloran, et al 2005).

Managing these important sagebrush communities to enhance sage-grouse populations can be a challenging venture, especially with fragmented habitats becoming more common. Typically, management of sagebrush and associated sage-grouse habitats involves livestock grazing and vegetation treatments. Well managed sagebrush communities should provide the essential habitat requirements for sage-grouse and other sagebrush obligate wildlife, along with providing a healthy ecosystem capable of supporting livestock and wild horses. The condition of some habitat may require the use of vegetation treatments to rejuvenate shrubs, grasses and forbs, but caution must be used to prevent negative impacts to sage-grouse by removing too much sagebrush. The presence of invasive plants creates additional challenges to land managers by limiting the types of management tools that may be utilized. In some areas, farming practices, such as haying, may provide benefits to sage-grouse. However, other farm operations may fragment sagebrush habitats, thus making some areas unsuitable for sage-grouse. The following sections will attempt to provide some guidance to how each management tool or issue can be utilized to benefit sage-grouse.

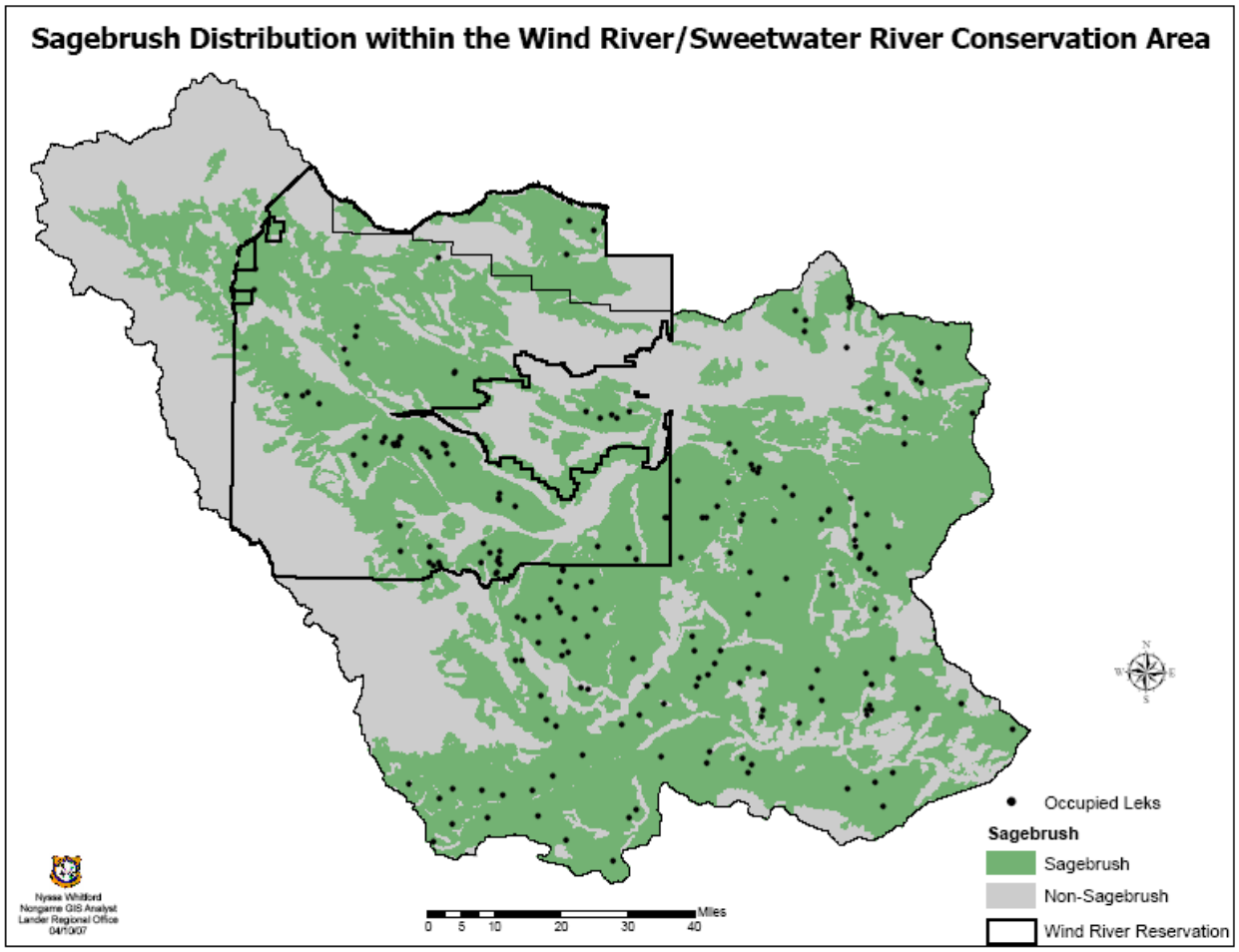


Figure 22. Distribution of sagebrush within the WRSRCA (dots = sage-grouse leks). Source BLM & WGFD

Farming

Various forms of crop production exist throughout the WRSRCA, but farming is most concentrated in the Riverton Reclamation Withdrawal Area, and near Lander, Hudson, Dubois, Crowheart and Fort Washakie (Figure 23). Farming includes production of perennial grasses and/or alfalfa hay, as well as production of annually planted crops for grain, silage, sugar beets, or hay. Irrigated hay production occurs throughout the WRSRCA along perennial rivers and streams. Production of alfalfa and grass hay may be beneficial to sage-grouse by providing a source of green forage (with flowering to attract insects) to sage-grouse in the summer and fall. Sage-grouse have been observed moving considerable distances to utilize these habitats. Contrary to other gallinaceous bird species, sage-grouse are not found nesting in hayfields, due to the absence of sagebrush and other shrubs. Destruction of nests by haying equipment has not been documented. However, conversion of sagebrush to irrigated crop/hay production can be locally significant. In the Riverton Reclamation Withdrawal Area, sagebrush communities were extensively converted to irrigated cropland and likely removed large tracts of traditional sage-grouse habitat. Such conversions also reduce landscape habitat quality by fragmentation and increased human related traffic and disturbance.

Ecological and economic constraints limit the amount of land in Wyoming that can be converted to farmland. While federal farm programs historically provided economic incentives for such conversion, the USDA has generally discouraged conversion of native grasslands and shrub lands to farmland beginning with the 1985 Farm Bill. Several popular programs have since been successful at protecting and restoring native plant communities that had previously been tilled or hayed.

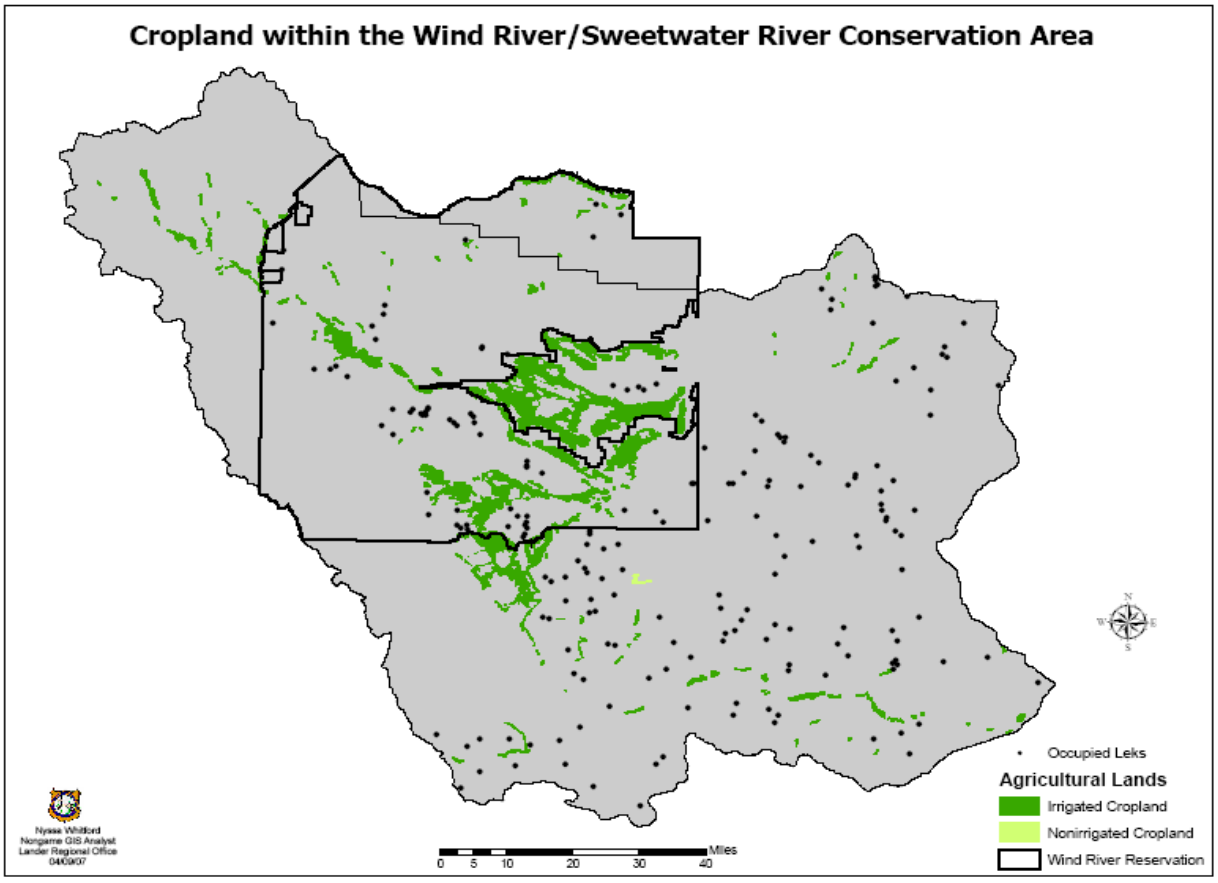


Figure 23. Cropland distribution within the WRSRCA (dots = sage-grouse leks). Source USGS GAP Analysis.

Invasive Plants

The extent to which invasive plants, primarily non-natives, have historically affected sage-grouse in central Wyoming is unknown. However, as more terrain in the WRSRCA is disturbed by activities such as pipeline and powerline installation, seismic activities, natural mineral resources exploration and development, and subdivision development, the potential for significant negative impact from invasive plants increases. Invasive plants along roadways and right-of-ways can spread to surrounding rangelands and riparian areas and replace native vegetation critical in sagebrush communities.

Little information exists on the effects invasive plants have on sage-grouse populations. County weed and pest districts have determined which species are most pervasive and which are most difficult to control, and often have some information on area extent. At least three Weed Management Areas (WMAs) have been formed within the WRSRCA to identify and target treatment areas to control noxious weeds. Unfortunately, there is no region-wide comprehensive mapping effort to track rates of infestations or spread, which somewhat limits a range-wide strategic approach to control invasive plants.

Mechanical, chemical, and biological/grazing treatments may be applied to control the spread of invasive plants. Prevention though proper grazing management, treatment of pioneering plants, and reclamation practices favoring native plants are necessary to control the proliferation of undesirable invasive plants. Mechanical treatments, such as repeated mowing or pulling, can remove invasive plants from native rangelands. Insect release is a form of biological control that can target specific invasive species. Chemical spot treatments can also effectively control and prevent the spread of invasive plants in targeted areas. However, chemical treatments should be conducted with caution to ensure the appropriate invasive plants are targeted while mortality of desired forbs and shrubs associated with sagebrush communities is minimized. 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. Simple steps such as washing of equipment before transportation or using certified weed-free hay can help minimize the spread of undesirable invasive plants.

Primary species of concern in sage-grouse habitats appear to be cheatgrass (*Bromus tectorum*), halogeton (*Halogeton glomeratus*), leafy spurge (*Euphorbia escula*), spotted knapweed (*Centaurea maculosa*), Russian olive (*Elaeagnus angustifolia* L.), Russian knapweed (*Acroptilon repens*) and Japanese brome (*Bromus japonicus)*. In riparian areas, Canada thistle (*Cirsium arvense*), burdock (*Arctium minus*), and tamarisk or salt cedar (*Tamarix pentandra)* compete with native plant communities that provide brood rearing habitat. The general distribution of invasive plants has been mapped by the Fremont County Weed and Pest District as shown in Figure 24. Invasive plants are not indicated for other counties.

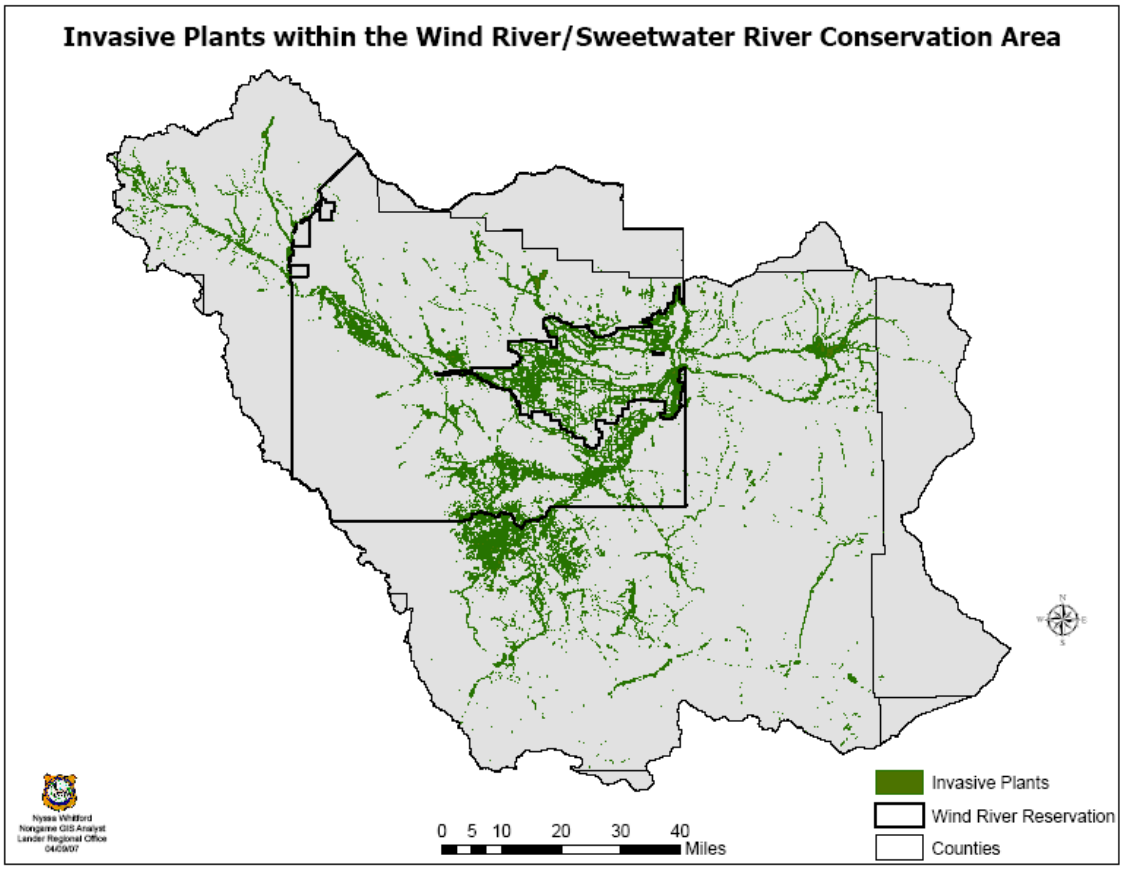


Figure 24. Distribution of invasive plants within Fremont County in the WRSRCA. Fremont Co. Weed & Pest Dept.

Livestock Grazing

Domestic livestock grazing has been identified as a major factor influencing 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. The majority of the livestock industry within the WRSRCA consists of cattle and sheep production, with lower levels of horse grazing. Livestock producers generally sell the current year's production (calves, lambs, etc.) while maintaining the producing herd or flock. Most ranching operations within the WRSRCA include Federal or State grazing lands.

Precipitation and livestock forage utilization levels during the growing season determine the amount of forage remaining after the grazing season. Agricultural economics, including commitments to lending institutions, are a contributing factor ranchers consider when formulating stocking rates and grazing programs. The amount of residual forage remaining from the prior year's growing season is a contributing factor influencing sage-grouse nest success.

Recent research in the Lander vicinity found that birds in the McGraw Flats area selected nest sites with greater green grass height and less residual grass height (Jensen 2006). These results suggested that birds nested in areas with ground cover and new growth of grass, but little residual grass. These conditions probably occurred following moderate-to-heavy grazing the previous year, but no grazing before nest initiation in spring. It was likely that nesting birds used areas with more litter, grass height, and total shrub cover to provide protection from predators and weather during nesting for themselves and their

brood after hatching. However, there tended to be less Wyoming sagebrush cover and greater residual grass cover at Hudson nest sites. Taller grass height was shown to be important in another Wyoming study (Holloran 1999), as was less bare ground (Lyon 2000; Slater 2003) and increased litter (Kuipers 2004). Differences in grass height have been shown in other areas (Wakkinen 1990). However, several studies have shown taller residual grass height at nest sites (Wakkinen 1990, Holloran 1999) and more residual grass cover (Klebenow 1969, Lyon 2000).

Both positive and negative direct effects of livestock grazing on sage-grouse habitats have been identified. For example, short duration grazing in late spring and early summer has been reported to improve both quantity and quality of summer forage (forbs) for sage-grouse (WGFD 2003). Conversely, continuous heavy use by livestock and/or wild ungulates rarely leaves suitable residual cover for nesting and often results in degradation of the functioning condition of riparian areas in sage-grouse habitats. However, there have been few research efforts made, and therefore little direct experimental evidence, linking specific livestock grazing practices to sage-grouse population levels.

The sagebrush ecosystem evolved with grazing by a variety of wildlife species. The timing, duration, location, and intensity of historical wildlife herbivory is not quantified. The introduction of livestock grazing into the sagebrush landscape presented a shift from a mixture of migrating, free ranging wildlife grazers and browsers toward managed domestic sheep and cattle. Since that time, there have been changes over the landscape in terms of the location and confinement (via fencing) of domestic livestock, class and season of use, grazing management systems, and total numbers of domestic and wild herbivores on the range, both large and small.

A focus on "improving range condition", defined by public policy over the last 70 years as growing more grass, coupled with a shift from sheep to cattle also have affected sage-grouse habitats, although these impacts are not well documented. Active management aimed toward opening the canopy in decadent sagebrush stands and creating and maintaining a diversity of desirable micro-sites is beneficial to sage-grouse. Forb diversity and forb-associated insects are important to pre-nesting condition of hens and early brood rearing of chicks. There is some evidence that there has been a reduction of these important habitat components as a result of current and historic grazing and fire management policies in some areas (WGFD 2003). The interaction between fire and grazing may be important to habitat diversity, but is not well understood.

A healthy sagebrush ecosystem provides the diverse age groups and classes of vegetative succession necessary to sustain and increase sage-grouse populations while providing for other wildlife and multiple uses of the area, including livestock grazing. Unfortunately, many sagebrush communities throughout the WRSRCA are late-seral, decadent communities with little sagebrush regeneration/age diversity. Such ecosystems not providing this diversity need long-term management strategies to allow recovery. These management changes should be analyzed to ensure those made on behalf of sage-grouse do not inadvertently cause unacceptable harm to other species.

Vegetation Treatments and Practices for Habitat Improvement

Desired vegetative communities benefiting sage-grouse can be achieved through vegetation management. Vegetation management tools may include biological/natural, mechanical, or chemical treatments. Treatments include prescribed fire, designed domestic livestock grazing systems, mechanical, and insect (biologic) control. Fire, floods, insects, mammal and bird herbivory, and plant diseases and allelopathy (chemical inhibition) are also biological/natural processes. Chemical treatments to manipulate, control, enhance, or remove sagebrush include a variety of herbicides and fertilizer. Mechanical treatments in sagebrush systems include mowing, roto-beating, chaining, disking, roller harrowing, aeration, railing, and blading.

Removal of large tracts of sagebrush is detrimental to sage-grouse populations. Spraying and burning have been the most common treatments in Wyoming. Limited spraying occurs today, but was used extensively in the past. Many large stands of sagebrush were converted to grassland by spraying, mainly with 2, 4-D. While some birds may be able to adjust by using adjacent sagebrush habitats, many areas of widespread treatment no longer support sage-grouse. However, sage-grouse habitats can be improved through sagebrush thinning or control when stands become over-mature and decadent. The herbicide tebuthiuron, aka Spike® 20P, may be used to selectively thin sagebrush with various application rates to control the degree to which a sagebrush stand is thinned, an attribute which can be beneficial when designing management prescription.

Burning is often more popular than other methods of sagebrush treatment, because it is generally less expensive and federal financial assistance for chemical control is less available. Burning can be preferable from a wildlife/sage-grouse standpoint because it promotes forb growth and generally produces a patchy treatment pattern. However, it is recognized that fires in preferred sage-grouse habitats with fine fuel accumulation (i.e. nesting habitat) are often detrimental since they remove important habitat, and such areas may not require treatment. Burning in Wyoming big sagebrush may not produce desired results, especially at large scales. Estimates of pre-historic fire frequency in Wyoming big sagebrush habitats range between 70-300 year intervals. Mosaic patches of sagebrush of different ages and structures benefit sage-grouse. Vegetation treatments also tend to increase the abundance and diversity of insects in sagebrush ecosystems.

Use of vegetative treatments requires careful planning and understanding of the sagebrush ecosystem and sage-grouse habitat use, to ensure sufficient stands of desirable sagebrush remain. When trying to improve sage-grouse habitats, threshold levels of habitat alteration that can occur without negatively impacting specific sage-grouse populations should be determined. As a general rule, no more than 20% of any seasonal habitat type should be treated until results are evaluated.

Weather

Sage-grouse evolved with variable weather and long-term climatic change, and survived multiple ice-ages and droughts. Annual weather fluctuations, multi-year weather events, and long term climatic change all influence sage-grouse populations through physical stress and by modification of habitats. Annual variations in precipitation and temperature can affect annual sage-grouse production and may be site-specific. Cold, wet weather during early brood-rearing can physically stress and kill young chicks and have adverse affects on insect populations. However, cool, wet springs can be advantageous to sage-grouse by promoting herbaceous growth, especially forbs. Extremely hot-dry conditions during the early summer forces sage-grouse to congregate on the few riparian areas that remain well hydrated, thereby increasing the potential for predation and the risk of disease. Typically, wet years are good for sage-grouse production and dry years can inhibit production.

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

Short-term climatic cycles affect the length of the growing season and influence plant succession and the abundance and duration of herbaceous cover and forb availability. Typically, wet cycles benefit sage-grouse while dry cycles or drought may reduce the amount of grass and forb production to levels that are inadequate for sage-grouse survival. Periodic weather events, such as extreme winters can increase snow depths to levels that cover most of the sagebrush and limit areas available for foraging and cover. Long term and/or extreme drought can cause changes in vegetative communities that decrease the effectiveness of sage-grouse habitats for long periods, and result in reductions in productivity that culminate in population declines. A multi-year weather cycle of above normal precipitation can enhance sage-grouse populations, due to the positive influence moisture has on vegetative communities. Multi-year weather events usually occur on a larger geographical scale than annual fluctuations, and influence sage-grouse populations at the regional level.

Drought monitoring data collected by the National Climatic Data Center (NCDC) branch of the National Oceanic and Atmospheric Administration (NOAA) is compiled into the Palmer Drought Index, which was developed in the 1960s and uses temperature and rainfall information in a formula to determine dryness. It has become the semi-official drought index. The Palmer Drought Severity Index for the Wind River Basin (Figure 25) indicates much of the WRSRCA has been drier than average beginning in the late 1940s (indicated by the red circle), with few wet periods of more than a few years in the last 60 years.

Exceptional drought conditions prevailed throughout the WRSRCA from 2000 to 2002, leading to very poor habitat conditions. Based on total precipitation and minimum daily temperatures, the summer of 2002 was only slightly less severe than in 2001, the harshest since weather records were collected beginning in 1892. Summer conditions in 2003 were much improved compared to 2001 and 2002, but were likely not adequate to restore subsoil moisture levels to provide adequate root system recovery to most sagebrush communities within the WRSRCA. Above average precipitation was recorded in 2004, leading to an increase in chick production over that observed in 2003. Weather conditions in 2004 and 2005 were greatly improved over the previous 5 years, particularly when comparing spring precipitation.

Contrary to 2004 and 2005, spring precipitation in 2006 was well below normal, with only 3.02" of precipitation in Lander from January 1 to April 30 (71% of average). Precipitation in Jeffrey City during the same period was 1.78" (63% of average). Conditions worsened as summer 2006 progressed, with only trace amounts of precipitation falling throughout much of the WRSRCA from May 1 through August. Abnormally high temperatures exacerbated the dry conditions, with July being the 2nd hottest on record for Lander and Riverton weather stations. These summer conditions diminished any benefits provided by the spring precipitation and livestock use remained high on rangeland allotments in many locations. Field personnel remarked that resulting habitat conditions were among the worst ever observed. Sagebrush showed nearly no new growth; resulting from previous combinations of extremely dry weather, low vegetative vigor, and heavy cattle use.

Lander and Riverton weather stations set or matched record high temperatures on 4 days in mid-March 2007. Despite a late-March snowstorm that brought nearly 30 inches of snow to Lander and 8 inches to Riverton, precipitation for the calendar year is about 21% and 45% below average in Lander and Riverton respectively (as of April 15, 2007). As of April 10, 2007, the WRSRCA was categorized as under "severe" drought, as depicted on the U.S. Drought Monitor website, showing improvement since the March 27 categorization of "extreme". http://www.drought.unl.edu/dm/monitor.html

Winters have been generally mild throughout most of the WRSRCA during the past decade. Since winter weather is not normally considered to be a limiting factor to sage-grouse, mild weather should have a positive influence on populations. One possible detrimental factor resulting from mild winters is lack of snowmelt precipitation, which would cause reduced spring grass and forb growth.

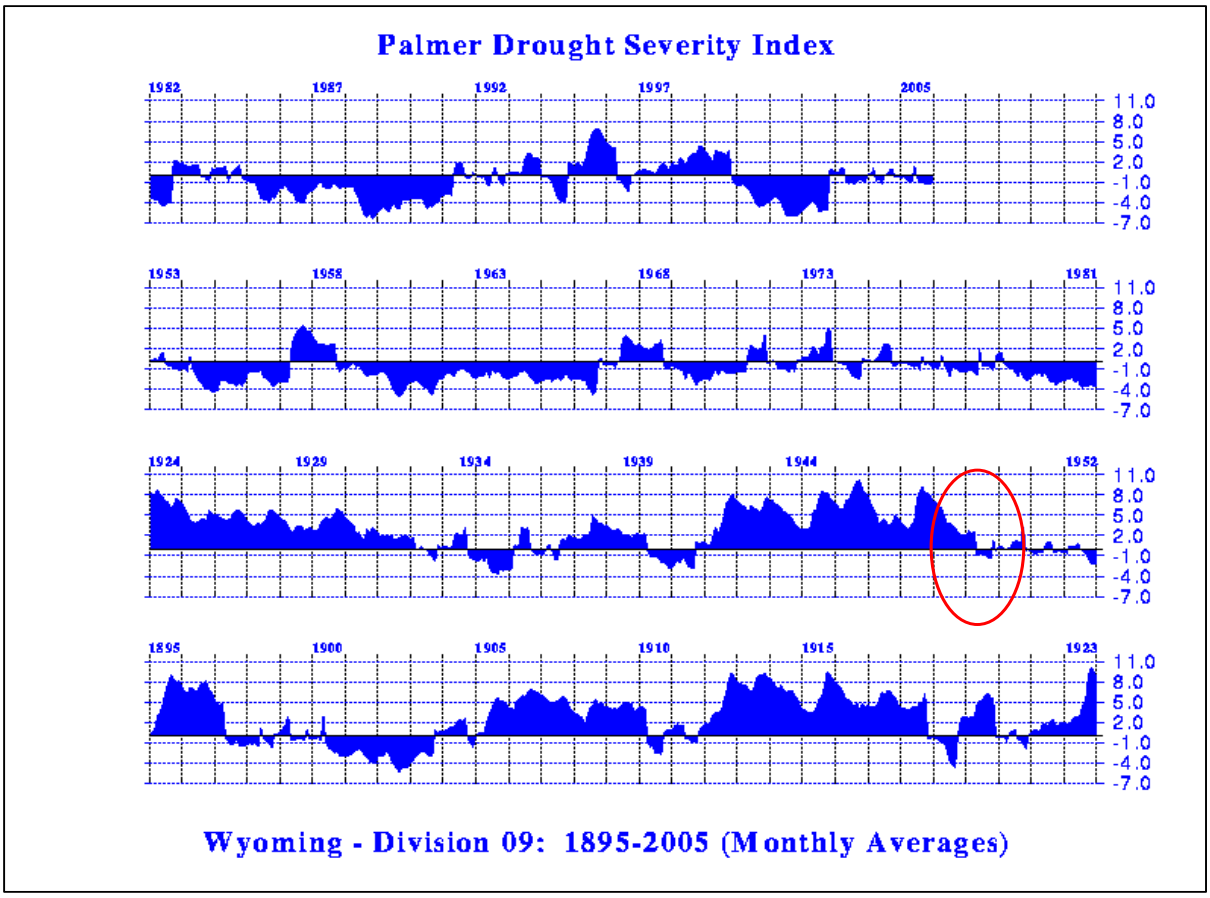


Figure 25. Palmer Drought Severity Index for Wyoming Division 09 (Wind River Basin) from 1895 – 2005.

A relationship between spring precipitation and chick production/survival is indicated through peak male attendance the following year (Figure 26). This connection is probably linked to the amount of residual grass cover remaining from the previous year (t-1), along with current year's grass and forb production. In most years, precipitation from the previous year appears to influence the amount of residual vegetation available for security understory cover at nests. The current year's new grass growth contributes additional security cover at nests and coupled with new forb growth, provides good hiding cover for newly hatched chicks. In addition, lush new vegetation seems to be linked with greater diversity and abundance of insects, which serve as the principal food source for chicks during the first 2 weeks after hatching. Divergence in the trend between precipitation and the following year's peak male lek attendance may be the result of cooler temperatures, conflicting land uses, and other disturbances.

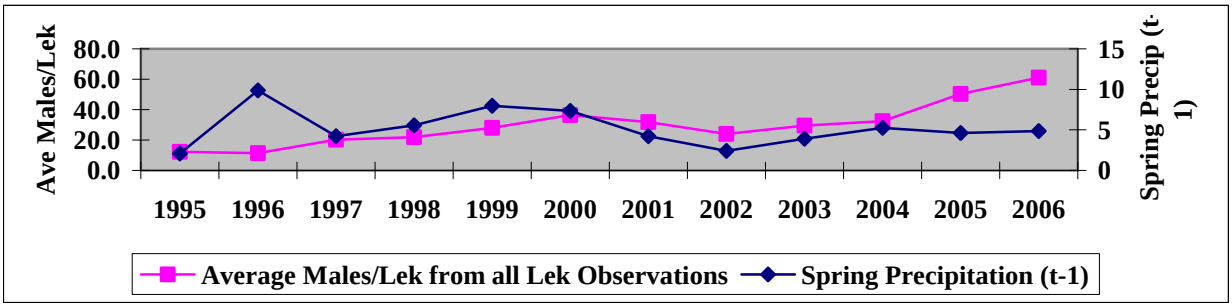


Figure 26. Spring precipitation (March - June) in year (t-1) compared to peak male attendance at all leks observed from 1995 – 2006 in the WRSRCA. Source WGFD & Western Regional Climate Center

FOCUS AREAS FOR PLANNING SAGE-GROUSE CONSERVATION EFFORTS

Since many of the factors that influence sage-grouse in the WRSRCA are not uniformly distributed across the planning area, the WRSR LWG identified 8 unique geographic "focus" areas to use in setting conservation priorities (Figure 27). These areas will be used to support decision-making processes as to how and where conservation actions will be implemented. Where possible, the Factors Influencing Sage-grouse Populations and Habitats section included a brief description of which focus areas each factor is found in. A general description of these focus areas, including a brief synopsis of factors most likely to influence sage-grouse in each focus area follows:

Badwater

This area is the most northeastern portion of the WRSRCA, encompassing all lands north of U.S. Highway 20/26, west of the Arminto-Bighorn Mountain Road, south of the Copper Mountain divide, and east of the Wind River at Boysen Reservoir. Many of the sage-grouse habitats in the Badwater Focus Area are naturally fragmented due to soil types and precipitation, with additional fragmentation occurring as a result of land uses. Factors identified as most likely to influence sage-grouse in along the Badwater area are conflicting wildlife management; mineral and energy development (oil, natural gas, and potential for wind power); and vegetation management (invasive plants and livestock grazing). Other influences determined to exist at varying levels include hunting; predation; residential development; and weather. Parasites and diseases; pesticides; and recreation are minimal, but may become important in the future.

Gas Hills

This area encompasses all lands south of U.S. Highway 26, east of Wyoming Highway 136 (aka Sand Draw Highway), and west of the Waltman-Gas Hills Road. Factors identified as most likely to influence sage-grouse in along the Gas Hills Focus Area are conflicting wildlife and wild horse management; mineral and energy development (oil, natural gas, and potential for wind power); and vegetation management (livestock grazing). Other influences determined to exist at varying levels include hunting; predation; recreation; residential development; and weather. Parasites and diseases; and pesticides are intermittent, and may become important in the future.

Lander – South Hudson

This area is located south of the Middle Fork Popo Agie River, west of Wyoming Highway 136 (aka Sand Draw Highway), and north of Beaver Rim. This focus area is recognized as one of the highest density sage-grouse areas in the state of Wyoming, and represents one of the strongholds for breeding populations of sage-grouse in western North America as shown on page 13-2 in the WAFWA Conservation Assessment of Greater Sage-grouse and Sagebrush Habitats (June 2004). Audubon Wyoming has designated a portion of this focus area as the Ninemile Draw Important Bird Area (IBA). Factors identified as most likely to influence sage-grouse in the Lander – South Hudson Focus Area are conflicting wildlife management; hunting; mineral and energy development (oil and natural gas); recreation; residential development; and vegetation management (invasive plants and livestock grazing). Other influences exist at varying levels, including pesticides, predation, and weather. Parasites and diseases are intermittent, and may become important in the future.

Lower Sweetwater River Drainage

This area is located in the southeastern portion of the WRSRCA and encompasses lands south of Beaver Rim and the Dry Creek Road, west of Wyoming Highway 220 and north of the Crooks Mountain/Green Mountain Divide. Factors identified as most likely to influence sage-grouse in the Lower Sweetwater Focus Area are conflicting wildlife and wild horse management, mineral and energy development (uranium mining, natural gas, and potential for wind power), and vegetation management (livestock grazing). Other influences determined to exist at varying levels include hunting, pesticides, predation, recreation, and weather. Parasites and diseases are intermittent, and residential development exists at very low levels, but may become important in the future.

Owl Creek Front

This area encompasses the south slope of the Owl Creek and Absaroka Mountains north of the main channel of the Wind River and Riverton Reclamation Withdrawal Area. Factors identified as most likely to influence sage-grouse along the Owl Creek Front Focus Area are conflicting wildlife management; hunting; mineral and energy development (oil, natural gas, and wind power); recreation; and vegetation management (livestock grazing). Other influences determined to exist at varying levels include pesticides, predation, and weather. Parasites and diseases are intermittent, and may become important in the future. The northern portion of the Wind River Reservation in Hot Springs County is included in the Owl Creek Front to allow the WRSRCA to prioritize projects on the whole WRR, even though lands in Hot Springs County are officially in the Bighorn Basin Local Sage-grouse Conservation Area.

Riverton Reclamation Withdrawal Area

This area is generally located north and west of Riverton, and consists of lands withdrawn from the Wind River Reservation by the U.S. Bureau of Reclamation for irrigation purposes. The majority of sage-grouse habitats within this area were converted to produce agricultural crops such as corn, sugar beets, and barley. The remaining sagebrush on Sand Mesa is also fragmented to some extent and supports only a few sage-grouse. Of the 5 known leks in this area, only one was confirmed to be active in 2006, with only 3 males attending the lek. The remaining 4 leks have experienced sporadic attendance, with only one active since 1994. Sage-grouse conservation efforts should only be implemented in appropriate habitat, and care needs to be taken to avoid further fragmenting this habitat. Factors identified as most likely to influence sage-grouse in the Riverton Reclamation Withdrawal Area are habitat fragmentation and lack of diversity; and mineral and energy development (oil and natural gas). Other influences determined to exist at varying levels include conflicting wildlife management; pesticides; predation; recreation; residential development; and vegetation management (livestock grazing); and weather. Hunting, parasites, and diseases are intermittent, and may become important in the future.

Upper Sweetwater River Drainage

This area is the most southwestern corner of the WRSRCA, encompassing lands south of Beaver Rim, northeast of the Continental Divide, and southwest of the Crooks Mountain divide north of Alkali Creek. This focus area is recognized as one of the highest density sage-grouse areas in the state of Wyoming, and represents one of the strongholds for breeding populations of sage-grouse in western North America as shown on page 13-2 in the WAFWA Conservation Assessment of Greater Sage-grouse and Sagebrush Habitats (June 2004). Factors identified as most likely to influence sage-grouse in the Upper Sweetwater Focus Area are conflicting wildlife and wild horse management, hunting, mineral and energy development (gold mining, natural gas, and potential for wind power), recreation, and vegetation management (livestock grazing). Other influences determined to exist at varying levels include pesticides, predation, and weather. Parasites and diseases are intermittent, and residential development exist at very low levels, but may become important in the future.

Wind River Front

This area encompasses the east slope of the Wind River Mountains from Togwotee Pass to Riverton, south of the main channel of the Wind River, and north of the Middle Fork Popo Agie River. Factors identified as most likely to influence sage-grouse along the Wind River Front Focus Area are conflicting wildlife management; hunting; mineral and energy development (oil and natural gas); residential development; and vegetation management (livestock grazing). Other influences determined to exist at varying levels include pesticides; predation; recreation; and weather. Parasites and diseases are intermittent, and may become important in the future.

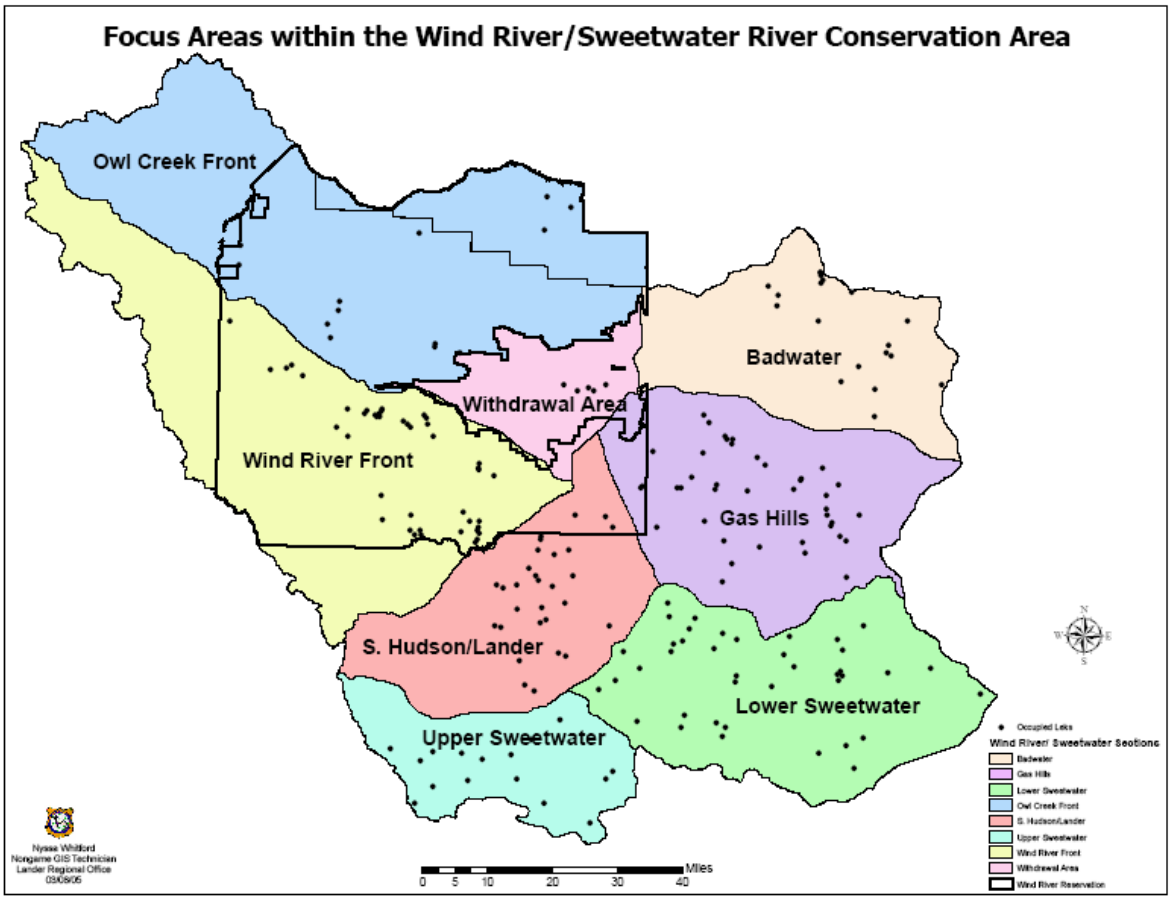


Figure 27. Map showing the 8 geographic focus areas within the WRSRCA (dots = sage-grouse leks). WGFD

SAGE-GROUSE CONSERVATION STRATEGY

Introduction

The Sage-grouse Conservation Strategy for the Wind River/Sweetwater River Conservation Area (WRSRCA) is presented in the following sections, beginning with Conservation Goals and Objectives; Project Commitments; and Recommended Actions. Recommended Management Practices (RMPs) for each factor influencing sage-grouse are listed the following section.

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

- Conservation Goal 1 deals with identification of seasonal habitats; then to maintain, restore, and/or enhance these habitats to improve sage-grouse populations.
- Conservation Goal 2 provides guidance toward improving sage-grouse populations by addressing the factors that influence sage-grouse populations through habitat modification or land uses. Factors are listed alphabetically, rather than in a priority ranking.
- Conservation Goal 3 outlines sage-grouse population and habitat monitoring needs.
- Conservation Goal 4 identifies research needs.
- Conservation Goal 5 outlines a public awareness outreach program to enhance public knowledge about sage-grouse and conservation issues facing the species.

Project commitments and recommended actions are provided in this strategy. A project commitment is an action that an agency or group has agreed to complete or has already completed. Not all project commitments have been specifically endorsed by the WRSR LWG, but represent what is currently being done to enhance sage-grouse populations and/or sage-grouse habitats. Current project commitments may or may not be adequately protecting sage-grouse and their habitats, based on recent research.

Recommended actions are ideas or projects identified to promote sage-grouse and sagebrush habitat conservation. However, the working group has not yet secured a commitment to implement these actions. The working group will be contacting the identified parties over the next two years to secure commitments to address these actions. The lead agency or group was identified as a result of public or private sector jurisdiction in the category and will undoubtedly involve many partner organizations.

RMPs identified by the WRSR LWG are also provided. These recommended practices or activities are in addition to conservation commitments and proposed management actions described in this document and are most appropriate in a certain set of conditions that may or may not be present throughout the LWG area. It is the user who determines the relevance and appropriateness of the RMP, and the user may modify any given RMP to meet particular circumstances. RMPs are not implied regulations and they are not appropriate in all circumstances.

SAGE-GROUSE CONSERVATION GOALS AND OBJECTIVES

Conservation Goal #1: Maintain, restore and/or enhance sage-grouse habitats in order to maintain and increase sage-grouse populations, using biological data and information to identify needs for each of the habitat types outlined below. Habitat types are listed in relative chronological order beginning with breeding season.

A. Breeding habitat

Maintain and protect strutting grounds (leks) and adjacent sagebrush stands.

Objective 1. Maintain a balance of openings and adjacent, healthy sagebrush stands on each breeding site.

B. Nesting habitat

Maintain or improve nesting habitat to provide adequate sagebrush, residual grass and forb cover.

Objective 1. Work with livestock operators and BLM to apply grazing management practices compatible with maintenance of appropriate sagebrush, grass and forb components for sage-grouse nesting in identified habitat areas.

Objective 2. Use appropriate treatment methods to create a mosaic pattern of various age classes of sagebrush across the landscape, particularly in areas with greater than 30% sagebrush cover and poor herbaceous components.

C. Early brood-rearing habitat

Maintain or improve early brood-rearing habitat adjacent to nesting areas with abundant herbaceous cover (especially forbs) and diverse insect populations. This is identified as a "bottleneck" for sage-grouse life history in the WRSRCA, and management should focus on improvement of these habitats.

Objective 1. Adjacent to nesting areas identified above, employ vegetation manipulation techniques (i.e. mechanical, prescribed fire, herbicide, animal impact, grazing, rest, seeding) to provide forbs and insect producing habitats for early-brood rearing.

D. Late brood-rearing habitat

Maintain or improve riparian, meadow, and irrigated habitats, to provide an abundance of forbs and grasses near sagebrush.

Objective 1. Identify at least one wet meadow restoration project opportunity in each of the 8 focus areas.

Objective 2. Where approved grazing and/or allotment management plans are in place, modify or improve one or more existing livestock watering projects to improve sage-grouse brood watering capabilities on appropriate sites in each of the 8 focus areas. Encourage and facilitate new water developments where location, design, and livestock management make them beneficial to sage-grouse and other wildlife.

Objective 3. Where headwater drainages are becoming "choked" with juniper, sagebrush, conifers, etc., design watershed improvement projects that identify system-wide improvement needs, rather than treating site-specific symptoms.

E. Winter concentration and severe winter relief areas

Maintain or improve winter habitat to provide sagebrush canopy for forage and cover above existing snow depths.

Objective 1. Identify potential habitat treatments to improve sagebrush health and stature.

F. Migration and transition habitats

Maintain or improve linkages of sagebrush habitats that allow birds to move between seasonal ranges.

Objective 1. Identify where these transition/migration habitats exist, and where possible, identify daily vs. seasonal movements to develop a better understanding of bird migrations

Objective 2. Following research that identifies transition/migration habitats, identify obstacles to migration routes.

Objective 3. Discourage development along migration routes and in transition habitats.

Conservation Goal #2: Maintain and/or increase distribution and populations of sage-grouse by addressing influences on populations. This goal provides the tools to implement land management actions and other recommendations based on habitat and population needs identified throughout the plan. These

A. Conflicting wildlife and wild horse management

Consider impacts on sage-grouse when developing management goals and strategies for other species.

Objective 1. Avoid single species wildlife management when dealing with wildlife habitat improvement projects, avoid complete sagebrush removal (need mosaics), avoid implementation of projects during critical sage-grouse time periods.

Objective 2. When dealing with wild horse management units, encourage BLM enforcement of populations within AML (Appropriate Management Level) with adjustments during drought, etc.

Objective 3. Inform Congress and the general public about land management with regards to wild horse impacts on other species and land uses. (Also applies to Goal #5)

B. Hunting

Conduct hunting of sage-grouse in a manner that is compatible with maintaining robust populations and allows depressed populations to increase.

C. Mineral and energy development

Minimize negative impacts of exploration and/or development of mineral and energy resources on sage-grouse habitats and ensure timely and effective reclamation.

Objective 1. Develop a 3-stage plan for mineral or energy developments that provides an outline to reduce the impacts of these developments on sage-grouse or their habitat.

Stage 1. Pre-Development Plan

Create a plan that includes placement of well sites, mines, pits, wind towers, etc. and all infrastructure in relationship to sage-grouse habitat and critical sage-grouse habitat.

Stage 2. Development Plan
Create a plan that includes but not limited to noise reduction, limited road use, water management, dust control, etc. in relationship to sage-grouse habitat and critical sage-grouse habitat.

Stage 3. Post-Development Plan
Create a reclamation and/or off-site mitigation plan that satisfy the needs of sage-grouse and their habitats.

D. Parasites and diseases

Encourage implementation of practices that are shown to reduce the occurrence of sage-grouse parasites and diseases, based on research results as available.

Objective 1. Understand the habitat needs of mosquito vectors of West Nile Virus and design ways to address the life cycle of the virus at its weakest link.

Objective 2. Avoid unnecessary surface water storage, such as old tires where mosquitoes may propagate, and address other water management issues such as flood irrigation.

E. Predation

Minimize the effects of predation to improve sage-grouse recruitment and maintain habitat quality that discourages predation.

Objective 1. Consider predator control to maintain or enhance local sage-grouse populations when they determine there is a demonstrated need such as a population is trending downward over a 3-year period; populations of "newcomer" predators are artificially high in sage-grouse habitat; specific sage-grouse populations need short-term help.

Objective 2. Address the predator habitat needs to favor/discourage populations, e.g. provide habitat that favors species like rabbits, which coyotes prey upon. (Basically if habitat supports more rabbits and other prey species, less predation may occur on sage-grouse.)

Objective 3. Where nest predation from ravens has been identified, attempt to limit raven predation through practices that may discourage raven distribution in sage-grouse nesting habitat. If possible, identify what may inhibit raven populations, and then target management to reduce their impacts on sage-grouse. (Essentially, reducing raven populations naturally may reduce sage-grouse nest predation.)

F. Recreation

Minimize the effects of recreation activities on sage-grouse and their habitats.

Objective 1. Establish lek viewing guidelines and establish/maintain a small number of lek viewing sites.

Objective 2. Limit ATV, snowmobile and other off road vehicles in key habitat areas, such as winter concentration areas, breeding and nesting habitat.

G. Residential development

Minimize negative impacts of urbanization on sage-grouse and their habitats.

Objective 1. Raise awareness at city and county levels to address land uses that impact sage-grouse habitat.

Objective 2. Develop mitigation practices to address those habitats that are already fragmented.

Objective 3. Encourage residential development where wildlife habitats are already fragmented, avoiding areas with contiguous sagebrush cover.

H. Vegetation management

Maintain or improve sagebrush habitats and associated riparian systems to include a healthy understory of native grasses and forbs, species and age class diversity, and patches of varying size and density. Management practices and actions based on habitat needs from Goal #1.

Objective 1. Promote farming operations that are compatible with maintenance and enhancement of sage-grouse habitat.

Objective 2. Prevent the introduction or proliferation of invasive plants in sage-grouse habitat and promote control and reduction of infestations.

Objective 3. Promote livestock grazing practices that maintain healthy sagebrush/grassland habitats on federal, state, tribal and private lands in the WRSRCA.

Objective 4. Work with land managers to implement vegetation management practices and/or treatments that benefit seasonal sage-grouse habitats.

I. Weather

Attempt to define weather and climate related effects on sage-grouse populations.

Objective 1. Encourage practices that moderate adverse impacts of weather on sage-grouse.

Conservation Goal #3: Improve and increase population and habitat monitoring.

Objective 1. Maintain, enhance, and expand sage-grouse population monitoring programs (i.e. lek surveys/counts, wing barrels, summer brood surveys).

Objective 2. Expand present lek survey efforts to search for new leks, verify and update data for known leks.

Objective 3. Consolidate existing NRCS, WRR, BLM, & WGFD vegetation monitoring data to identify specific sage-grouse habitat needs.

Objective 4. Monitor the impacts of predators on local sage-grouse populations.

Objective 5. Monitor influences of weather on sage-grouse populations and habitat.

Objective 6. Monitor development and other potentially detrimental activities in sage-grouse habitat.

Objective 7. Monitor sage-grouse for evidence of Avian Flu (H5N1) and West Nile Virus locally, while collaborating with statewide monitoring efforts.

Conservation Goal #4: Initiate and/or encourage sage-grouse research.

Objective 1. Expand our knowledge of habitat requirements and sage-grouse interactions in the WRSRCA. Identify sage-grouse habitat and seasonal use mapping needs. (Remote-sensing GIS cover types, see habitat types in Goal #1, disturbances, etc.)

Objective 2. Determine how land management and human activities affect sagebrush ecosystems and sage-grouse habitat and populations.

Objective 3. Utilize existing and develop new research to determine the best land reclamation practices to improve sage-grouse habitat and control undesirable vegetation. (Plant species mix, application methods, minimizing surface disturbance. Undesirable vegetation includes juniper encroachment, invasive and noxious species.)

Objective 4. Encourage and utilize industry, educational institutions, and other partners to fund and/or conduct research projects that fit the identified needs of the WRSRCA.

Conservation Goal #5: Inform and educate the public about sage-grouse issues.

Objective 1. Develop a public awareness program to present sage-grouse information.

Objective 2. Work with local, state, and federal governments, tribal interests, and private landowners to promote positive conservation efforts, share available data, and minimize negative impacts to sage-grouse and their habitats.

Objective 3. Implement the final WRSRCA plan through development of working relationships with all interested parties.

Photo by Stan Harter

IMPLEMENTATION STRATEGY

FUNDING

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. $425,000 of the $500,000 appropriation was to be used for conservation projects. The Wind River/Sweetwater River LWG ranked 5 project proposals, of which 2 were implemented. The top ranked project in the WRSRCA was the Government Draw mowing project, which was implemented through the purchase of a mower for Wyoming Game & Fish Department (the second ranked project).

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 includes about $135,000 for the administrative costs of local working group functions and mapping in addition to $1 million for implementation of local conservation plan projects. This funding is 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 River, received $134,000 over the biennium ($67,000/yr) while the Jackson Hole LWG received $62,000 over the biennium ($31,000/yr).

The funding is to be used for plan implementation, as opposed to the interim funding that was used to fund the 2005-2006 projects. Projects the groups support (via consensus) should be outlined and justified in the LWG plans. Projects may be funded before plan finalization if necessary, but the project should then be included in the plan.

The groups may choose to utilize a revised project proposal form and solicit projects within their local communities. Or they may choose to fund projects already identified through their planning process. There will not be statewide ranking and evaluation aside from ensuring the projects follow state fiscal policies and procedures. The funding may 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 are encouraged and a list of potential funding sources aside from the General Fund appropriations are listed in Appendix A. Additional funding sources via the Western Association of Fish and Wildlife Agencies' Greater Sage-Grouse Conservation Strategy and/or other national scale funding sources may materialize in the coming years.

PRIORITIZATION OF CONSERVATION ACTIONS

The WRSR LWG is responsible for prioritizing projects submitted to the group for funding through the Wyoming Governor's Sage-grouse Conservation Fund. Others interested in initiating projects to benefit sage-grouse can proceed on their own by obtaining technical assistance and securing funding through other sources. The LWG will consider various criteria to prioritize projects for funding such as relative significance of project, availability of cooperative funding, and potentially limiting factors. Projects receiving the highest priority will be those that mitigate for significant habitat loss resulting from natural resource development or those that have substantial potential to benefit sage-grouse and/or habitats. Conservation projects presented in the Project Commitments section of the plan are in various phases of implementation including completed, ongoing, planning, and conceptual. Implementation of projects will depend on a number of factors, including funding, willing cooperators, project sponsors, and NEPA processes.

Sage-grouse population densities are not currently being considered when prioritizing conservation projects. Due to the variety of projects likely to be submitted in the future, the significance and feasibility of proposed projects will probably be readily determined, thus providing for unambiguous selection. However, maps of peak male sage-grouse density at leks are shown in Figures 28 and 29. These maps illustrate the variation within the WRSRCA, and between 2000 and 2006.

A flow chart developed by the WRSR LWG to prioritize and rank sage-grouse conservation projects based on the aforementioned criteria and the Conservation Strategy Goal(s) addressed (in order of relative importance as determined by the working group) is shown on pages 70. Essentially, the WRSR LWG will prioritize funding conservation projects that meet the goals, objectives, and project commitments of this plan, provide the most benefit for the cost, and demonstrate adequate pre- and post-project monitoring and management to ensure project success. Projects designed to address the primary or "root" cause of the "problem" identified will likely get higher priority than those that only treat "symptoms". Projects designated as "Low" priority for sage-grouse may still receive funding, if funds remain available after the projects determined as "High and Moderate" priority are funded. As of July 2006, the WRSR LWG received an allocation of approximately $134,000, available for conservation and education practices by mid-2008.

MONITORING AND ADAPTIVE MANAGEMENT STRATEGY

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 estimating populations are critical to evaluate effectiveness of conservation actions implemented across the landscape. Consistent monitoring of sage-grouse populations and sage-grouse habitats will provide the data needed to measure the long-term success of this plan as well as provide the basis adapting management to take advantage of newly acquired information.

Techniques currently used for monitoring sage-grouse populations in the WRSRCA are consistent with those recommended by the Western Association of Fish and Wildlife Agencies' 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 will be implemented in the WRSRCA as they become available. The current protocol can be found in the recently updated Wildlife Management Techniques Manual of the Wyoming Game and Fish Department.

Also in 2005, 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 with sagebrush habitats are monitored across the range including Southwest Wyoming.

Adaptive management incorporates monitoring and research into land use planning and implementation. It integrates project implementation with monitoring and research to test project-planning assumptions. This kind of management assumes projects will be changed if monitoring or research data indicate future conditions were wrongly predicted. Quantitative (measurable, not subjective) data must be collected for adaptive management to succeed.

The Wind River/Sweetwater River Local Sage-Grouse Working Group will continue to meet at least annually to evaluate population and habitat monitoring results, research results, plan implementation status, and potential for new conservation projects or commitments. Results of these meetings will be incorporated into annual addendums/updates to this Conservation Plan.

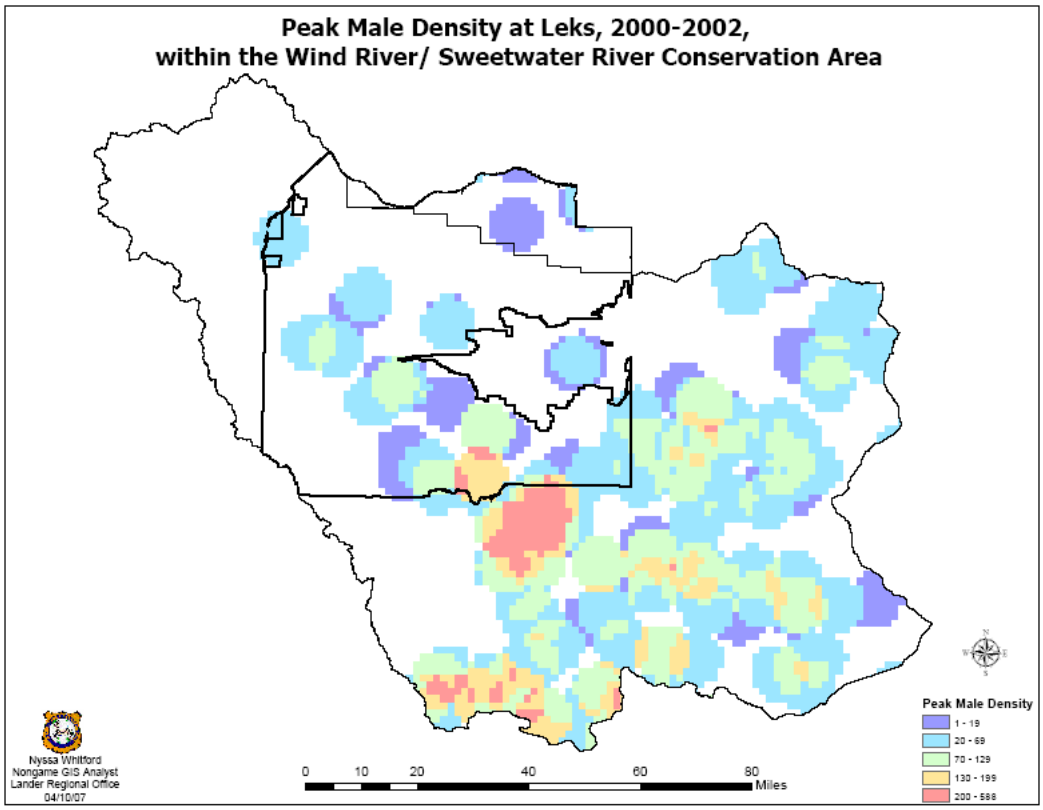


Figure 28. Peak male sage-grouse density at leks (average from 2000-02) for the WRSRCA. (source WGFD)

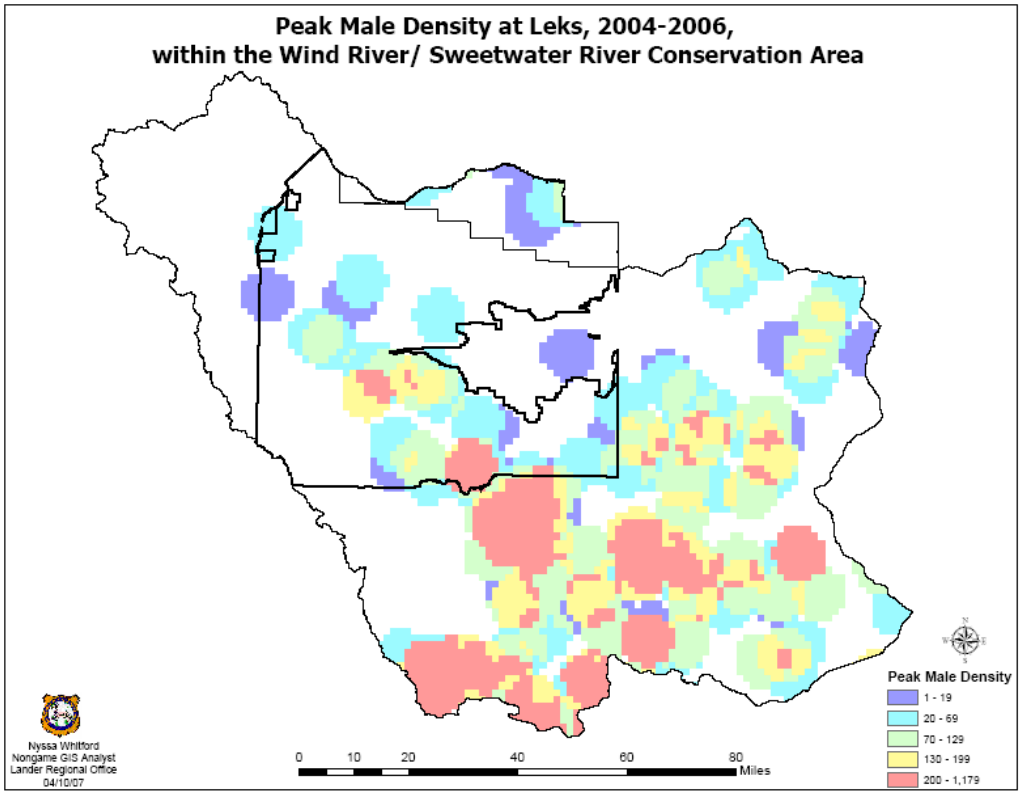
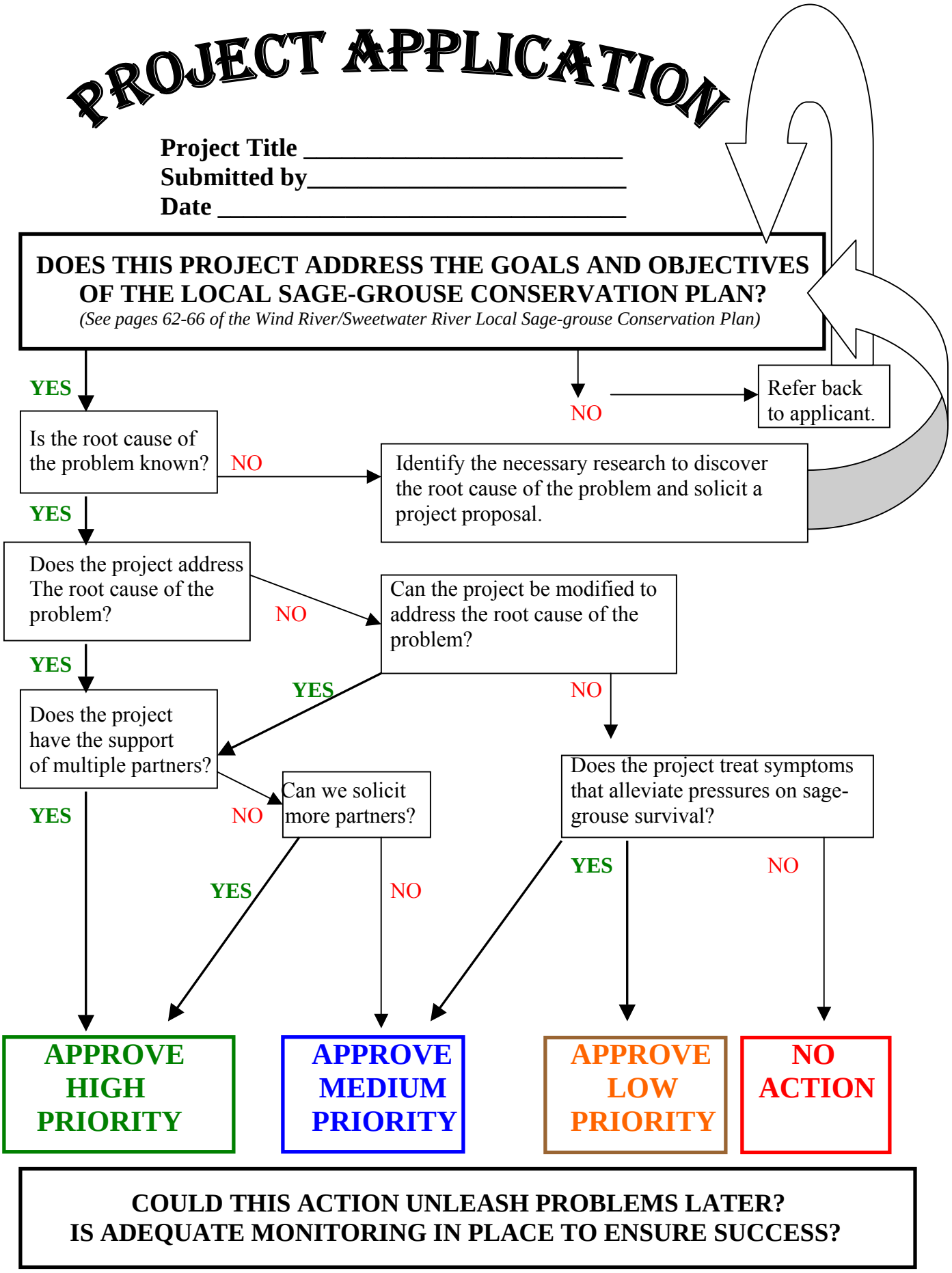


Figure 29. Peak male sage-grouse density at leks (average from 2004-06) for the WRSRCA. (source WGFD)

PROJECT APPLICATION

Project Title _____
Submitted by_____
Date _____



PROJECT COMMITMENTS AND RECOMMENDED ACTIONS

The following tables identify project commitments and recommended actions developed and/or supported by the Wind River/Sweetwater River LWG. The Project Commitments table contains projects that are planned or already ongoing, as well as projects recently completed that are expected to provide benefits to sage-grouse. The Recommended Actions table lists project ideas the LWG determined would be appropriate to implement in the future, but for which no specific project proposals have been developed. To the extent possible, each Project Commitment and Recommended Action is linked to conservations goals and objectives outlined in the preceding Conservation Strategy.

It is anticipated that completion of the projects outlined below will provide direct or indirect benefits to sage-grouse and/or their habitat. Some projects may temporarily displace sage-grouse, but these projects will be carefully planned to minimize the risk to sage-grouse populations within the WRSRCA.

Project Commitments	**Relationship to Conservation Plan Goals and Objectives**	**Priority by Focus Area**	**Timeline**	**Responsible Parties & Possible Funding Sources**
Assemble vegetation, topography and sage-grouse seasonal use mapping for all habitats in the WRSRCA (use existing data and determine gaps where data collection needs to be focused). Maps from statewide remote-sensing efforts may also be available soon, similar to efforts by SW LWG – WYGISC).	Goal 1. All Habitat Types	ALL	Ongoing w/ Completion by 2008	BLM, WGFD, WRR
Collect ground verifying vegetation data points on Wind River Reservation, BLM, USFS, and WGFD lands to assist with the WyGISC habitat mapping project.	Goal 1. All Habitat Types	ALL	Ongoing 2006 - 07	WRR, USFWS, BIA
Enhance ground and aerial surveys, to discover leks not currently identified. Need to identify and prioritize potential search zones on annual basis. BLM requires searches/surveys as part of land use permitting requirements.	Goal 1A. Breeding Habitat (Obj. 1)	ALL	Ongoing 2007	BLM, WGFD, WRR/USFWS
Design bird waterers or guzzlers associated with livestock water systems to improve water availability to wildlife on Hansen's North Fork Ranch.	Goal 1D. Late Brood Rearing Habitat	Lander-South Hudson	2007	BLM, WGFD, Water for Wildlife
Propose repairs to guzzler on Sheep Mountain.	Goal 1D. Late Brood Rearing Habitat	Lander -South Hudson	2007	BLM, WGFD, Water for Wildlife, Devon Energy
Create wet meadow habitat using overflow water and erect fences around wet meadows to maintain integrity along the Sandhills water pipeline on Wind River Reservation.	Goal 1D. Late Brood Rearing Habitat	Wind River Reservation	2008?	WRR, USFWS, WY SG Fund, BIA
Conduct winter flights/surveys to identify winter concentration areas and habitats across WRSRCA (using GIS, Wildlife Observation System, other data)	Goal 1E. Winter Habitat and Goal 4. Research	Lower Sweetwater, Badwater, Gas Hills, WRR	Ongoing Weather dependent	WGFD, BLM, WY SG Fund, WWNRTF

Project Commitments	Relationship to Conservation Plan Goals and Objectives	Priority by Focus Area	Timeline	Responsible Parties & Possible Funding Sources
Support inventory of sage-grouse use and habitats, and measurement of ecological condition on Bill Keith Ranch in eastern Fremont County. Data collected is hoped to provide guidance toward a grazing management and habitat improvement plan in order to enhance values for livestock production, sage-grouse, and other wildlife.	Goal 1. All Habitat Types	Gas Hills	2007	NRCS, Private landowners, WRSR LWG
Develop support documentation to submit to Wyoming Office of State Lands and Investments to support land use stipulations similar to those in place on Federal lands to protect sage-grouse and other wildlife	Goal 2. All Influencing Factors	ALL	2007	WRSR LWG (Stan/Pat to draft letter)
Sage-grouse hunting seasons are conducted throughout the WRSRCA, set by WGFD and SATFG.	Goal 2B. Hunting	ALL	Ongoing	WGFD
a. When populations are stable or increasing (based on lek count information), hunting seasons are 2 to 4 weeks with a 3-bird daily bag limit beginning no earlier than September 15.				
b. If populations are declining (for 3 or more consecutive years based on lek count information), implement more conservative regulations that might include reduced bag limits and adjusted season dates.				
c. Populations should not be hunted where less than 300 birds comprise the breeding populations. (i.e. less than 100 males are counted on leks)				
d. Implement hunting seasons to harvest no more than 10% of the projected fall population.				
e. Continue using wing barrels to estimate sex and age structure of the harvest.				
f. Continue to collect hunter harvest data using a hunter survey.				
g. WRR conducts unique hunting seasons, with spring "males only" hunting allowed for cultural purposes.		WRR	Ongoing	WRR
In 2004 and 2005, at least 14,500 used tires were collected in Fremont County to reduce the threat of West Nile Virus, by eliminating small mosquito breeding sites that can exist inside tires.	Goal 2D. Parasites & Diseases (Objective 2)	ALL	2004 & 2005	Fremont County Landfills
Cities of Lander and Riverton have stocked plains killifish in several ponds to reduce risk of West Nile Virus	Goal 2D. Parasites & Diseases	Lander - South Hudson, Withdrawal Area	2004, Ongoing	City of Lander, City of Riverton
Conservation easement on Twin Creek Ranch (4,970 acres private land; 16,000+ total ranch size) protecting important sage-grouse leks and nesting, brood-rearing and winter habitats.	Goal 2G. Residential Development	Lander - South Hudson	**Completed 2005**	NRCS (FRPP) WGFD, TNC
Conservation easement on North Fork Ranch (~2,100 acres private land; ~3,600 acre total ranch size) protecting important sage-grouse nesting, brood-rearing and winter habitats.	Goal 2G. Residential Development	Lander - South Hudson	2007	WGFD, TNC, NRCS (FRPP), MDF, RMEF

Project Commitments	Relationship to Conservation Plan Goals and Objectives	Priority by Focus Area	Timeline	Responsible Parties & Possible Funding Sources
Conservation easements in the Red Butte area northwest of Lander (~1,100 acres private lands, 6 private owners) protecting important sage-grouse nesting, brood-rearing and potential wintering habitats.	Goal 2G. Residential Development	Lander - South Hudson	2007	WGFD, MDF, RMEF
Design reclamation test projects to prevent noxious and invasive weeds, and improve native vegetation restoration on BLM lands. Possible test projects include watering reclamation sites, varying seeding stages/mixes with grasses & forbs, then sagebrush vs. sagebrush first, then grasses/forbs; trying non-native plant species on BLM, develop mixes with NRCS Plant Materials Center	Goal 2H. Vegetation Management (Objective 2)	WRR, Gas Hills, Badwater, Beaver Creek (Lander - South Hudson)	Ongoing, starting 2007	BLM, WGFD, NRCS, AML, Conservation Districts, Industry, WWNRTF
Design plans and complete a comprehensive weed management project to control invasive weeds along Beaver Creek including Russian knapweed, salt cedar, reed grasses and restoration of the original vegetation community. Hayfields (native or introduced) will be replanted, where desired. Re-seeding of native vegetation will be necessary in some areas.	Goal 2H. Vegetation Management (Objective 2)	Lander - South Hudson	Ongoing, starting 2007	Fremont Co. Weed & Pest, Private landowners, BLM, WGFD, WRR
Design an experimental project targeting a comprehensive approach to invasive weed treatments and restoration of native vegetation in the Badwater area (halogeton, salt cedar)	Goal 2H. Vegetation Management (Objective 2)	Badwater	2008	Fremont Co. Weed & Pest, Private LOs, BLM, WGFD
Since 2003, Fremont County Weed and Pest Dept has spent nearly $455,000 on invasive/noxious weed treatments within 3 miles of known leks within the WRSRCA. Total expenditures within 2 miles of known leks were about $246,000.	Goal 2H. Vegetation Management (Objective 2)	ALL	**Completed 2003 thru 2006**	Fremont County Weed & Pest, Multiple agencies and landowners
Incorporate mule deer habitat projects designed by WGFD for the Lander area that can be appropriately modified to benefit sage-grouse habitat. Planned Habitat Projects on North Fork Ranch, Table Mountain, Red Canyon, Twin Creek Area will incorporate these treatments and will have some opportunity to enhance sage-grouse habitat.	Goal 2H. Vegetation Management (Objective 4)	Lander - South Hudson	Ongoing, starting 2007	WGFD, BLM, TNC, Private landowners, NRCS
Develop treatments such as those recently completed in Government Draw that encourage regeneration of decadent sagebrush and enhance grass and forb composition and density. (Mechanical, Chemical, Burning, etc.)	Goal 2H. Vegetation Management (Objective 4)	ALL	Ongoing Starting 2007	BLM, WGFD
Government Draw Mechanical Treatments (Mowed about 400 acres and used Lawson Aerator on about 60 acres within a 2,000 acre project boundary)	Goal 2H. Vegetation Management (Objective 4)	Lander - South Hudson	**Completed February 2006**	BLM, WGFD, Devon Energy, WWF

Project Commitments	Relationship to Conservation Plan Goals and Objectives	Priority by Focus Area	Timeline	Responsible Parties & Possible Funding Sources
Government Draw Phase II Mowing Treatments - (Mowed 830 acres within a 7,500 acre project boundary)	Goal 2H. Vegetation Management (Objective 4)	Lander - South Hudson	**Completed February 2007**	BLM, WGFD, Devon Energy, WWF
Government Draw long-term project (~10 year annual treatments similar to those in 2006, such as mowing, aerator, fire, *tebuthiuron/* Spike 20P, seed mixes for soil disturbing treatments, etc.)	Goal 2H. Vegetation Management (Objective 4)	Lander - South Hudson	2008 and beyond	BLM, WGFD, WY SG Fund, WY Dept. of Ag.
Apply thinning rates of tebuthiuron (Spike 20P) to reduce sagebrush canopy and release understory herbaceous vegetation on private and state lands on Tom Abernathy's ranch, Hansen's North Fork Ranch, and Table Mountain. Develop projects for public lands, realizing some delays for processing NEPA and other clearance issues may occur.	Goal 2H. Vegetation Management (Objective 4)	Lander - South Hudson	2007 and beyond	Private landowners, WGFD, WY SG Fund, WY Dept of Ag.
Support NRCS project to apply thinning rates of tebuthiuron (Spike 20P) to reduce sagebrush canopy and release understory herbaceous vegetation on private lands on Ken Persson's property. Between 480 - 900 acres, depending on mosaic and potential to treat adjacent BLM lands.	Goal 2H. Vegetation Management (Objective 4)	Lander - South Hudson	2007 and beyond	NRCS, Private landowners, WY Dept. Ag, WGFD, BLM, WY SG Fund
Implement prescribed vegetation treatments on Wind River Reservation; mowing, Lawson aerator, and/or prescribed burning in the Sandhills, Mule Butte, and Willow Creek areas (about 500 acres in each area), to improve early-brood rearing habitat.	Goal 2H. Vegetation Management (Objective 4)	Wind River Reservation	2008 - 2009	Wind River Reservation, WY SG Fund, BIA, USFWS
Sandhills Prescribed Burn (mosaic burn of 200 acres within a 620 project boundary)	Goal 2H. Vegetation Management (Objective 4)	Wind River Front	**Completed Fall 2004**	BIA, WRR
Sandhills Mowing Project (mosaic treatment of 250 acres with a 500 acre project boundary)	Goal 2H. Vegetation Management (Objective 4)	Wind River Front	**Completed Fall 2004**	BIA, WRR
Big Table Mountain Mowing Project (mosaic treatment of 177 acres within a 600 acre project boundary)	Goal 2H. Vegetation Management (Objective 4)	Hot Springs County on WRR	**Complete Fall 2004**	BIA, WRR
Cedar Butte Prescribed Burn (mosaic burn of 215 acres within a 1,000 acre project boundary)	Goal 2H. Vegetation Management (Objective 4)	Wind River Front	**Completed Fall 2005**	BIA, WRR
Cedar Butte Prescribed Burn (mosaic burn of 300 acres within a 1,000 acre project boundary)	Goal 2H. Vegetation Management (Objective 4)	Wind River Front	**Completed Spring 2006**	BIA, WRR
Spring Creek Mowing Project (mosaic treatment of 170 acres within a 370 acre project boundary)	Goal 2H. Vegetation Management (Objective 4)	Wind River Front	Spring 2007	BIA, WRR
Riverton East Mowing Project (mosaic treatment of 510 acres within a 1,280 acre project boundary)	Goal 2H. Vegetation Management (Objective 4)	Lander - South Hudson	Spring 2007	BIA, WRR

Project Commitments	Relationship to Conservation Plan Goals and Objectives	Priority by Focus Area	Timeline	Responsible Parties & Possible Funding Sources
Argo Butte Prescribed Burn (mosaic burn of 150 acres within a 300 acre project boundary)	Goal 2H. Vegetation Management (Objective 4)	Wind River Front	Spring 2007	BIA, WRR
Mountain Meadows Mowing Project (mosaic treatment of 250 acres within a 625 acre project boundary)	Goal 2H. Vegetation Management (Objective 4)	Owl Creek Front	Pending	BIA, WRR
Bull Lake Creek Mowing Project (mosaic treatment of 170 acres within a 420 acre project boundary)	Goal 2H. Vegetation Management (Objective 4)	Wind River Front	Pending	BIA, WRR
Cedar Butte Prescribed Burn (~170 acres planned for mule deer winter range and summer sage grouse foraging habitat improvement)	Goal 2H. Vegetation Management (Objective 4)	Wind River Front	**Completed Spring 2007**	BIA, WRR
Conduct juniper removal project on BLM, state and private lands in the Red Canyon and Twin Creek areas.	Goal 2H. Vegetation Management (Objective 4)	Lander - South Hudson	2007	WGFD, BLM, State Land Board, Private landowners
Treat approximately 200 acres in the Bridger Creek area on the Philp Ranch to improve riparian and upland areas.	Goal 2H. Vegetation Management (Objective 4)	Badwater	2008	BLM, State Land, WY SG Fund, WGFD
Incorporate info from Landowner Survey to enhance existing data/information. Follow-up contacts with respondents interested in assisting with sage-grouse monitoring and management.	Goal 3. Monitoring (Objective 1 Populations)	ALL	2007	WRSR LWG
Develop methods to collect landowner sage-grouse observations such as field notebooks and/or web-based reporting. Sponsor/develop volunteer programs to collect data.	Goal 3. Monitoring (Objective 1 Populations)	ALL	2007	WGFD, BLM, Conservation Districts
Support Animal Damage Management Board (ADMB) nest predator study in Gas Hills/Muskrat area.	Goal 3. Monitoring (Objective 3 Predators)	Gas Hills	2007	WGFD, BLM, USDA Wildlife Services
Study raven activity related to nesting season in the Government Draw area using a systematic approach to identify if ravens are impacting nesting success. If desired, attempt raven control. (Recent changes in trash unloading at Lander and Sand Draw landfills to balefill operations may be serving to reduce raven use of "flyway" between these sites.)	Goal 3. Monitoring (Objective 4 Predators)	Lander - South Hudson (Gov't Draw)	2007 - 2008	WGFD, BLM, USDA Wildlife Services
Assimilate weather monitoring from NOAA and other weather bureaus and vegetation data to assess past and existing conditions to evaluate effects on sage-grouse populations.	Goal 3. Monitoring (Objective 5 Weather)	ALL	Jun-05	WGFD JCR & Conservation Assessments
Analyze effects of habitat improvement projects in Government Draw.	Goal 3. Monitoring	Lander - South Hudson	Ongoing	BLM, WGFD
Continue sage-grouse movement study on Wind River Reservation - delineating seasonal ranges.	Goal 4. Research	Wind River Front	Ongoing	WRR, USFWS, BIA, Tribal Fish & Game, WY SG Fund

Project Commitments	Relationship to Conservation Plan Goals and Objectives	Priority by Focus Area	Timeline	Responsible Parties & Possible Funding Sources
Establish and maintain a small number of public lek viewing sites and minimize viewing impacts on these sites. Viewing sage-grouse on leks (and monitoring leks) should be conducted so that disturbance to birds is minimized or preferably eliminated.	Goal 5. I&E Outreach	Lander - South Hudson (Twin Creek Lek)	**Completed 2007**	WGFD
Develop and distribute appropriate literature about sage-grouse and their habitats to land developers and county planners.	Goal 5. I&E Outreach	ALL	Ongoing	WRSR LWG, WGFD
Develop sage-grouse section on agency websites to disseminate information.	Goal #5A. Objective 1.	ALL	**Completed for WGFD,** Others 2007	WGFD, BLM
Present the final WRSRCA plan to agencies and organizations involved with land management. (i.e.. NRCS, BLM, BIA, BOR, WGFD, WYDOT, USFWS, County Planning, Conservation Districts, Weed & Pest Depts., City & County Landfills, Energy Industry, TNC, Wyoming Wildlife Federation, RMEF, Mule Deer Foundation, North American Grouse Partnership, etc.).	Goal 5. I&E Outreach	ALL	2007	WRSR LWG
Audubon Wyoming has designated the Ninemile Draw Important Bird Area to signify the importance of this area for sage-grouse.	Goal 5. I&E Outreach	Lander-South Hudson	**Complete 2005**	Audubon Wyoming

Recommended Actions Potential Projects and Activities Without Current Commitments	Relationship to Conservation Strategy	Responsible Parties & Possible Funding
Habitat		
Recommend that the BLM designate a special management area (e.g. ACEC) for sage-grouse in the Government Draw/Cottonwood Divide/Sweetwater River area. This area contains important sage-grouse habitat and falls within the South Hudson – Lander and Upper Sweetwater Focus areas. The area is recognized as one of the highest density sage-grouse areas in the state of Wyoming, as well as in the west and contributes significantly to the conservation of sage-grouse throughout its range. Encourage the BLM to focus on sage-grouse needs when managing public land uses and resources in the area and develop protection measures that are compatible with maintaining quality sage-grouse habitat and populations.	Goal 1. All Habitats	WRSR LWG, BLM, WGFD
Recommend to BIA and the Shoshone and Arapaho Tribes that the Sharpnose Sage Grouse area (~40,000 ac) be awarded special management status to ensure that other uses of the landscape are compatible with the needs of sage grouse and to protect important sage grouse habitats. The area, contiguous with the proposed BLM Special Management Area for sage grouse in the Hudson/Government Draw area, is encroached by human development. Currently, it has 4 to 5 active leks numbering ~270 males and has historically had the largest number of males counted on a single lek on the Wind River Reservation.	Goal 1. All Habitats	WRSR LWG, BIA, WRR
Where possible, identify leks where sagebrush has encroached into lek sites, and design treatments to restore historical conditions (tying lek attendance data with photographs, etc to determine the best treatment)	Goal 1A. Breeding Habitat (Objective 2)	BLM, WGFD, WRR, Private landowners
Identify vegetation enhancement projects to improve nesting and early brood-rearing habitats.	Goal 1B & 1C. Nesting and Early Brood Rearing Habitat.	BLM, WGFD, WRR, NRCS, Private landowners
Design bird waterers or guzzlers associated with livestock water systems to improve water availability to wildlife. (Create fenced wet meadows, etc.)	Goal 1D. Late Brood Rearing Habitat	BLM, WGFD, Water for Wildlife
Identify viable stock water reservoirs in need of repair/cleanout, and rebuild reservoirs for livestock/wildlife. Enhance water availability to all wildlife by providing offsite wildlife water troughs in fenced areas to protect from livestock trampling.	Goal 1D. Late Brood Rearing Habitat	BLM, WGFD, Water for Wildlife, WY Water Development Comm., Small Watershed Comms.
Fence the riparian area along the South Fork of the Little Wind River on the Wind River Reservation (Unsure of when this can occur).	Goal 1D. Late Brood Rearing Habitat	WRR, WY SG Fund, BIA
Develop riparian restoration and wet meadow enhancement projects in conjunction with grazing management planning and upcoming Coal Bed Natural Gas projects, and include fencing to protect these projects.	Goal 1D. Late Brood Rearing Habitat	BLM, Industry, Private Landowners, WRR
Where sagebrush in wintering areas is in poor condition, design projects that would improve sagebrush health.	Goal 1E. Winter Concentration Areas	WGFD, BLM, WRR

Recommended Actions **Potential Projects and Activities Without Current Commitments**	**Relationship to Conservation Strategy**	**Responsible Parties & Possible Funding**
Create residential and energy development guidelines in brochure format to be available for the public, then incorporate this into Goal #5 (I&E efforts).	Goal 1F. Migration Habitat and Goal 5. I&E	WGFD, BLM, Industry, WRR
Work with private landowners to prepare maps that identify seasonal habitats for sage-grouse and to develop a voluntary site-specific management program.	Goal 1. All Habitats	WGFD, Private landowners, NRCS, Conservation Districts
Complete seasonal habitat mapping efforts, then direct efforts to maintain, identify, rank, and monitor sage-grouse populations within the WRSRCA.	Goal 1. All Habitats	WGFD, BLM
Mineral and Energy Development		
Look at ways to increase bonding amount to ensure adequate funding is available for effective reclamation. Develop a method of providing funding for reclamation that comes from all companies that have had ownership in the field over time. This will ensure that funds are available for reclamation when the field is dry.	Goal 2C. Mineral & Energy Development	BLM, WY DEQ
Parasites and Diseases		
Investigate and document sage-grouse deaths attributed to parasites or disease.	Goal 2D.	WGFD
Develop and implement strategies, including public education, to deal with avian disease outbreaks, when appropriate.	Goal 2D.	WGFD, University of Wyoming
Implement pond design standards to minimize mosquito breeding habitat to reduce risks of West Nile Virus (Naugle 2006d).	Goal 2D.	BLM, WRR, Energy Industry, Dept of Ag
a. Overbuild the size of ponds to accommodate a greater volume of water than is discharged. This will result in non-vegetated and muddy shorelines that breeding mosquitoes avoid. b. Build steep shorelines to reduce shallow water and aquatic vegetation around the perimeter of impoundments. Construction of steep shorelines also will increase wave action that deters mosquito production. c. Maintain the water level below that of rooted vegetation for a muddy shoreline that is unfavorable habitat for mosquito larvae. Rooted vegetation includes both aquatic and upland vegetative types. Always avoid flooding terrestrial vegetation in flat terrain or low lying areas. d. Construct dams or impoundments that restrict down slope seepage or overflow. Seepage and overflow results in down-grade accumulation of vegetated shallow water areas that support breeding mosquitoes. e. Line the channel where discharge water flows into the pond with crushed rock, or use a horizontal pipe to discharge inflow directly into existing open water, thus precluding shallow surface inflow and accumulation of sediment that promotes aquatic vegetation. f. Line the overflow spillway with crushed rock, and construct the spillway with steep sides to preclude the accumulation of shallow water and vegetation. g. Fence pond sites to restrict access by livestock and other wild ungulates that trample and disturb shorelines, enrich sediments with manure and create hoof print pockets of water that are attractive to breeding mosquitoes.		
Predation		
Use a systematic approach to assess predation and determine whether actions are needed (see Idaho Sage-grouse State Plan).	Goal 2E. Objective 1.	WGFD, USDA APHIS

Recommended Actions Potential Projects and Activities Without Current Commitments	Relationship to Conservation Strategy	Responsible Parties & Possible Funding
Develop and distribute educational materials regarding human practices that may allow establishment/expansion of predator populations. Examples of these activities include landfills and other garbage/waste disposal that may provide artificial food sources for a variety of predators, and buildings/structures that provide nesting/roosting habitat for ravens/raptors.	Goal 2E and Goal 5.	WGFD, University of Wyoming, USDA APHIS
Recreation		
Develop travel management plans and enforce existing plans.	Goal 2F. Recreation	BLM, WGFD, WRR
Restrict organized recreational activities within 2 miles (3.4 km) of a lek between March 1 and July 15.	Goal 2F. Recreation	BLM, WRR
Vegetation Management		
Design comprehensive plans and complete one weed management project to control invasive weed treatments. Where desired, weed-free hayfields (native or introduced) will be the end-goal. Re-seeding of native or introduced vegetation may be necessary.	Goal 2H. Vegetation Management (Objective 2).	BLM, WGFD, NRCS, Fremont County Weed & Pest, Private landowners
Utilize experimental grazing systems to evaluate benefits for sage-grouse and livestock production.	Goal 2H. Vegetation Management (Obj. 3) and Goal 4.	BLM, NRCS, WRR, BIA, Private Landowners
Recommend the BLM complete the required Rangeland Health assessments on public rangelands throughout the WRSW LWG area as soon as possible. These assessments will help classify rangeland conditions in important sage-grouse habitats and identify potential habitat enhancement projects.	Goal 2H. Vegetation Management (Obj. 3)	WRSR LWG, BLM
Investigate the possibility of developing forage banks for use during periods of drought to alleviate excessive use by grazing animals on sage-grouse habitat.	Goal 2H. Vegetation Management (Obj. 3)	BLM, NRCS, BIA, WRR, Private Landowners
Recommend to BIA and the Shoshone and Arapaho Tribes that forage-banks be created on the Wind River Reservation by retaining select grazing permits when Tribal allotments become vacant. Allotments could be used in a rest-rotational system on a large scale to lessen the effects of ≥9-month grazing that currently occurs on 1,116,000 acres across nearly 70% of Tribal grazing lands on Wind River.	Goal 2H. Vegetation Management (Obj. 3)	BIA, WRR
Investigate opportunities for grass banks to facilitate resting areas following prescribed vegetation treatments, such as fire.	Goal 2H. Vegetation Management (Obj. 3)	BLM, NRCS, BIA, WRR, Private Landowners
When specific needs are identified in Riparian CRP areas, recommend the Farm Services Agency (FSA) allow short-term grazing as a tool for riparian system recovery.	Goal 2H. Vegetation Management (Obj. 3)	WRSR LWG, NRCS
Apply thinning rates of tebuthiuron (Spike 20P) to reduce sagebrush canopy and release understory herbaceous vegetation on private lands.	Goal 2H. Vegetation Management (Obj. 4)	Private landowners, WGFD, WY SG Fund, WY Dept of Ag.
Develop projects for use of tebuthiuron (Spike 20P) public lands, realizing some delays may be required for processing NEPA and other clearance issues.	Goal 2H. Vegetation Management (Obj. 4)	BLM, WGFD, WY SG Fund, WY Dept of Ag.

Recommended Actions Potential Projects and Activities Without Current Commitments	Relationship to Conservation Strategy	Responsible Parties & Possible Funding
Monitoring		
Develop methods to utilize and consolidate G&F, BLM, NRCS, WRR and landowner ongoing activities to collect data, such as lek monitoring, brood surveys, and winter observations.	Goal 3. Monitoring (Objective 1 Populations)	WGFD, BLM, NRCS, WRR
Catalogue existing habitat data in the area to identify how different management practices affect habitat, i.e. forbs, insects, sagebrush, riparian habitat, etc.	Goal 3. Monitoring (Objective 2 Vegetation)	Fremont County Weed & Pest, NRCS, WGFD, WRR
Create multi-agency vegetation and habitat maps to be used in conjunction with all planning efforts, including all 8 geographic focus areas of the WRSRCA, to be used in all phases of our efforts and would help with monitoring of loss or expansion of the habitat.	Goal 3. Monitoring (Objective 2 Vegetation)	WGFD & BLM GIS
Use aerial and satellite photography and GIS mapping to evaluate past development expansion and other activity into known sage-grouse habitats. Monitor future expansion for impacts. (Development includes residential, O&G, roads, etc.) (Activity includes recreation, hunting, grazing, mineral exploration and energy field monitoring)	Goal 3. Monitoring (Objective 5 Development and Activities)	WGFD, BLM, Industry, County, others to help fund photo imagery for GIS use
Monitor all vegetation/habitat treatments for vegetation and sage-grouse responses.	Goal 3. Monitoring & Goal 2B. Veg. Mgmt	WGFD, BLM, WRR
Research		
Determine migratory and non-migratory populations (definitions found in Connelly guidelines) through movement studies.	Goal 4. Research (Objective 1 Habitat)	WGFD
Summarize prior research projects and identify needs to expand throughout the WRSRCA.	Goal 4. Research (Objective 1 Habitat)	WGFD, BLM, WRR, NRCS
Identify how habitat and other factors influence chick survival (early brood rearing period).	Goal 4. Research (Objective 1 Habitat)	WGFD
Since insect abundance and diversity is a key component of early brood-rearing habitat, identify practices that enhance insect production.	Goal 4. Research (Objective 1 Habitat)	BLM, NRCS, WGFD, WY Dept of Ag
Study what different grass and forb heights do for nesting success.	Goal 4. Research Needs (Obj. 1 Habitat)	WGFD, University of Wyoming
Compile and make available existing sage-grouse data applicable to the area from agencies, universities, researchers, etc. to identify how different management practices affect habitat components i.e. forbs, insects, sagebrush, riparian habitat, etc.	Goal 4. Research Needs (Objective 2 Land Use)	Fremont County Weed & Pest, NRCS, WGFD, WRR,
Develop research to determine grazing management practices that have potential to benefit sage-grouse habitats. Review previous research conducted, literature reviews, grazing BMPs, and range-wide sage-grouse conservation strategy.	Goal 4. Research Needs (Objective 3 Grazing)	BLM, NRCS, WGFD, WRR, WY Dept of Ag, University of Wyoming
Develop research to determine the best reclamation practices to improve sage-grouse habitat. Focus on plant species mixes, application methods, and timing.	Goal 4. Research Needs (Objective 4 Reclamation)	BLM, Energy Industry, WRR
Design additional research to identify, modify, or develop anti-raptor perching systems on powerlines.	Goal 4. Research Needs	Energy Industry, WGFD, BLM

Recommended Actions Potential Projects and Activities Without Current Commitments	Relationship to Conservation Strategy	Responsible Parties & Possible Funding
Information and Education Outreach		
Develop presentations and materials for sage-grouse education purposes, such as traveling education trunks, videos focusing on WRSRCA, sage-grouse issues, tribal dances, etc. Presentations could be used at civic groups such as Lions Club, Rotary Club, Audubon, Elks Clubs, Boy and Girls Scouts, etc.	Goal #5A. Objective 1	WGFD, WRR
Develop brochures, handouts, and other "literature" about sage-grouse and their habitat and distribute to license selling agents, hunters, schools, landowners, and any other interested public.	Goal #5A. Objective 1	WGFD, Conservation Districts
Train Audubon and other conservation group members about sage-grouse habitat and encourage them to conduct tours.	Goal #5A. Objective 1	WGFD
Actively educate stakeholders about grazing strategies that can be used to improve or maintain sage-grouse habitats.	Goal #5A. Objective 1	BLM, NRCS, WY Dept of Ag, WRR
Create a media information network to enhance public knowledge of local sage-grouse conservation efforts. (Enhanced new releases, feature articles, public service announcements, TV, Radio, Farm Bureau News, PAW, Wyoming Livestock Roundup, local news)	Goal #5A. Objective 1	WRSR LWG
Incorporate a calendar of events where the WRSR LWG could provide sage-grouse conservation updates (i.e.. Farm/Ranch Days, Fremont County Fair, Winter Fair, EXPO in Casper, Schools)	Goal #5A. Objective 1	WRSR LWG
Organize field trips and volunteer education programs for schools and civic groups.	Goal #5A. Objective 1	WGFD, BLM, WRR
Create a training program for data collection and monitoring for volunteers and others.	Goal #5A. Objective 1	WGFD, BLM, WRR
Promote Farm Bill and other landowner incentive programs to maximize benefits to sage-grouse and their habitats on private lands.	Goal 5. I & E & Goal 2B. Vegetation Mgmt	LIP w/ WGFD, NRCS -WHIP, GRP, CRP, etc.

RECOMMENDED MANAGEMENT PRACTICES FOR SAGE-GROUSE

The following section outlines some general practices that may be used to enhance sage-grouse habitats and/or populations. Recommended Management Practices (RMPs) are those that are most appropriate in a certain set of conditions. The land manager, on private, state, tribal and federal lands, determines the relevance and appropriateness of the RMP, which may require modification to meet site-specific conditions. On state, tribal and federally managed lands, some of the following RMPs may currently be practiced voluntarily while some may be part of standard guidelines that these land managers currently use and have previously used when permitting surface activities. The LWG does not have the authority to enforce implementation of RMPs, they are not implied regulations, and may not be appropriate in all circumstances. RMPs may be a useful management tool for land managers.

RMPs that have been identified by the Wind River/Sweetwater River Local Sage-Grouse Working Group (WRSR LWG) are listed below. Some RMPs were taken from the Wyoming Greater Sage-Grouse Conservation Plan (WGSGCP) and adapted, where necessary, to better fit the WRSRCA. The intent of this section to provide the user with recommended practices that address the Goals and Objectives outlined in the Conservation Strategy, and to meet sage-grouse conservation needs and habitat requirements as outlined in other sections of this Conservation Plan.

Seasonal RMPs entail clear timing guidelines for activities normally requiring permits on public lands, such as mineral and energy development, placement of structures, fences, powerlines, radio communication towers, vehicle use and other general human activity near and around sage-grouse habitat areas. Project type RMPs are identified for project level planning. Many of these guidelines are also re-stated under relevant limiting factors. Use of these guidelines on private lands is intended to be voluntary.

Seasonal Guidelines

Unless additional or conflicting data is available, the WRSR LWG supports the following seasonal guidelines and land use restrictions for each habitat type as currently recommended by the Wyoming Game & Fish Department, BLM, and other land management agencies. However, recent research suggests these stipulations are not adequate to protect sage-grouse. Discussions are continuing at all levels to better determine appropriate protection measures. These land use restrictions normally apply to surface disturbing activities on public lands, such as road construction, well drilling, placement of fences, powerlines, etc. and most are not meant to preclude incidental activities such as livestock presence or travel through sage-grouse habitats, unless specifically described.

Sage-grouse leks: 1) Avoid surface disturbance or occupancy within ¼ mile of the perimeter of occupied sage-grouse leks. 2) Avoid human activity between 8:00 p.m. and 8:00 a.m. from March 1 – May 15 within ¼ mile of the perimeter of occupied sage-grouse leks.

Sage-grouse nesting/early brood rearing habitat: Avoid surface disturbing activities, geophysical surveys, and organized recreational activities (events) which require a special use permit in suitable sage-grouse nesting and early brood-rearing habitat within 2 miles of an occupied lek or in identified sage-grouse nesting and early brood-rearing habitat outside the 2-mile buffer from March 15 – July 15.
Note: The WRSR LWG recognizes the need to identify sage-grouse nesting and early brood-rearing habitats and suggests this effort be completed as quickly as possible. Once these habitats are identified, the WRSR LWG encourages BLM and WGFD modify these stipulations to provide protections to identified habitats, rather than the arbitrary 2-mile radius buffer currently used.

Sage-grouse winter concentration areas: Where designated, avoid human activity in sage-grouse winter concentration areas from November 15 – March 14.

"Where not a requirement, RMPs may be used as voluntary conservation practices on a site-specific basis."

HABITAT

1. Increase forb production through seeding in key areas, particularly following ground disturbing treatments, such as the aerator project in Government Draw. (Mostly native plants on public lands, consider non-native on private lands and site-specific BLM projects, e.g. Deseret Ranch seed mix)

2. In nesting/wintering areas, minimize the removal of large patches of basin big sagebrush and sagebrush along wind-swept ridgelines.

3. Some grazing periods may be beneficial to sagebrush generation by trampling seed into soil and/or reducing seedling competition with grasses.

4. Manage for broad and functional riparian systems.

ALL LAND USES

1. Avoid, where possible, human activity near leks during the breeding season between the hours of 8:00 p.m. to 8:00 a.m., except at designated lek viewing areas.

2. Except for livestock guard/herding dogs, avoid allowing dogs to run uncontrolled in sage-grouse habitats.

3. Where feasible, place structures such as fences, corrals, loading facilities, water storage tanks, windmills, powerlines, etc. at least ½ mile from or out of sight of leks to reduce opportunities for perching raptors. To further increase visibility and reduce raptor perches, placement of cones on fence posts is encouraged.

4. Minimize visual/auditory impacts where possible, in important sage-grouse habitat (e.g. place roads below ridgelines or along topographic features).

5. If seasonal road closures are required to protect a high-risk sage-grouse population, travel management plans should be developed for permitted uses (i.e. recreation, hunting, and permitted leasing operations). In addition, encourage the reclamation of unnecessary or redundant roads.

CONFLICTING WILDLIFE AND WILD HORSE MANAGEMENT

1. Incorporate sage-grouse needs into management plans for wildlife, especially big game.
2. Evaluate effects to sage-grouse populations or habitats when managing for other wildlife species.
3. Document areas where conflicting species management goals may negatively impact sage-grouse.
4. Assess how proposed habitat improvement projects geared toward other species could impact sage-grouse.

5. When developing mitigation plans to compensate for loss of wildlife habitats, avoid negative impacts to sage-grouse in mitigation areas.

"Where not a requirement, RMPs may be used as voluntary conservation practices on a site-specific basis."

6. Review big game herd goals and modify and implement special big game hunting seasons to meet harvest objectives as necessary to improve habitat conditions for sage-grouse.

7. Evaluate effects wild horses have on sage-grouse.

8. Review federal Appropriate Management Levels (AML) for wild horses as they relate to habitat conditions for sage-grouse. Until then, maintain wild horse numbers at or below AML.

HUNTING

1. Encourage and support the Shoshone and Arapaho tribes in maintaining the Wind River Reservation spring hunting season during the first part of March and avoid hunting during the peak of breeding (late March and early April).

2. Include a discussion of sage-grouse life history and the effects of hunting in Hunter Education classes and general information for the general public.

3. Inform the public that intentionally using sage-grouse for bird-dog training outside the hunting season is unlawful wildlife harassment.

MINERAL AND ENERGY DEVELOPMENT

1. Utilize minimum construction and maintenance standards appropriate for the operation.

2. Avoid surface disturbance or occupancy on or within ¼ mile of occupied leks.

3. Avoid, where possible, placement of well pads, roads and other well field facilities on mapped winter habitats, or within a 1/8-mile (200 m) buffer surrounding winter habitat.

4. Avoid surface disturbance in riparian areas where possible. If avoidance is not possible, minimize impacts to riparian, wetland, or wet meadow habitats to limit impacts to brood rearing areas. (Exploration, drilling, production and operations).
5. Avoid depleting surface or sub-irrigated water in brood-rearing habitats.

6. Consider off-site mitigation for mineral development impacts on known sage-grouse habitat. Work with mineral entities to develop and implement acceptable off-site mitigation measures for enhancing sage-grouse or habitat, as needed, to offset impacts of surface disturbing activities.

7. As a general rule, do not permit new or expand existing mining activities within 2 miles (3.2 km) of occupied leks between March 1st and July 15th.

8. Where feasible, encourage mowing pads or using pallets instead of blading on flat grades and where terrain permits in order to minimize soil and vegetation disturbance.

9. Ask mineral exploration companies to report all potentially usable water discovered during drilling activities for possible use as water sources for wildlife.

10. Examine information regarding “dry holes” to evaluate potential as wildlife water sources.

"Where not a requirement, RMPs may be used as voluntary conservation practices on a site-specific basis."

11. Where technically and economically feasible, use directional drilling or multiple wells from the same pad to reduce impacts to sage-grouse habitats.

12. Encourage new technologies that would reduce total surface disturbance within occupied sage-grouse habitat.

13. Encourage the use of existing corridors (flow lines, roadways, and powerlines) to minimize surface alteration.

14. Co-locate powerlines, pipelines and roads to minimize surface disturbance.

15. Encourage burying flowlines and powerlines in road beds and railways.

16. Encourage road rehabilitation or realignment to minimize impacts to sage-grouse.

17. Consider minimizing the number of vehicles per visit, and the number of roads used within important sage-grouse habitats.

18. Control dust from roads and other surface disturbances within sage-grouse habitats.

19. Consider applying acceptable times for road construction and maintenance that will minimize disturbance during critical seasonal use periods.

20. Where possible, avoid erecting pipeline markers, which can be used as predator perches adjacent to leks.

21. Where feasible, consider using pipelines for transporting product to central facilities to minimize roads and traffic.

22. Reduce existing above-ground powerlines by burying them as opportunities (like rebuilds) arise.

23. If power-lines cannot be buried, install perch guards to prevent raptor use.

24. Where feasible, locate any above-ground power-lines away from ridge tops and riparian areas. Utilize a 1,000 ft (300 m) riparian buffer where possible.

25. Use on-site power generation to minimize overhead power lines in applicable areas.

26. Where CBNG is developed, surface water discharge should be allowed, if benefits can be demonstrated for sage-grouse.

27. Reduce noise from compressors and permanent production facilities using mufflers or noise suppression devices to reduce decibel levels in breeding and brood-rearing habitats.

28. Encourage remote monitoring of production sites to minimize road use and reduce disturbance of birds during critical seasons (breeding, nesting, brood-rearing, and winter).

"Where not a requirement, RMPs may be used as voluntary conservation practices on a site-specific basis."

29. Work cooperatively with all involved permittees, lease holders or field operators, and affected landowners, to develop a road use, utility routes, and travel plan for areas within 2 miles (3.2 km) of occupied sage-grouse leks and other important sage-grouse habitats.

30. Salvage and replace all topsoil as quickly as possible.

31. Utilize techniques that would greatly enhance seed establishment and thus minimize the potential for weed invasion. These include seed drilling and watering. Where feasible, seedbeds could be watered using trucks equipped with sprayers.

32. Consider using early seral-staged native forbs and grasses and non-native forbs that are non-invasive and non-increasing (dryland alfalfa, sanfoin, small burnett) to reclaim sites. Work with land managers to utilize non-native species, where appropriate, that benefit sage-grouse.

PARASITES AND DISEASES

1. Minimize risks for West Nile Virus (WNV) by controlling mosquito larvae, to the extent feasible, by eliminating unnecessary surface water sources.

PESTICIDES

1. When possible, adjust timing of alfalfa harvest instead of applying pesticides to control weevils.

2. Avoid broadcast spraying within 2 miles of leks during nesting season, March 1-July 15.

PREDATION

1. Predator control may be warranted to maintain or enhance local sage-grouse populations when there is a demonstrated need, such as a population trending downward over a 3-year period; populations of "newcomer" predators are artificially high in sage-grouse habitat; specific sage-grouse populations need short-term help.

2. Develop and distribute educational materials regarding human practices that may allow establishment/expansion of predator populations. Examples of these activities include landfills and other garbage/waste disposal that may provide artificial food sources for a variety of predators, and buildings/structures that provide nesting/roosting habitat for ravens/raptors.

3. 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.

4. Predator control to enhance sage-grouse survival should be targeted only to predators identified as impacting that sage-grouse population.

5. Better define the role of predation on sage-grouse in Wyoming.

6. Discourage establishment or reduce populations of “newcomer” predators in sage-grouse habitat.

7. Monitor the effectiveness of any predator control efforts that are implemented.

"Where not a requirement, RMPs may be used as voluntary conservation practices on a site-specific basis."

8. Request the U.S. Fish and Wildlife Service (USFWS) to do a species assessment on the raven.

9. Encourage the U.S. Fish and Wildlife Service to include ravens in 50CFR21.43 “Control of Depredating Birds.”

RECREATION

1. Avoid off-road-vehicle use in occupied sage-grouse habitats.

2. Avoid recreational activities in sage-grouse nesting habitat during the nesting season.

3. Locate recreational facilities at least 2 miles (3.2 km) from lek sites or in areas that do not contain important sage-grouse habitat.

4. Agencies should not provide all lek locations to individuals simply interested in viewing birds.

5. Avoid camping within important riparian habitats occupied by sage-grouse during late summer.

RESIDENTIAL DEVELOPMENT

1. Inform county and city planning and zoning boards where important sage-grouse habitats exist and encourage alternatives that avoid authorization of subdivisions and other developments within those habitats.

2. During project design and permitting, work closely with private landowners and developers to minimize impacts to sage-grouse.

3. Identify key habitats most likely to be developed and attempt to protect them through conservation easements or other incentives.

4. Encourage county planners to incorporate information about sage-grouse habitats and populations into county plans as they are developed.

5. Limit free-roaming dogs and cats.

6. Maintain appropriate stocking rates of livestock on small acreages.

7. Encourage cluster development, road consolidation and common facilities that would have a reduced impact on sage-grouse and other wildlife.

8. Reduce predator impacts to sage-grouse by locating sanitary landfills, dumps and trash transfer stations away from sage-grouse habitat, and managing to minimize avian and mammalian predator concentrations.

"Where not a requirement, RMPs may be used as voluntary conservation practices on a site-specific basis."

VEGETATION MANAGEMENT

Invasive Plants

1. Promote and encourage managed use of browsing animals for weed control.

2. Incorporate BEHAVE (Behavioral Education for Human, Animal, Vegetation, and Ecosystems) practices to reduce invasive plants, where appropriate.

3. Encourage cleaning equipment between project locations.

4. Consider "dry-lotting" livestock when moving animals from weed-infested areas to new pastures.

5. Employ appropriate site preparation techniques and timely reseeding with approved seed mixes of any disturbed areas to prevent encroachment of invasive plants.

6. Consider removing juniper/conifers where they have invaded sagebrush important to sage-grouse.

7. Land managers, in conjunction with county weed and pest districts, are encouraged to identify and map noxious and invasive plants that are detrimental to sage-grouse habitat, and subsequently prioritize and aggressively treat these invasive species. Where necessary, incorporate a re-vegetation plan to re-establish desirable vegetation.

8. Consider developing site-specific prevention programs, maintain cumulative treatment records and evaluation of the cumulative impact to sage-grouse habitats.

Livestock Grazing

The following RMPs are intended to provide a set of "tools" that livestock producers can use at their discretion to assist with achieving healthy rangelands capable of supporting healthy sage-grouse populations and other wildlife, while also providing sustainable forage values for their livestock.

A multi-discipline Technical Team has been formed by the Wyoming Game & Fish Department, Wyoming Department of Agriculture, Bureau of Land Management, and Natural Resource Conservation Service to develop a matrix of desired vegetative outcomes within the NRCS range site and precipitation zone potentials found in the Wyoming Basin floristic region.

In addition, the team will produce a comprehensive list of grazing management practices that will give land managers multiple options for supporting the identified desired vegetative outcomes through voluntary grazing management actions. The RMPs described below may or may not be included in the list the aforementioned Technical Team compiles. The resource produced by the team will be incorporated into the document entitled "Understanding and Enhancing Sage-Grouse Habitat in Wyoming" to be completed by the Wyoming Game & Fish Department in 2007.

1. In interactions between wildlife professionals, livestock producers and other interested parties, employ tolerance and understanding, and respect other perspectives. Focus on areas of mutual interest.

2. Consider effects of different grazing treatments and practices on sage-grouse productivity, survival, and habitat use.

"Where not a requirement, RMPs may be used as voluntary conservation practices on a site-specific basis."

3. Utilize good range management grazing systems in sage-grouse habitat. Yearlong and spring-to-fall grazing may be a tool if it is not continued each year.

4. Where appropriate, implement livestock grazing systems that take into consideration the seasonal sage-grouse habitat needs and provide for areas and times of rest or deferment. Consider a variety of grazing systems (i.e. rest-rotation, short-duration or site-specific innovative ideas).

5. Consider grazing systems that protect and enhance sage-grouse habitat in riparian areas and around water sources.

6. Encourage adjusting livestock stocking rates, season of use, and duration during extreme or long-term drought periods in order to maintain plant vigor, species composition and plant cover.

7. Reduce disturbance to sage-grouse habitat from livestock management activities (e.g. salting or mineral placement, turnout or gathering, bed ground/camp locations, etc.)

    a. During sage-grouse breeding season (March 1st through May 15th), use sheep bedding grounds away from leks. Should sheep herding practices regain popularity, herders should attempt to avoid disturbing occupied leks with their sheep bands, once they leave the bed ground and begin their daily movements.

    b. During sage-grouse breeding season (March 1st through May 15th), reduce physical disturbance to breeding sage-grouse by placing salt or mineral supplements beyond 1/4 mile of lek locations.

8. Minimize negative impacts and enhance sage-grouse habitat when establishing livestock range improvement projects (e.g. water overflow for sage-grouse from water developments, placement of fences, facilities that provide raptor perch sites, construction of roads, salt grounds).

9. Consider alternative grazing systems to improve sage-grouse habitat, for high-risk populations when and where appropriate. This should be accompanied by monitoring to determine effects on sage-grouse for future reference.

10. In suitable nesting habitat within 2 miles (3.2 km) of leks, consider utilizing grazing systems that manage for residual herbaceous vegetation to provide cover for nesting sage-grouse hens. Residual grass and live grass heights, as documented by Wyoming research, are described in the nesting habitat section found on page 19 and in the livestock grazing section on page 51. Options to promote herbaceous cover include:

    a. When circumstances allow, shift early-season livestock use to pastures with minimal, or no, potential for nesting.

    b. When pastures with potential nesting habitat are grazed early in the season, use an appropriate stocking rate when herbaceous plants are not rapidly growing (generally prior to late-April).

"Where not a requirement, RMPs may be used as voluntary conservation practices on a site-specific basis."

11. Encourage adjusting stocking rates and plant recovery periods (rotations) to maintain the health and productivity of rangelands for livestock and sage-grouse. Grazing systems may be managed by monitoring grazing frequency, intensity and timing of livestock grazing to promote proper utilization rates and opportunity for plant recovery to optimize nesting and early brood-rearing habitat (including improvement of forb abundance and diversity, insect productivity, reduction of bare ground, increase litter and herbaceous vegetation cover).

    The Wyoming Rangelands Monitoring Guide (June 2001) includes a Grazing Response Index (GRI) that was developed to describe annual grazing use, interpret annual grazing effects, and to aid in planning the grazing pattern for the following year. This monitoring guide is available through local NRCS and Conservation District offices. Colorado State University Range Extension Program also utilizes the Grazing Response Index (GRI) to score grazing management based on the aforementioned factors (Reed et al., 1999). Instructions for implementing the GRI can be found at most NRCS and USFS offices or on the Internet at: http://www.behave.net/fact_sheets/GRI_plant_evaluation.pdf

    Managers should strive to achieve positive GRI values in pastures with nesting and early-brood rearing habitats.

Key Concepts Related to Plant Health as described in the Wyoming and CSU GRI

a. "Frequency " refers to the number of times forage plants are defoliated during the grazing period. An index value is assigned to the number of defoliations in a grazing period. Plants that have been defoliated only once are assigned a positive value, with plants defoliated 2 times assigned a neutral value. Three or more successive defoliations of a plant in one growing season have been shown to be detrimental to plants and are assigned a negative value.

b. "Intensity" is a description of the amount of leaf material removed during the grazing period, by leaf length. To ensure sufficient photosynthetically active leaf material remains. Generally, less than 40% defoliation will not inhibit plant (grass) growth (GRI in Wyoming Rangeland Monitoring Guide). The idea is to leave more than one-half the leaf of desirable grass species, to jump-start photosynthesis. This is not the age-old rule of "take half, leave half" (50% total utilization by weight).

c. "Opportunity" is the amount of time plants have to grow prior to grazing or re-grow after grazing. Timing of grazing should provide the "opportunity" for plants to grow prior to grazing or to re-grow after grazing. This is critical to maintaining the plant. The plant must be able to fully store energy at some time during the active growing season (Reed et al. 1999).

12. Where possible, supplemental winter-feeding of livestock in occupied sage-grouse winter habitats should be avoided for both sheep and cattle operations to prevent over-utilization of sagebrush resources by sheep and trampling damage by cattle.

13. Minimize the impact of fence placement on sage-grouse. In general, avoid constructing fences within ½ mile of leks. Avoid locating fences in swales and on ridge tops. Minimize fence height and maximize bottom wire height to the extent possible. In areas with documented collisions make fences as visible as possible, (e.g. wire markers, use white-topped steel fence posts, use wooden stays and/or reduce spacing between fence posts, etc.). Evaluate opportunities to remove or relocate unnecessary or problem fences.

"Where not a requirement, RMPs may be used as voluntary conservation practices on a site-specific basis."

14. Water developments of natural springs in sage-grouse habitat should be designed to maintain or enhance the free-flowing characteristics. Water developments, springs, and wet meadows should be fenced to protect from over-utilization and trampling by livestock and wild horses.

15. Utilize escape ramps and/or ground level watering troughs in new and existing livestock watering systems and open water storage tanks for sage-grouse and other wildlife.

Vegetation Treatments

1. Grazing management following sagebrush treatments or manipulations should be designed to benefit long-term sagebrush diversity and ecosystem health. Grazing management strategies should be designed to permit re-establishment of native sagebrush, grasses, and forbs that benefit sage-grouse.

2. Where treatments require or would benefit from seeding, incorporate forb and grass mixes that provide maximum benefits for sage-grouse (similar to reclamation seed mixes).

3. Urge Federal and state land managers to allow incorporation of non-native forbs that are non-invasive, such as varieties of dryland legumes, in seed mixtures.

4. When implementing mechanical treatments in important sage-grouse habitats, limit disturbance to less than 120 yards width, and ensure untreated patches are at least 120 yards in width, unless site-specific evaluations indicate otherwise. (Sagebrush/sage-grouse habitat management guidelines, WGFD; Slater 2003)

5. Keep plant diversity in mind during treatment planning. Consider ecological, economic and cumulative impacts that may result from treatments.

6. Ensure vegetation treatments and post-treatment management actions are appropriate to the soil, climate, and landform of the area.

7. Avoid removing sagebrush adjacent to sage-grouse foraging areas along riparian zones, meadows, lakebeds and farmland unless such removal is necessary to achieve management goals.

    a. Recognize that fire provides a natural diversity component in sagebrush habitats; manage fire on a landscape and patch scale at a local level.

    b. Use prescribed fire to maintain, enhance or promote sagebrush ecosystem health by mimicking natural fire frequencies.

    c. Evaluate all wildfires greater than 40 acres in occupied sage-grouse habitat to determine if rehabilitation of the burned area is needed with emphasis placed on habitats that would be susceptible to invasion by annual grasses.

8. In sage-grouse habitats, where post-burn conditions make rehabilitation necessary, the first priority is protection of the soil resource. Seed mixtures should contain appropriate shrubs, grasses and forbs that permit burned areas to recover to good sage-grouse habitat.

9. Consider protecting significant patches of sagebrush within large burned areas from disturbance and manipulation.

"Where not a requirement, RMPs may be used as voluntary conservation practices on a site-specific basis."

10. Consider all alternatives, when designing sagebrush treatments.

11. In areas with relatively high shrub cover and a poor herbaceous component, use mechanical or other appropriate treatments such as herbicides, in order to improve brood-rearing habitats.

12. Develop and maintain permanent records for all vegetation treatments to evaluate site-specific and cumulative impacts to sage-grouse habitats and populations and to better define RMPs for vegetation treatments.

13. Encourage private landowners to coordinate planning of vegetation treatment projects with WGFD and NRCS.

Farming

1. If possible, consider adjusting haying and insect control where impacts to sage-grouse may occur.

2. Use a flushing bar on haying equipment, and when possible, hay from the center of the field out, or from one side to the other. This will provide escape routes to sage-grouse in the path of haying equipment.

3. Use certified seed for planting to avoid the introduction of undesirable species.

WEATHER

1. Document how variations in weather (wet vs. dry periods; mild vs. severe winters) affect sage-grouse movements and survival.

2. Observe how herbaceous cover affects water infiltration within the water cycle.

3. Where drought has been documented for two consecutive years, consider implementation of appropriate RMPs for the following year, such as:
    a. Drought management of livestock and wildlife grazing.
    b. Protection of critical sage-grouse habitats from wildfire and prescribed fire.
    c. Reduced bag limits during sage-grouse hunting seasons.
    d. Predator management programs to enhance nesting and early-brood-rearing success of impacted populations.
    e. Water hauling and protection of water sources from evaporation.
    f. Installation of guzzlers, snow fences and fencing of water source overflows.
    g. Insure wildlife escape ramps are in place on existing water sources.
    h. Implement other appropriate management options developed by local sage-grouse working groups.

"Where not a requirement, RMPs may be used as voluntary conservation practices on a site-specific basis."

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Appendix A. Funding Opportunities for Wyoming Sage-Grouse Conservation Efforts

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

STATE OF WYOMING SOURCES:

Wyoming Wildlife and Natural Resource Trust Account (WWNRTF)- 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

WGFD/U.S. Fish & Wildlife Service – Landowner Incentive Program (LIP) - 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

WGFD/Wyoming State General Fund – Wyoming Sage-Grouse Conservation 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

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-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 one state or 90% for 2 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 promotes 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.

Farm and Ranch Lands Protection Program (FRPP) – A voluntary program that helps farmers and ranchers keep their lands in agriculture. Provides matching funds to State, Tribal, or local governments and non-governmental organizations to purchase conservation easements.

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 staff 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

Other potential funding sources include but are not limited to:

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

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 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

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 land bird 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

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

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

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

One Shot Antelope Foundation -Water for Wildlife - 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

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/

APPENDIX B.

WYOMING SAGE-GROUSE CONSERVATION FUND FINAL REPORT

Project Start Date: January 1, 2006 to June 30, 2006
Project Name/Title: Examining the effects of noise from energy exploration and development on the breeding biology of the greater sage-grouse (*Centrocercus urophasianus)*
Principal Investigator: Gail L. Patricelli, Assistant Professor, University of California, Davis
Phone: 530-754-8310 **Email:** GPatricelli@ucdavis.edu

SUMMARY OF ACTIVITIES

Populations of the greater sage-grouse (*Centrocercus urophasianus*) are declining throughout their range, leading to their designation as a Species of Concern and their recent consideration for listing under the Endangered Species Act. Many factors have been implicated in this decline (e.g. grazing, habitat loss) and there appears to be no universal cause across the range of the species. It is likely that a suite of interacting factors is contributing to the decline, which complicates conservation efforts. Over the last decade, natural gas development has expanded rapidly across much of the sage-grouse habitat. It is crucial to determine whether this activity is contributing to observed declines in sage-grouse populations. Since we are still in the relatively early stages of this energy exploration, steps can be taken to mitigate the impact of these activities if the problem is diagnosed early. Determining whether natural gas development impacts sage-grouse is critical to the goal of providing sound environmental protections in areas of energy development, therefore ensuring that it will not again be necessary to consider listing sage-grouse under the Endangered Species Act.

One potential means by which energy development might impact sage-grouse populations is through the production of noise. Acoustic communication is known to be important in the reproductive behaviors of sage-grouse, and energy exploration and development activities generate substantial noise; it is therefore important to determine whether noise produced from energy development affects sage-grouse breeding biology. Sage-grouse mate during the early spring (March-April). During this mating season, males aggregate on display sites called "leks" where females visit to observe male display behaviors and choose their mates. There is evidence that the acoustic displays produced by males on leks facilitate reproduction in at least two ways. First, females use these vocalizations to find leks within the habitat. Second, after arrival at a lek, there is evidence that females use male vocalizations (and other aspects of male display) to choose a mate. Anthropogenic noise in the sage-grouse habitat may mask vocalizations produced by males, interfering both with females' ability to locate leks and to choose mates.

The overall goal of this research is to investigate the potential effects of noise from natural gas development on sage-grouse lekking behaviors. This research has three major lines of inquiry: 1) Descriptive- the characterization of sounds produced by energy development and by sage-grouse, and how these sounds propagate through the environment, 2) Experimental - playback of recorded noise to sage-grouse leks to determine whether noise impacts sage-grouse breeding behaviors, and 3) Predictive - landscape-level modeling of sound propagation in the sagebrush habitat.

Our specific goals for WSGCF granting period were to:

1. Descriptive Acoustics: continue characterization of the major sound sources associated with energy development (e.g. compressors, drilling rigs, road noise).
2. Experimental: Begin an experiment to investigate how grouse respond to controlled noise near their lek.

WORK ACCOMPLISHED

1. Descriptive Acoustics:

WSGCF funds were used to pay a technician for 3 months and one field assistant for 2 months to work on the descriptive acoustics portion of the study. Two autonomous recording units (ARUs) were

built with WSGCF matching funds to record and measure noise sources. During March and April, we measured gas field noise primarily on the Anticline Project Area in Sublette County near Pinedale WY using the ARUs. We measured noise at 5-20 minute intervals throughout the day, we sampled noise at between 2 to 8 locations at each site (2 microphones per ARU, 1-4 ARUs per site). We also took noise measurements with a precision sound level meter (purchased with UCD funds) and GPS (purchased with WSGCF funds) circling each site and along line transects radiating from the source. This year we measured sound at two drilling sites, two large compressor stations, and on three roads (see Table 1).

Transects were done to characterize vegetation cover. We will use these for modeling of sound propagation (objective 3 of the overall project). Noise data is currently being analyzed at UC Davis.

Table 1. Recording Sites

Site	Type of Site	Start date	End date	Number of site Microphones
Ultra, Gray Wolf 520	Drilling rig	20-Mar	4-Apr	8
Shell, Nabors 476	Drilling rig	24-Mar	7-Apr	6
Stone Energy, Unit 233	Drilling rig	6-Apr	18-Apr	8
Ultra, Cyclone 17	Drilling rig	7-Apr	19-Apr	4
Ultra, Cyclone 9	Drilling rig	9-Apr	19-Apr	4
Questar, Unit 232	Drilling rig	19-Apr	29-Apr	6
Questar, Unit 106	Drilling rig	19-Apr	29-Apr	4
Shell, Nabors 92	Drilling rig	21-Apr	28-Apr	4
East of Hwy 191 near Boulder	Road	19-Mar	8-Apr	2
East of Hwy 191 near Jonah	Road	8-Apr	20-Apr	2
East of North Jonah Road	Road	19-Mar	8-Apr	2
Big Fred lek	Grouse lek	21-Apr	28-Apr	2
Speedway lek	Grouse lek	21-Apr	28-Apr	2

2. Experimental:

In spring 2006, we began an experiment to test the hypothesis that noise from energy development affects sage-grouse reproductive behavior. To do so, we played back recorded noise to 4 leks and monitored another 4 leks as controls. We placed leks in groups to balance for size and location, and then randomly assigned them to noise or control groups. We plan to continue this experiment for at least 2 more seasons, so results are not available at this time. No WSGCF funds were expended to support this portion of the project; matching funds from NFWF supported both the experimental and descriptive acoustics portions of the project.

We monitored the leks daily by video-taping and photo-identification of birds, and by counting males and females at multiple times during the lekking period. We placed a line of markers at 25-meter intervals along the far edge of the lek relative to the observer to divide the lek into sections. Birds were counted by section each day, allowing us to examine the spatial distribution of birds on the lek relative to the playback speakers.

Four people monitored leks so that each person visited two leks each day. Multiple counts were made each day for each section of each lek. The first lek visited each day was videotaped using HD 1080i format, which allows resolution of strutting behaviors on a sample of 10-20 birds per day. The video tapes are currently being analyzed at UC Davis for behaviors and position of birds. Photographs of plumage patterns were taken at the second lek visited each day and labeled by date, time, lek and section of the lek. Photographs will be analyzed at UCD Davis for identification of individuals (the pattern of white on the tails of male sage-grouse are unique within a given season and can be used for identification of individuals without the disturbance of trapping and marking birds). The order of visiting the leks was swapped each day so a lek was videotaped every other day and photographed on alternate days.

We encountered difficulty building an amplifier/speaker system to play noise during the playback experiment. Our target amplitude was 70 dB SPL—the average level of noise measured at 1/4 mile from

drilling stations in Pinedale in 2006. Playback of drilling noise at this amplitude caused 6 speakers to fail; correction of this problem and replacement of speakers delayed the beginning of the experiment. This delay had one positive consequence: we improved our baseline data on lek attendance and behaviors on experimental and control leks. A second difficulty was that our experimental noise did not propagate well across the lek, such that not all birds on a lek experienced the noise at a sufficient level. We will seek funding to add additional speakers to correct this problem for next year.

Appendix C.

Progress Report for the Sage-grouse Movements and Survival Study on the Wind River Reservation, Wyoming - March 2, 2007

Pat Hnilicka and Dave Skates, US Fish and Wildlife Service, Lander, WY

Sage-grouse are a species that has garnered much attention in the last 10 years. It has been petitioned for listing as a Threatened or Endangered species on multiple occasions due to large population declines from historic highs, shrinking distribution throughout its range, and threats to its habitat (US Fish & Wildlife Service 2005).The Wind River Reservation contains excellent sage-grouse habitat and has at a minimum, 50 leks that have averaged 36 displaying males since 1986. This study will provide baseline information on movements, seasonal ranges and survival that will assist in managing this population sustainably.

In early April 2006, 31 grouse (10 adult females, 10 adult males, 4 yearling females and 7 yearling males) were captured from 3 different leks: Mule Butte North, Sharpnose and Willow Creek (see Table 2 and Figure 1). Initially we attempted to capture sage-grouse by night spotlighting and netting while in pickups and on foot. Males could be caught but females were difficult to find and capture, and consequently, we switched to rocket netting. Rocket-netted grouse were covered with burlap bags, removed from the net as quickly as possible, assessed for age and sex and released with a Telonics Model A4060 necklace radio transmitter weighing 20.5 grams. From the time of capture to release was less than 1 hour. Transmitters were equipped with mortality sensors and would switch to a higher pulse rate if the transmitter had not moved for 8 hours. Transmitter batteries are expected to last 2+ years. Sage-grouse were monitored as frequently as possible from the ground and occasionally from the air. We located sage-grouse on the ground by walking toward radioed grouse and visually observing them or by triangulation from 2 to 4 listening points. A total of 285 relocations were made between early April 2006 and the end of February 2007. Seasonal categories were defined as follows: Spring (March 1 to June 15), Summer (June 16 to September 15), Fall (September 16 to November 15) and Winter (November 16 to February 28). For mortalities, date of death was conservative because death was assumed to occur the last day that an active signal was detected, not the first day that a mortality signal was detected.

Five of 7 hens attempted to nest. We were unable to determine whether an additional 6 hens attempted to nest. Nest success was poor (20%). Three hens were killed while on their nest and 1 hen was accidentally flushed while incubating and subsequently abandoned her nest. We suspect that there was an increased susceptibility to predation because of extreme Spring drought during which 1/3 of average precipitation fell. Drought resulted in a subsequent lack of grass and forb growth and poor nesting cover. No chicks were observed with any radio-marked hens during 2006.

Generally, sage-grouse moved from low elevation breeding grounds to summer and fall in the foothills of the Wind River Mountains (see Figure 1). This was especially true for both males and females from the Willow Creek lek. This area has virtually no human disturbance or alteration of the landscape accept for a few fences and a dirt road that is used infrequently. Male grouse from the Mule Butte and Sharpnose leks generally followed this same pattern. In contrast, female grouse from the Mule Butte and Sharpnose leks did not move up in elevation and stayed relatively close to their lek of capture, spending the summer and fall along riparian areas and irrigated hay meadows (see Figure 2). These 2 leks are surrounded by human-altered landscapes including highways, home-sites, subdivisions, towns, and farmland. Males from all leks moved an average of 12.0 miles from the lek of capture to the furthest documented summer location, while females moved 4.8 miles ($p = 0.001$). Generally, the greatest distances moved by sage-grouse were from leks that were located the furthest from the foothills of the Wind River Mountains. The greatest straight-line distance of 25.2 miles was traveled by M03 from the Mule Butte lek. The greatest

elevational movement was by M15 from the Willow Creek lek. It died in alpine habitat on Dinwoody Peak at an elevation of 10,000 ft. There were no differences in movements between adults and yearlings. When comparing grouse that survived to those that died, there was no statistically significant difference in distance traveled from lek of capture to the furthest documented Summer location.

Overall survival from early April 2006 to the end of February 2007 for all grouse was 54%. Adult females had the highest survival at 67% while yearling females had the lowest survival at 33% (see Table 1). Three birds were removed from the analysis because of death within 5 days of capture (F10 and M11) or a lost radio signal (F12). For mortalities, 4 occurred in Spring, 7 in Summer and 2 in Winter. None occurred during the Fall. Causes of mortality were 5 by predation, 3 by disease, and 5 unknown. Most Spring mortalities were females on the nest. Late summer mortalities were likely related to West Nile Virus, though lab tests of remains were inconclusive. WNV was widespread in humans and horses in Fremont County in 2006 during mid to late Summer. Factors that enhance mosquito and WNV production include low elevation, moist areas and warm temperatures. These circumstances were present for 3 grouse that died at low elevation, along riparian or irrigated meadows and at the height of summer heat.

Literature Cited

US Fish and Wildlife Service. 2005. Endangered and Threatened Wildlife and Plants; 12-Month Finding for Petitions To List the Greater Sage-Grouse as Threatened or Endangered; Proposed Rule. 50 CFR Part 17. 40 pp.

Acknowledgements

We'd like to thank the following individuals for without their assistance this project would not have been possible. Shoshone and Arapaho Tribal Fish and Game: Bob St. Clair, Herman St. Clair, Larry Makeshine, Dennis O'Neal, Ben Snyder, Western Thayer, Ben Warren, and Tibbs Washakie for their help with capturing grouse and funding aerial surveys; Wyoming Game and Fish: Daryl Lutz and Martin Grenier for loaning the rocket net and batteries for spotlighting, and Brian Jensen for his advice on capturing methods; Nathan Burkepile, Jerry Kaiser, Paul Rembold, Scott Roth, and Carol Taylor for assistance with capturing grouse; Bob "Doc" Eng for his invaluable advice on capturing methods; and Gabe Anderson for his efforts in radio-tracking.

Table 1. Survival of radio-marked sage-grouse from April 2006 to February 2007 on the Wind River Reservation.

	Adult	Yearling	All
Male	50% (5 of 10)	50% (3 of 6)	50% (8 of 16)
Female	67% (6 of 9)	33% (1 of 3)	58% (7 of 12)
All	58% (11 of 19)	44% (4 of 9)	54% (15 of 28)

APPENDIX D.

September 22, 2005

Dear Landowner,

The members of the Wind River/Sweetwater River Local Sage-grouse Working Group have developed the attached questionnaire. The purpose of the questionnaire is to get input from the people who are closest to the land, i.e. the landowner or the person who is in charge of the day-to-day operations.

The Local Sage-grouse Working Group consists of about 15 members from all walks of life, including several ranchers. Our group meets every month and we are working to keep the sage-grouse *off* of the threatened or endangered species list. Your input and cooperation is very important to this effort.

I hope you will take a few minutes and complete the enclosed questionnaire and return it to us in the enclosed envelope or you may drop it by the Lander office. Please feel free to attend any of our open meetings. They are usually held at the Lander Regional Game & Fish Office, 260 Buena Vista Dr., Lander. If you have any questions call Brad Meyer at the Regional Office, 332-2688.

If you have any additional comments please put them on the back of the questionnaire and indicate whether or not you would like to be contacted by one of the working group members. If you ***do not have any sage-grouse*** on your deeded or leased property, please write that on the questionnaire and return it. That is also important to this survey.

Thanks.

Members of the Wind River/Sweetwater River Local Sage-grouse Working Group are:

Tom Abernathy	Brad Meyer
Mickey Asbell	Sue Oberlie
Bob Budd	Rob Philip
Jim Haverkamp	Steve Platt
Pat Hnilicka	Bill Skelton
Stan Harter	Western “Gus” Thayer
Dave Lieb, Chairman	Dave Vaughan
Tony Malmberg	Jack Welch

LANDOWNER QUESTIONAIRE

1. Your frame of reference for this questionnaire is (Circle one) 10 20 30 plus (Years)

2. Are you seeing (circle one) ***MORE*** ***ABOUT THE SAME*** ***LESS*** numbers of sage-grouse this year ? Compared to the past.

3. What years have you observed the *most* birds? What time ***Spring Fall Winter***

4. What years have you observed the *least* number of birds?

5. Have you observed sage-grouse on strutting grounds? ***YES*** ***NO*** (go to 5)
Where ? (General vicinity)

6. Have you observed sage-grouse nests? ***YES*** ***NO***

Have you observed hens with chicks? ***YES*** ***NO***

7. Are the sage-grouse generally using the ***SAME AREAS*** ***NEW AREAS***

Where are these areas?

8. Is the amount of sage brush in your area?

MORE ***ABOUT THE SAME*** ***LESS***

9. Has the sagebrush canopy become ***THICKER*** ***SAME*** ***LESS***

10. Is there ***MORE*** ***SAME*** ***LESS*** grass cover .

11. Are the forbs, used by sage-grouse and insects ***MORE*** ***SAME*** ***LESS***
Forbs are usually flowering plants, such as the common dandelion and sweet clover.

12. Have you observed sage-grouse on your meadows? ***YES*** ***NO***

13. Have you observed sage-grouse in the winter? ***YES*** ***NO***

14. What factors do you think influence sage-grouse the most?
(habitat - predation – human influences – hunting – grazing)

Would you like to help monitor sage-grouse ***YES*** ***NO***

Thanks for your help and please return to the Lander Game & Fish Office or mail it using the enclosed stamped & addressed envelope.

Appendix E. Sagebrush identification and management considerations.

The following are general identification features and brief management considerations for the most common sagebrush species/subspecies found in Wyoming sage-grouse habitats. This information is largely taken from "Sagebrush of Colorado; taxonomy, distribution, ecology and management" by Alma Winward and available from the Colorado Division of Wildlife. This or a similar publication should be obtained for more specific information on identifying these and other species/varieties of sagebrush. Hybridization between sagebrush species, subspecies and varieties is common making identification difficult in some places. Seek additional assistance when such difficulties arise.

Wyoming big sagebrush *(Artemisia tridentata* ssp. *wyomingensis)*

Wyoming big sagebrush is the most common and widespread sagebrush species in Wyoming. It most commonly reaches heights of 12-36 inches. Flower stalks tend to occur in clusters mixed throughout the crown, which gives it an irregular looking crown compared to the flat-topped mountain big sagebrush. Wyoming big sage grows on the driest sites of the big sages (Wyoming, mountain and basin). Annual precipitation on these sites ranges from 7-11 inches. It can be found as high as 8000 feet in dry areas but most commonly occurs at elevation of 5,000 to 7,000 feet. Wyoming big sage is a long-lived species, exceeding 150 years in undisturbed settings though 40-60 year old plants are common in mature Wyoming big sagebrush communities. Plants exceeding 60 years of age are often in declining condition.

Wyoming big sagebrush provides a high percentage of the winter habitat for big game and the nesting, early brood-rearing and winter habitat for sage-grouse. Between the high amount of browsing and drought conditions, large acreages of this sagebrush community are in poor health, especially in the drier portions of its range. Historic livestock use has eliminated some forb species in some locations. Good sites in Wyoming big sagebrush should have 10-12 perennial forb species per acre.

Habitat treatment and management in Wyoming big sagebrush needs to consider the site's current state versus its potential and seasonal habitat use by sage-grouse and other wildlife. Well-planned and managed mechanical or chemical treatments, as described elsewhere in this document, may be beneficial.

Mountain big sagebrush *(Artemisia tridentata* ssp. *vaseyana* var. *pauciflora)*

Mountain big sagebrush is found on well-drained soils at mid-to upper elevation (6,800-9,500 feet). The easiest way to tell mountain big sage from other sages is the generally flat-topped stature and long flower stalks that extend high above the crown. The appearance has been compared to that of a birthday cake.

Most sites supporting mountain big sagebrush are very productive and diverse; often up to 35-40 plant species of grasses, grass-likes, forbs and shrubs occur as associates of this widespread variety. This productivity provides ideal spring, summer and fall forage for livestock, big game and sage-grouse. Mountain big sage is seldom over-browsed because it does not occur on winter ranges however understory vegetation can be over-grazed causing a decline in diversity and abundance of favored plant species.

Mountain big sagebrush has a higher potential for increasing its density and canopy cover than any other sagebrush. It is not uncommon to have canopy cover up to 25-30 percent within 20 years after a fire or other disturbance. On areas that have not been disturbed for several decades, canopy cover can reach 40-50 percent. Because of this characteristic, as well as the productive nature of the sites it occupies, many acres of control treatments have occurred in mountain big sagebrush. Such thinning treatments can be beneficial if properly designed, including follow up grazing practices that maintain diverse and abundant understory plants (grasses and forbs).

Basin big sagebrush *(Artemisia tridentata* ssp. *tridentata)*

Basin big sagebrush is commonly the tallest sagebrush with heights of 5-6 feet being common and on some sites plants may reach 10 feet tall. It is found on deep, well-drained soils and occurs where soil moisture remains available into late August. Because of these features much of its original habitat across the west has been converted into cultivated fields. On a percent loss basis, basin big sagebrush has lost more acres since western settlement than any other sagebrush.

While basin big sage is not favored forage during most years, big game and sage-grouse use it heavily during severe winters when snow covers other forage. Any plans to treat or remove basin big sagebrush should consider its unique values and the limited amount of its acreage that remains.

Plains silver sagebrush *(Artemisia cana* ssp. *cana)*

Plains silver sagebrush medium sized sagebrush (24-26 inches tall) and grows on well-drained sandy or loamy soils in northeast Wyoming. The leaves of plains silver sagebrush are silvery gray due to pubescence (fine hairs) and are generally not lobed. Much of the foliage of plains silver sagebrush grows close to the ground. This foliage, along with associated grasses, forbs and insects, provide good cover and foraging sites for sage-grouse. The majority of leaves fall from the plants before winter; leaving only juvenile leaves to provide winter feed for birds and mammals. As a result, it is rarely over-browsed.

Silver sagebrush re-sprouts after fire or mowing so the best management for maintaining grasses and forbs within silver sagebrush stands is through proper grazing management.

Black sagebrush *(Artemisia nova)*

Black sagebrush is a low growing (4-12 inches) multi-branched shrub. It can be identified by the combination of its bright yellow-green foliage, long persisting flower stalks that extend above the plant crowns and by its small bell shaped leaves that are sticky when crushed. Using a hand lens, small glands can be seen on the leaves. The stickiness is caused by resin from these glands.

Black sage is found on rocky or clayey soils that are often saturated in the spring and extremely dry in the summer. These sites do not lend themselves to treatment. Management practices should be aimed at restoring the associated forb and grass species that historically helped cover opening between black sagebrush crowns. Turn-of-the-century grazing caused a decline of these species. Black sagebrush is currently being heavily browsed in many areas by wildlife in winter. Drought has compounded this problem. Monitoring approaches should be designed to assure that new young plants are establishing in numbers high enough to replace plants that are dying.

Early sagebrush, a.k.a. Alkali sagebrush *(Artemisia longiloba)*

Early sagebrush is a low growing shrub about 8-16 inches tall depending on site conditions and genetics. Some taxonomists have ranked early sagebrush as a variety of low sagebrush *(Artemisia arbuscula)*, which has very similar features. Distinguishing between the two can be difficult. Both species have leaves that are both ephemeral (short-lived) and persistent (remain attached for more than one year) and the leaves of both species are covered with fine gray hairs (pubescence) that result in plants that appear gray in color. However, early sagebrush begins flowering in early June with seed ripening in August. This is one to two months earlier than other sages. In addition, the persistent leaves of early sage have a center lobe that is wider in the center than at either end giving it the appearance of being "buck-toothed" since it does not fit in the narrow opening between the lobes. Low sagebrush is much less common in Wyoming than is early sagebrush so we have not included low sage in this condensed guide.

Early sagebrush occurs on clayey, often alkaline, soils. A compacted layer of clay commonly exists within the first foot of the surface. This often results in highly saturated soils in the spring and extremely dry soils in the summer. Where the clay layer is near one foot in depth, grasses and forbs can be moderately productive. But where the clay layer exists within six inches of the surface there is a naturally high proportion of bare ground.

Long-term management should be geared toward regaining some of the natural understory plants that have been lost and reducing browsing impacts where needed. Early sage grows at the elevational range where turn-of-the-century livestock grazing was most severe and many grass and forb species in these areas have been reduced or lost. Early sagebrush is often heavily browsed where snow cover is light and the area serves as ungulate winter range.

Fringed sagebrush, a.k.a. Prairie sagewort *(Artemisia frigida)*

Fringed sagebrush is sometimes referred to as a "subshrub" or even a forb but it often has a woody base, sagebrush fragrance, and grows within the sagebrush zone of most states. Fringed sagebrush is a low growing plant, typically less than 12 inches in height. The leaves are evergreen, silvery-white and have several fan-like clefts.

Sage-grouse have been documented using fringed sagebrush as late summer or fall forage. Fringed sage often grows on windswept ridges and is available as a winter food source as well. Fringed sage is usually kept in check by livestock and wildlife browsing. In some areas of the Great Plains, Fringed sagebrush is an increaser where there is excessive grazing of other plants. This does not occur in more typical sagebrush ecosystems however and there is no need to control it in these environments.

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